

PROJECT MANUAL
FOR
CONSTRUCT BAGGAGE HANDLING SYSTEM (BHS) AND
WEST TERMINAL EXPANSION
AT THE
DESTIN – FORT WALTON BEACH AIRPORT



FOR THE
OKALOOSA COUNTY, FLORIDA
BOARD OF COUNTY COMMISSIONERS

ITB AP 59-20

FAA AIP Project No. TBD

100% Issued for Bids

May 2020

PREPARED BY:



2300 Maitland Center Parkway, Suite 210
Maitland, Florida 32751
FL Certificate of Authorization No. P08036

NOTICE TO RESPONDENTS

ITB AP 59-20

CONSTRUCT BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION

at

DESTIN-FORT WALTON BEACH AIRPORT (VPS)

OKALOOSA COUNTY, FLORIDA

Notice is hereby given that the Board of County Commissioners of Okaloosa County will receive sealed bids until **17 June, 2020 at 3:30 P.M.** (Central Daylight Savings Time) for the Destin-Fort Walton Beach Airport – Construct Baggage Handling System and West Terminal Expansion at VPS project. Interested respondents desiring consideration shall provide an original and two (2) copies (total three (3)) of their Invitation to Bid (ITB) response with the respondent's area of expertise identified. Submissions shall be portrait oriented, unbound, and 8 ½"x 11" where practical. **All originals must have original signatures in blue ink.**

Okaloosa County (COUNTY) and the airport staff (AIRPORT) desire to modify the existing system and construct an expansion of the baggage handling system (BHS) and west terminal non-secure public use areas. The project will construct a baggage handling system expansion with checked baggage inspection system room, a checked baggage resolution area room, and support spaces. The project will also construct a terminal expansion with expanded airline ticketing, public use lobby circulation space and restrooms. Impacts to existing airport facilities that will be incurred include: connection to water, sewer, electrical, landscaping, covered walkway, and other airport facilities.

Beginning on **Monday 18 May, 2020** digital copies of the above documents may be downloaded by accessing the following sites:

<http://www.myokaloosa.com/purchasing/home> then accessing the link "View Current Solicitations"

<https://www.bidnetdirect.com/florida>

https://www.demandstar.com/supplier/bids/agency_inc/bid_list.asp?f=search&mi=2442519

Funding for this project is being provided by federal funds (FAA, AIP and PFC regulated funds), FDOT grant, and Airport local match funds and will be subject to all applicable County, State and Federal requirements as determined applicable.

A non-mandatory Pre-Bid Conference will be conducted through a Zoom meeting on 28 May 2020 at 10:00 a.m. All interested attendees must e-mail the following e-mail address for further link, login and password instructions. For further information e-mail jdarr@myokaloosa.com

On **17 June, 2020 at 3:30 P.M.** (Central Daylight Savings Time), all bids will be opened and read aloud. All bids must be in sealed envelopes reflecting on the outside thereof the Respondent's name and "ITB AP 59-20 CONSTRUCT BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION AT THE DESTIN – FORT WALTON BEACH AIRPORT (VPS)". The Board of County Commissioners will consider all bids properly submitted at its scheduled bid opening in the Okaloosa County Purchasing Department located at opening located at 5479A Old Bethel Rd., Crestview, FL 32536. Bids may be submitted at the Purchasing department prior to bid opening or delivered to the Okaloosa County Purchasing Department, 5479A Old Bethel Rd., Crestview, FL 32536

Staff will be following the latest guidance from the CDC, State, and Local authorities.

On **17 June, 2020 at 3:30 P.M** (Central Daylight Savings Time), all bids will be opened and read aloud. All bids must be in sealed envelopes reflecting on the outside thereof the Respondent's name and "ITB AP 59-20 CONSTRUCT BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION AT THE DESTIN – FORT WALTON BEACH AIRPORT (VPS)". The Board of County Commissioners will consider all bids properly submitted at its scheduled bid opening in the Okaloosa County Purchasing Department located at opening located at 5479A Old Bethel Rd., Crestview, FL 32536. Bids may be submitted at the Purchasing department prior to bid opening or delivered to the Okaloosa County Purchasing Department, 5479A Old Bethel Rd., Crestview, FL 32536.

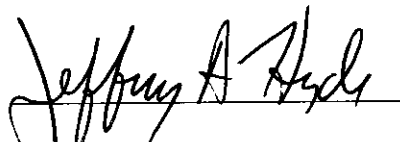
NOTE: Crestview, FL is not a next day guaranteed delivery location by most delivery services. Respondents using mail or delivery services assume all risks of late or non-delivery.

All originals must have original signatures in blue pen ink.

All bids should be addressed as follows:

BID ENCLOSED – CONSTRUCT BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION AT THE DESTIN – FORT WALTON BEACH AIRPORT (VPS)

ITB AP 59-20
Okaloosa County Purchasing Department
5479A Old Bethel Rd.
Crestview, FL 32536


Jeff Hyde
Purchasing Manager

05/13/2020
Date

BOARD OF COUNTY COMMISSIONERS
OKALOOSA COUNTY, FL

Robert A. "Trey" Goodwin, III
Chairman

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INVITATION TO BID (ITB) & RESPONDENT'S ACKNOWLEDGEMENT

ITB TITLE: CONSTRUCT BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION – DESTIN-FORT WALTON BEACH AIRPORT (VPS)

**ITB NUMBER:
ITB AP 59-20**

<u>ISSUE DATE:</u>	18 May, 2020	8:00 A.M. C.D.S.T.
<u>PRE-BID MEETING:</u>	28 May, 2020	10:00 A.M. C.D.S.T.
<u>LAST DAY FOR QUESTIONS:</u>	5 June, 2020	3:00 P.M. C.D.S.T.
<u>ITB OPENING DATE & TIME:</u>	17 June, 2020	3:30 P.M. C.D.S.T.

NOTE: BIDS RECEIVED AFTER THE BID OPENING DATE & TIME WILL NOT BE CONSIDERED.

Okaloosa County, Florida solicits your company to submit a bid on the above referenced goods or services. All terms, specifications and conditions set forth in this ITB are incorporated into your response. A bid will not be accepted unless all conditions have been met. All bids must have an authorized signature in the space provided below. All bids must be sealed and received by the Okaloosa County Purchasing Department by the "ITB Opening Date & Time" referenced above. The official clock for the purpose of receiving bids is located in the Okaloosa County Purchasing Department, located at 5479A Old Bethel Rd., Crestview, FL 32536. All envelopes containing sealed bids must reference the "ITB Title", "ITB Number" and the "ITB Opening Date & Time". Okaloosa County is not responsible for lost or late delivery of bids by the U.S. Postal Service or other delivery services used by the respondent. Neither faxed nor electronically submitted bids will be accepted. Bids may not be withdrawn for a period of one-hundred twenty (120) days after the bid opening unless otherwise specified.

RESPONDENT ACKNOWLEDGEMENT FORM BELOW MUST BE COMPLETED, SIGNED, AND RETURNED AS PART OF YOUR BID. BIDS WILL NOT BE ACCEPTED WITHOUT THIS FORM, SIGNED BY AN AUTHORIZED AGENT OF THE RESPONDENT.

COMPANY NAME _____
MAILING ADDRESS _____
CITY, STATE, ZIP _____
FEDERAL EMPLOYER'S IDENTIFICATION NUMBER (FEIN): _____
TELEPHONE NUMBER: _____ EXT: _____
E-MAIL ADDRESS: _____

I CERTIFY THAT THIS BID IS MADE WITHOUT PRIOR UNDERSTANDING, AGREEMENT, OR CONNECTION WITH ANY OTHER RESPONDENT SUBMITTING A BID FOR THE SAME MATERIALS, SUPPLIES, EQUIPMENT OR SERVICES, AND IS IN ALL RESPECTS FAIR AND WITHOUT COLLUSION OR FRAUD. I AGREE TO ABIDE BY ALL TERMS AND CONDITIONS OF THIS BID AND CERTIFY THAT I AM AUTHORIZED TO SIGN THIS BID FOR THE RESPONDENT.

AUTHORIZED SIGNATURE: _____
TYPED OR PRINTED NAME: _____
TITLE: _____ **DATE:** _____

INSTRUCTIONS TO RESPONDENTS

PROJECT IDENTIFICATION:

a) Project Title:

ITB AP 59-20 CONSTRUCT BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION AT VPS

b) Owner:

OKALOOSA COUNTY BOARD OF COUNTY COMMISSIONERS

c) A/E Lead:

Graef-USA Inc.

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1. Defined Terms

Certain additional terms used in the Instruction to Contractors have the meanings indicated below which are applicable to both the singular and plural thereof.

1.1 Contractor – one who submits a Bid directly to Owner as distinct from sub-contractor, who submits a bid to a Contractor

1.2 Issuing Office/Purchasing Department – the office from which the Project Documents are to be issued and where the bid procedures are to be administered.

1.3 Successful Contractor – the lowest, responsible and responsive Contractor to whom Owner (on the basis of Owner's evaluation as hereinafter provided) makes an award.

2. Copies of Project Documents

2.1 Complete sets of the Project Documents may be obtained from BidNet and the Okaloosa County website.

2.2 Complete sets of Project Documents must be used in preparing Bids; neither Owner nor Architect/Engineer assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Project Documents.

2.3 Owner and Architect/Engineer in making copies of Project Documents available on the above terms do so only for the purpose of obtaining Bids for the Work and do not confer a license or grant for any other use.

3. Qualifications of Contractors

To demonstrate qualifications to perform the Work, each Contractor must upon Owner's request, provide detailed written evidence such as financial data, previous experience, present commitments and other such data as may be called for below. Each Bid must contain evidence of Contractors qualification to do business in the state where the Project is located or covenant to obtain such qualification prior to award of the contract.

4. Examination of Documents and Site

4.1 It is the responsibility of each contractor before submitting a Bid:

4.1.1 To examine thoroughly these documents and other related data identified (including "technical data" referred to below);

4.1.2 To visit the site to become familiar with and satisfy Contractor as to the general, local and site conditions that may affect cost, progress, performance, or furnishing of the Work;

4.1.3 To consider federal, state, and local Laws and Regulations that may affect cost, progress, performance or furnishing of the Work;

4.1.4 To study and carefully correlate Contractor's knowledge and observations with these Project Documents and such other related data; and

4.1.5 To promptly notify Architect/Engineer of all conflicts, errors, ambiguities or discrepancies which Contractor has discovered in or between these Project Documents and such other related documents.

4.2 thru 4.5 (Omitted-Supplementary Conditions Not Applicable)

4.6 Upon request to the Purchasing Department, Owner will provide each Contractor access to the site to conduct such examinations, investigations, explorations, tests, and studies as each Contractor deems necessary for submission of a Bid. Contractor must fill all holes and clean up and restore the site to its former conditions upon completion of such explorations, investigations, tests, and studies.

4.7 Reference is made to the Bid documents for the identification of the general nature of work that is to be performed at the site by Owner or others (such as utilities and other prime contractors) that relates to the work for which a Bid is to be submitted. On request to the Purchasing Department, Owner will provide to each Contractor for examination access to or copies of appropriate documents (other than portions thereof related to price) for such work.

4.8 The submission of a Bid will constitute and incontrovertible representation by Contractor that Contractor has complied with every requirement of this Article 4, that without exception of the Bid is premised upon performing and furnishing the Work required by these Project Documents and applying the specific means, methods, techniques, sequences, or procedures for construction (if any) that may be shown or indicated or expressly required by these Project Documents, the Contractor has given Architect/Engineer written notice of all conflicts, errors, ambiguities and discrepancies that Contractor has discovered in these Project Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

4.9 The provisions of 4.1 through 4.8, inclusive, do not apply to Asbestos, Polychlorinated biphenyls (PCBs), Petroleum, Hazardous Waste, or Radioactive Material by paragraph 4.5 of the General Conditions.

5. Availability of Lands for Work, etc.

The lands upon which the Work is to be performed, rights-of-way and easements for access thereto and other lands designated for use by the successful Contractor in performing the Work are identified in these Project Documents. All additional land and access thereto required for temporary construction facilities, construction equipment, or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by the Successful Contractor.

Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in these Project Documents.

6. Interpretations and Addenda

6.1 All questions about the meaning or intent of these Project Documents are to be directed to Issuing Office. Interpretations or clarifications considered necessary by Issuing Office in response to such questions will be issued by Addenda on the Purchasing website and bid net as mentioned above. Questions received after the question deadline may not be answered. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

Addenda may also be issued to modify these Project Documents as deemed advisable by Owner or Architect/Engineer.

7. Bid Security

7.1 Each Bid must be accompanied by Bid security made payable to Owner in an amount of five percent (5%) of Contractors maximum Bid Price in the form of a certified or bank check or a Bid Bond on form attached, issued by a surety meeting the requirements of Paragraph 5.1 of the General Conditions.

7.2 The Bid security of Successful Contractor will be retained until such Contractor has executed the Agreement, furnished the required contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Contractor fails to execute and deliver the Agreement and furnishes the required contract security within fifteen days after the Notice of Award, Owner may annul the Notice of Award and the Bid security of that Contractor will be forfeited. The Bid security of other Contractors whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of:

the seventh (7th) day after the Effective Date of the Agreement
or
the one-hundred and twentieth (120th) day after the Bid opening,

whereupon Bid security furnished by such Contractors will be returned. Bid security with Bids which are not competitive will be returned within seven (7) days after the Bid Opening.

8. Contract Times

The Contract Time in calendar days, from the Issuance of the Notice to Proceed to Final Project Completion is defined in Section 5 of BID FORMS (BF-3).

9. Substitute and "Or-Equal" Items

The Contract, if awarded, will be on the basis of materials and equipment described in the Drawings or specified in the Specifications. Whenever it is indicated in the Drawings or specified in the Specifications that a substitute or "or-equal" item of material or equipment may be furnished or used by Contractor if acceptable to the County, acceptance of the substitution "or equal" to material or equipment, will typically be considered by the County after the contract is awarded. However, any proposed substitution that represents a deviation from the design intent, must be approved prior to submission of the bid responses. A determination as to whether a design deviation or particular item that changes the design intent of the plans or specification is acceptable as a substitute or "equal" will be made by the County and Architect/Engineer. Design deviations approved prior to bid submittals will be made known to other contractors through an addendum.

10. Subcontractors, Suppliers, and Others

10.1 If the Bid documents require the identity of certain Subcontractors, Suppliers and other persons and organizations (including those who are to furnish the principal items of material and equipment) are to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement. Apparent Successful Contractor, and any other Contractor so requested, shall with Bid documents submit to Owner a list of all such Subcontractors, Suppliers, and other persons and organizations proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor Supplier, person, or organization if requested by Owner. An Owner or Architect/Engineer who after due investigation has reasonable objection to any proposed Subcontractor, Supplier, other person, or organization, may before the Notice of Award is given request apparent Successful Contractor to submit an acceptable substitute without an increase in Bid Price.

If apparent Successful Contractor declines to make any such substitution, Owner may award the contract to the next lowest Contractor that proposes to use acceptable Subcontractors, Suppliers, and other persons and organizations. The declining to make requested substitutions will not constitute grounds for sacrificing the Bid security of any Contractor. Any subcontractor, Supplier, other person or organization listed and to whom Owner or Architect/Engineer does not make written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Architect/Engineer subject to revocation of such acceptance after the Effective Date of the Agreement as provided in Paragraph 6.8.2 of the General Conditions.

11. Pre-Bid Activity

Except as provided in this section, contractors are prohibited from contacting or lobbying the County, County Administrator, Commissioners, County staff, and Review Committee members, or any other person authorized on behalf of the County related or involved with the solicitation. All inquiries on the scope of work, specifications, additional requirements, attachments, terms and general conditions or instructions, or any issue must be directed in writing, by US mail or email to:

Okaloosa County Purchasing Department
5479A Old Bethel Road
Crestview, FL 32536
Email: jdarr@myokaloosa.com
(850) 689-5960

All questions or inquiries must be received no later than the last day for questions (reference ITB & Respondent's Acknowledgement form). Any addenda or other modification to the bid documents will be issued by the County five (5) days prior to the date and time of bid closing, as written addenda, and will be posted to and the Okaloosa County website at <http://www.myokaloosa.com/purchasing/current-solicitations> and the Bidnet website at <https://www.bidnetdirect.com/florida>.

Such written addenda or modification shall be part of the bid documents and shall be binding upon each contractor. Each contractor is required to acknowledge receipt of any and all addenda in writing and submit with their bid. No contractor may rely upon any verbal modification or interpretation.

12. Preparation of Bid – The bid form is included with the bid documents. Additional copies may be obtained from the County. The contractor shall submit bids in accordance with the public notice.

All blanks in the bid documents shall be completed by printing in ink or typed in both words and numbers with the amounts extended, totaled and the bid signed. A bid price shall be indicated for each section, bid item, alternative, adjustment unit price item, and unit price item listed therein, or the words "No Bid", "No Change", or "Not Applicable" entered. No changes shall be made to the phraseology of the form or in the items mentioned therein. In case of any discrepancy between the written amount and the numerical figures, the written amount shall govern. Any bid which contains any omissions, erasures, alterations, additions, irregularities of any kind, or items not called for which shall in any manner fail to conform to the conditions of public notice inviting bids may be rejected.

A bid submitted by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature). The official address of the partnership shall be shown below the signature.

A bid submitted by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown below the signature.

A bid submitted by an individual shall show the contractor's name and official address.

A bid submitted by a joint venture shall be executed by each joint venture in the manner indicated on the bid form. The official address of the joint venture must be shown below the signature.

It is preferred that all signatures be in blue ink with the names typed or printed below the signature. Okaloosa County does not accept electronic signatures.

The bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the form. The address and telephone # for communications regarding the bid shall be shown.

If the contractor is an out-of-state corporation, the bid shall contain evidence of contractor's authority and qualification to do business as an out-of-state corporation in the State of Florida. A state contractor license # for the State of Florida shall also be included on the bid form. Contractor shall be licensed in accordance with the requirements of Chapter 489, Florida Statutes.

13. Integrity of Bid Documents - Contractors shall use the original Bid documents provided by the Purchasing Department and enter information only in the spaces where a response is requested. Contractors may use an attachment as an addendum to the Bid documents if sufficient space is not available. Any modifications or alterations to the original bid documents by the contractor, whether intentional or otherwise, will constitute grounds for rejection of a bid. Any such modification or alteration that a contractor wish to propose must be clearly stated in the contractor's response in the form of an addendum to the original bid documents.

14. Submittal of Bid – A bid shall be submitted no later than the date and time prescribed and at the place indicated in the advertisement or invitation to bid and shall be enclosed in an opaque sealed envelope plainly marked with the project title (and, if applicable, the designated portion of the project for which the bid is submitted), the name and address of the contractor, and shall be accompanied by the bid security and other required documents. It is the contractor's responsibility to assure that its bid is delivered at the proper time and place. Offers by email, facsimile, or telephone will **NOT** be accepted.

Contractor shall submit the original plus two (2) copies of their bid to the place indicated in the Advertisement of Notice to Contractor.

Note: Crestview is not a next day delivery site for overnight carriers.

15. Modification & Withdrawal of Bid - A bid may be modified or withdrawn by an appropriate document duly executed in the manner that a bid must be executed and delivered to the place where bids are to be submitted prior to the date and time for the opening of bids.

If within 24 hours after bids are opened any contractor files a duly signed written notice with the County and promptly thereafter demonstrates to the reasonable satisfaction of the County that there was a material substantial mistake in the preparation of its bid, that contractor may withdraw its bid, and the bid security may be returned. Thereafter, if the work is rebid, that contractor will be disqualified from 1) further bidding on the work, and 2) doing any work on the contract, either as a subcontractor or in any other capacity.

16. Bids to Remain Subject to Acceptance – All bids will remain subject to acceptance or rejection for one-hundred twenty (120) calendar days after the day of the bid opening, but the County may, in its sole discretion, release any bid and return the bid security prior to the end of this period.

17. Identical Tie Bids – In cases of identical procurement responses, the award shall be determined either by lot or on the basis of factors deemed to serve the best interest of the County. In the case of the latter, there must be adequate documentation to support such a decision.

18. Conditional & Incomplete Bids – Okaloosa County specifically reserves the right to reject any conditional bid and bids which make it impossible to determine the true amount of the bid.

19. Applicable Laws & Regulations – All applicable Federal and State laws, County and municipal ordinances, orders, rules and regulations of all authorities having jurisdiction over the project shall apply to the bid throughout, and they will be deemed to be included in the contract the same as though they were written in full therein.

20. Disqualification of Contractors – Any of the following reasons may be considered as sufficient for the disqualification of a contractor and the rejection of its bid:

- a. Submission of more than one proposal for the same work from an individual, firm or corporation under the same or different name.
- b. Evidence that the contractor has a financial interest in the firm of another contractor for the same work.
- c. Evidence of collusion among contractors. Participants in such collusion will receive no recognition as contractors for any future work of the County until such participant has been reinstated as a qualified contractor.
- d. Uncompleted work which in the judgment of the County might hinder or prevent the prompt completion of additional work if awarded.
- e. Failure to pay or satisfactorily settle all bills due for labor and material on former contracts in force at the time of advertisement of proposals.
- f. Default under previous contract.
- g. Listing of the contractor by any Local, State or Federal Government on its barred/suspended vendor list.
- h. Violation of the Cone of Silence.

21. Award of Bid

- a. **Okaloosa County Review** - Okaloosa County Designated Staff, to include design consultant, will review all bids and will participate in the Recommendation to Award.
- b. The County will award the bid to the responsive and responsible vendor(s) with the lowest responsive bid(s), Base Bid plus any combination of Additive Alternates, and the County reserves the right to award the bid to the contractor submitting a responsive bid with a resulting negotiated agreement which is most advantageous and in the best interest of the County, and to reject any and all bids or to waive any irregularity or technicality in bids received. Okaloosa County shall be the sole judge of the bid and the resulting negotiated agreement that is in its best interest and its decision shall be final.
- c. Okaloosa County reserves the right to waive any informalities or reject any and all bids, in whole or part, to utilize any applicable state contracts in lieu of or in addition to this bid and to accept the bid that in its judgment will best serve the interest of the County.
- d. Okaloosa County specifically reserves the right to reject any conditional bids and will normally reject those which made it impossible to determine the true amount of the bid. Each item must be bid separately and no attempt is to be made to tie any item or items to any other item or items.

22. Payments – The respondent shall be paid upon submission of invoices and approval of acceptance by Okaloosa County Board of County Commissioners, Finance Office, 302 N. Wilson St., #203, Crestview FL 32536, for the prices stipulated herein for articles delivered and accepted. Invoices must show Contract number.

23. Discrimination – An entity or affiliate who has been placed on the discriminatory vendor list may not submit a bid on a contract to provide goods or services to a public entity, may not submit a bid on a contract with a public entity for the construction or repair of a public building or public work, may not submit bids on leases of real property to a public entity, may not award or perform work as a contractor, supplier, subcontractor, or consultant under contract with any public entity, and may not transact business with any public entity.

24. Public Entity Crime Information – Pursuant to Florida Statute 287.133, a contractor may not be awarded or perform work as a contractor, supplier, subcontractor, or consultant under a contract with any public entity; and may not transact business with any public entity in excess of the threshold amount provided in s. [287.017](#) for CATEGORY TWO for a period of 36 months following the date of being placed on the convicted vendor list.

25. Conflict of Interest – The award hereunder is subject to the provisions of Chapter 112, Florida Statutes. All contractors must disclose with their bids the name of any officer, director, or agent who is also a public officer or an employee of the Okaloosa Board of County Commissioners, or any of its agencies. Furthermore, all contractors must disclose the name of any County officer

or employee who owns, directly or indirectly, an interest of five percent (5%) or more in the firm or any of its branches.

Note: For contractor's convenience, this certification form is enclosed and is made a part of the bid package.

26. Reorganization or Bankruptcy Proceedings – Bids will not be considered from contractors who are currently involved in official financial reorganization or bankruptcy proceedings.

27. Investigation of Contractor – The County may make such investigations, as it deems necessary to determine the stability of the contractor to perform the work and that there is no conflict of interest as it relates to the project. The contractor shall furnish to the Owner any additional information and financial data for this purpose as the County may request.

28. Cone of Silence Clause - The Okaloosa County Board of County Commissioners has established a solicitation silence policy (**Cone of Silence Clause**) that prohibits oral and written communication regarding all formal solicitations for goods and services (formal bids, Request for Proposals, Requests for Qualifications) issued by the Board through the County Purchasing Department. The period commences from the date of advertisement until award of contract.

All communications shall be directed to the Purchasing Department.

Note: For contractor's convenience, this certification form is enclosed and is made a part of the bid package.

29. Review of Procurement Documents – Per Florida Statute 119.071(1)(b) 2 sealed bids, proposals, or replies received by the County pursuant to a competitive solicitation are exempt from public disclosure until such time as the County provides notice of an intended decision or until 30 days after opening the bids, proposals, or final replies, whichever is earlier.

30. Compliance with Florida Statute 119.0701 – The Contractor shall comply with all the provisions of section 119.0701, Florida Statutes relating to the public records which requires, among other things, that the Contractor: (a) Keep and maintain public records; (b) Provide the public with access to public records on the same terms and conditions that the public agency would provide the records; (c) ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law; and (d) Meet all requirements for retaining public records and transfer, at no cost, to the public agency all public records in possession of the contractor upon termination of the contract.

31. Protection of Resident Workers – The Okaloosa County Board of County Commissioners actively supports the Immigration and Nationality Act (INA) which includes provisions addressing employment eligibility, employment verifications, and nondiscrimination. Under the (INA), which employers may hire only persons who may legally work in the United States (i.e., citizens and nationals of the U.S.) and aliens authorized to work in the U.S. The

employer must verify the identity and employment eligibility of anyone to be hired, which includes completing the Employment Eligibility Verifications. The contractor shall establish appropriate procedures and controls so no services or products under the Contract Documents will be performed or manufactured by any worker who is not legally eligible to perform such services or employment. Okaloosa County reserves the right to request documentation showing compliance with the requirements.

Contractors doing construction business with Okaloosa County are required to use the Federal Government Department of Homeland Security's website and use the E-Verify Employment Eligibility Verifications System to confirm eligibility of all employees to work in the United States.

32. Suspension or Termination for Convenience – The County may, at any time, without cause, order Contractor in writing to suspend, delay or interrupt the work in whole or in part for such period of time as the County may determine, or to terminate all or a portion of the Contract for the County's convenience. Upon such termination, the Contract Price earned to the date of termination shall be paid to Contractor, but Contractor waives any claim for damages, including loss of profits arising out of or related to the early termination. Those Contract provisions which by their nature survive final acceptance shall remain in full force and effect. If the County orders a suspension, the Contract price and Contract time may be adjusted for increases in the cost and time caused by suspension, delay or interruption. No adjustment shall be made to the extent that performance is, was or would have been so suspended, delayed or interrupted by reason for which Contractor is responsible; or that an equitable adjustment is made or denied under another provision of this Contract.

33. Failure of Performance/Delivery – In case of default by the contractor, the County after due notice (oral or written) may procure the necessary supplies or services from other sources and hold the contractor responsible for difference in cost incurred. Continuous instances of default shall result in cancellation of the award and removal of the contractor from the bid list for duration of one (1) year, at the option of the County.

34. Audit – If requested, contractor shall permit the County or an authorized, independent audit agency to inspect all data and records of contractor relating to its performance and its subcontracts under this bid from the date of the award through three (3) years after the expiration of contract.

35. Equal Employment Opportunity; Non Discrimination – Contractor will not discriminate against any employee or an applicant for employment because of race, color, religion, gender, sexual orientation, national origin, age, familial status or handicap.

36. Non-Collusion – Contractor certifies that it has entered into no agreement to commit a fraudulent, deceitful, unlawful or wrongful act, or any act which may result in an unfair advantage over other contractors. See Florida Statute 838.22.

37. Unauthorized Aliens/Patriot's Act – The knowing employment by contractor or its subcontractors of any alien not authorized to work by the immigration laws is prohibited and shall

be a default of the contract. In the event that the contractor is notified or becomes aware of such default, the contractor shall take steps as are necessary to terminate said employment with 24 hours of notification or actual knowledge that an alien is being employed. Contractor's failure to take such steps as are necessary to terminate the employment of any said alien within 24 hours of notification or actual knowledge that an alien is being employed shall be grounds for immediate termination of the contract. Contractor shall take all commercially reasonable precautions to ensure that it and its subcontractors do not employ persons who are not authorized to work by the immigration laws.

38. Acceptance – Delivery of material to Okaloosa Board of County Commissioners does not constitute acceptance for the purpose of payment. Final acceptance and authorization of payment shall be given only after a thorough inspection indicates that the material meets contract specifications and conditions as listed. Should the delivered material differ in any respect from specifications, payment will be withheld until such time as the supplier takes necessary corrective action. The Purchasing Department shall be notified of the deviation in writing within 10 days and the provisions of the delivery paragraph shall prevail. If the proposed corrective action is not acceptable to Okaloosa County, the final acceptance of the material shall remain the property of the supplier and the county shall not be liable for payment for any portion thereof.

39. Pre-Bid Conference

A Pre-Bid Conference will be conducted at the time and place stated in the Notice to Contractors. The County's Purchasing Department, will transmit via the County website and BidNet such Addenda as Architect/Engineer and Owner consider necessary in response to written questions received no later than the question deadline specified in the Invitation to Bid. Oral statements may not be relied upon and will not be binding or legally effective.

Upon arrival to the Destin-Fort Walton Beach Airport for the pre-bid meeting, respondents will park in Lot A and proceed to the center lobby where an Airport representative will be standing by to provide instructions to meeting attendees. In order to help protect yourself and others, a face covering or mask will be required the meeting. The Airports and Purchasing Department staff will provide additional instructions to attendees to ensure a safe atmosphere during the pre-bid meeting. Staff will be following the latest guidance from the CDC, State, and Local authorities.

40. Sales and Use Taxes

Work under this Bid is subject to the provisions of Chapter 212, Florida Statutes, Tax on state, Use and Other Transactions. Other state, local, or federal taxes may be applicable. The contractor is responsible to remit to the appropriate governmental entity all applicable taxes. Any applicable tax shall be included in the total Bid price by the contractor.

END OF INSTRUCTIONS TO RESPONDENTS

OKALOOSA COUNTY STANDARD CLAUSES

INDEMNIFICATION AND HOLD HARMLESS

CONTRACTOR shall indemnify and hold harmless **COUNTY**, its officers and employees from liabilities, damages, losses, and costs including but not limited to reasonable attorney fees, to the extent caused by the negligence, recklessness, or intentional wrongful conduct of the **CONTRACTOR** and other persons employed or utilized by the **CONTRACTOR** in the performance of this Agreement.

NOTE: For Contractor's convenience, this certification form is enclosed and is made a part of the bid package.

TRENCH SAFETY ACT

Each contractor must submit with his bid an executed sworn certification that he will comply with the Trench Safety Act, Chapter 90-96, Florida Statutes, on trench safety.

NOTE: For Contractor's convenience, a certification form is enclosed and is made a part of the bid package.

PUBLIC ENTITY CRIME INFORMATION

A person or affiliate who has been placed on the convicted vendor list following a conviction for a public entity crime may not submit a bid on a contract to provide any goods or services to a public entity, may not submit a bid on a contract with a public entity for the construction or repair of a public building or public work, may not submit bids on leases of real property to a public entity, may not be awarded or perform work as a contractor, supplier, subcontractor, or consultant under a contract with any public entity, and may not transact business with any public entity in excess of the threshold amount provided in Section 287.107, for CATEGORY TWO for a period of 36 months from the date of being placed on the convicted vendor list.

BONDING REQUIREMENTS

A Bid Bond is required with the Contractor's submittal for 5% of the Bid price, in the form of a cashier's check, certified check or bond. A performance and payment bond will be required in the amount of 100% of the estimated contract value. The performance bond and payment bond can be a total of 100% combined.

GENERAL SERVICES INSURANCE REQUIREMENTS

CONTRACTORS INSURANCE

1. The Contractor shall not commence any work in connection with this Agreement until he has obtained all required insurance and such insurance has been approved by the Okaloosa County Risk Manager or designee.
2. All insurance policies shall be with insurers authorized to do business in the State of Florida.
3. All insurance shall include the interest of all entities named and their respective officials, employees & volunteers of each and all other interests as may be reasonably required by Okaloosa County. The coverage afforded the Additional Insured under this policy shall be primary insurance. If the Additional Insured have other insurance that is applicable to the loss, such other insurance shall be on an excess or contingent basis. The amount of the company's liability under this policy shall not be reduced by the existence of such other insurance.
4. The County and the State of Florida Department of Transportation shall be shown as an Additional Insured with a Waiver of Subrogation on the Certificate of Insurance.
5. The County shall retain the right to reject all insurance policies that do not meet the requirement of this Agreement. Further, the County reserves the right to change these insurance requirements with 60-day notice to the Contractor.
6. The County reserves the right at any time to require the Contractor to provide copies (redacted if necessary) of any insurance policies to document the insurance coverage specified in this Agreement.
7. The designation of Contractor shall include any associated or subsidiary company which is involved and is a part of the contract and such, if any associated or subsidiary company involved in the project must be named in the Workers' Compensation coverage.
8. Any exclusions or provisions in the insurance maintained by the Contractor that excludes coverage for work contemplated in this agreement shall be deemed unacceptable and shall be considered breach of contract.

WORKERS' COMPENSATION INSURANCE

1. The Contractor shall secure and maintain during the life of this Agreement Workers' Compensation insurance for all of his employees employed for the project or any site connected with the work, including supervision, administration or management, of this project and in case any work is sublet, with the approval of the County, the

Contractor shall require the Subcontractor similarly to provide Workers' Compensation insurance for all employees employed at the site of the project, and such evidence of insurance shall be furnished to the County not less than ten (10) days prior to the commencement of any and all sub-contractual Agreements which have been approved by the County.

2. Contractor must be in compliance with all applicable State and Federal workers' compensation laws, including the U.S. Longshore Harbor Workers' Act or Jones Act, if applicable.
3. No class of employee, including the Contractor himself, shall be excluded from the Workers' Compensation insurance coverage. The Workers' Compensation insurance shall also include Employer's Liability coverage.

BUSINESS AUTOMOBILE LIABILITY

Coverage must be afforded for all Owned, Hired, Scheduled, and Non-Owned vehicles for Bodily Injury and Property Damage in an amount not less than \$15,000,000 combined single limit each accident. If the contractor does not own vehicles, the contractor shall maintain coverage for Hired & Non-Owned Auto Liability, which may be satisfied by way of endorsement to the Commercial General Liability policy or separate Business Auto Policy. Contractor must maintain this insurance coverage throughout the life of this Agreement.

COMMERCIAL GENERAL LIABILITY INSURANCE

1. The Contractor shall carry other Commercial General Liability insurance against all other Bodily Injury, Property Damage and Personal and Advertising Injury exposures.
2. All liability insurance (other than Professional Liability) shall be written on an occurrence basis and shall not be written on a claims-made basis. If the insurance is issued with an aggregate limit of liability, the aggregate limit of liability shall apply only to the locations included in this Agreement. If, as the result of any claims or other reasons, the available limits of insurance reduce to less than those stated in the Limits of Liability, the Contractor shall notify the County representative in writing. The Contractor shall purchase additional liability insurance to maintain the requirements established in this Agreement. Umbrella or Excess Liability insurance can be purchased to meet the Limits of Liability specified in this Agreement.
3. Commercial General Liability coverage shall include the following:
 - 1.) Premises & Operations Liability
 - 2.) Bodily Injury and Property Damage Liability
 - 3.) Independent Contractors Liability
 - 4.) Contractual Liability
 - 5.) Products and Completed Operations Liability

4. Contractor shall agree to keep in continuous force Commercial General Liability coverage for the length of the contract.

LIMITS OF LIABILITY

The insurance required shall be written for not less than the following, or greater if required by law and shall include Employer’s liability with limits as prescribed in this contract:

	<u>LIMIT</u>
1. Worker’s Compensation	
1.) State	Statutory
2.) Employer’s Liability	\$500,000 each accident
2. Business Automobile	\$15,000,000.00 each accident (A combined single limit)
3. Commercial General Liability	\$15,000,000.00 each occurrence for Bodily Injury & Property Damage
	\$15,000,000.00 each occurrence Products and completed operations
4. Personal and Advertising Injury	\$15,000,000.00 each occurrence

NOTICE OF CLAIMS OR LITIGATION

The Contractor agrees to report any incident or claim that results from performance of this Agreement. The County representative shall receive written notice in the form of a detailed written report describing the incident or claim within ten (10) days of the Contractor’s knowledge. In the event such incident or claim involves injury and/or property damage to a third party, verbal notification shall be given the same day the Contractor becomes aware of the incident or claim followed by a written detailed report within ten (10) days of verbal notification.

INDEMNIFICATION & HOLD HARMLESS

Contractor shall indemnify and hold harmless the County, its officers and employees from liabilities, damages, losses, and costs including but not limited to reasonable attorney fees, to the extent caused by the negligence, recklessness, or wrongful conduct of the Contractor and other persons employed or utilized by the Contractor in the performance of this contract.

Note: For Contractor’s convenience, this certification form is enclosed and is made a part of the bid package.

CERTIFICATE OF INSURANCE

1. Certificates of insurance indicating the job site and evidencing all required coverage must be submitted not less than 10 days prior to the commencement of any of the work. The certificate holder(s) shall be as follows: Okaloosa County, 5479A Old Bethel Road, Crestview, Florida, 32536.
2. The contractor shall provide a Certificate of Insurance to the County with a thirty (30) day notice of cancellation; ten (10) days' notice if cancellation is for nonpayment of premium.
3. In the event that the insurer is unable to accommodate the cancellation notice requirement, it shall be the responsibility of the contractor to provide the proper notice. Such notification shall be in writing by registered mail, return receipt requested, and addressed to the Okaloosa County Purchasing Department at 5479-A Old Bethel Road, Crestview, FL 32536.
4. In the event the contract term goes beyond the expiration date of the insurance policy, the contractor shall provide the County with an updated Certificate of insurance no later than ten (10) days prior to the expiration of the insurance currently in effect. The County reserves the right to suspend the contract until this requirement is met.
5. The certificate shall indicate if coverage is provided under a claims-made or occurrence form. If any coverage is provided on a claims-made form, the certificate will show a retroactive date, which should be the same date of the initial contract or prior.
6. All certificates shall be subject to Okaloosa County's approval of adequacy of protection and the satisfactory character of the Insurer.
7. All deductibles whether approved by Okaloosa County or not, shall be the Contractor's full responsibility. In particular, the Contractor shall afford full coverage as specified herein to entities listed as Additional Insured. There are no self-insured retentions (SIR) allowable for this requirement and contract.
8. In no way will the entities listed as Additional Insured be responsible for, pay for, be damaged by, or limited to coverage required by this schedule due to the existence of a deductible.

GENERAL TERMS

Any type of insurance or increase of limits of liability not described above which, the Contractor required for its own protection or on account of statute shall be its own responsibility and at its own expense.

Any exclusions or provisions in the insurance maintained by the contractor that excludes coverage for work contemplated in this contract shall be deemed unacceptable and shall be considered breach of contract.

The carrying of the insurance described shall in no way be interpreted as relieving the Contractor of any responsibility under this contract.

Should the Contractor engage a subcontractor or sub-subcontractor, the same conditions will apply under this Agreement to each subcontractor and sub-subcontractor.

The Contractor hereby waives all rights of subrogation against Okaloosa County and its consultants and other indemnities of the Contractor under all the foregoing policies of insurance.

UMBRELLA INSURANCE

The Contractor shall have the right to meet the liability insurance requirements with the purchase of an umbrella insurance policy. In all instances, the combination of primary and umbrella liability coverage must equal or exceed the minimum liability insurance limits stated in this Agreement.

DELIVERY OF BIDS

Bid Opening shall be public, on the date and time specified on the NOTICE TO CONTRACTORS. It is the contractor's responsibility to assure that his bid is delivered at the proper time and place. Offers by telegram, facsimile, or telephone are NOT acceptable. NOTE: Crestview, Florida is "not a next-day-guaranteed delivery location" by delivery services.

Liquidated Damages:

In case of failure on the part of the Contractor to complete the work within the time(s) specified in the contract, or within such additional time(s) as may be granted by Okaloosa County, the County will suffer damage, the amount of which may be difficult, if not impossible, to ascertain. Therefore, the Contractor shall pay to the County, as liquidated damages, the amount established in the schedule below for each calendar day of delay that actual completion extends beyond the time limit specified until such reasonable time as may be required for final completion of the work. In no way shall costs for liquidated damages be construed as penalty on the contractor.

Daily Charge

<u>Original Contract Amount</u>	<u>Per Calendar Day</u>
\$50,000 and under	\$ 311
Over \$50,000 but less than \$250,000	\$ 972
\$250,000 but less than \$500,000	\$1584
\$500,000 but less than \$2,500,000	\$1924
\$2,500,000 but less than \$5,000,000	\$2694
\$5,000,000 but less than \$10,000,000	\$3902

\$10,000,000 but less than \$15,000,000	\$6102
\$15,000,000 but less than \$20,000,000	\$7022
\$20,000,000 and over	\$7022

Determination of Number of Days of Default: For all contracts, regardless of whether the contract time is stipulated in calendar days or working days, the default days shall be counted in calendar days. Construction Time is stipulated in Section 5 of the BID FORMS.

Conditions under which Liquidated Damages are Imposed: Should the Contractor or, in case of his default, the Surety, fail to complete the work within the time stipulated in the contract, or within such extra time as may have been granted by the County, the Contractor or, in case of his default, the Surety, shall pay to the County, not as a penalty, but as liquidated damages, the amount so due as determined by the Daily Charge requirements, as provided above.

Right of Collection: The County shall have the right to apply as payment on such liquidated damages any money which is due to the Contractor by the County.

Permitting Contractor to Finish Work: Permitting the Contractor to continue and to finish the work, or any part of it, after the expiration of the contract time allowed, including extensions of time granted to the Contractor, shall in no way act as a waiver on the part of the County the liquidated damages due under the contract.

Completion of Work by County: In case of default of the contract and the completion of the work by the County, the Contractor and his Surety shall be liable for the liquidated damages under the contract, but no liquidated damages shall be chargeable for any delay in the final completion of the work by the County due to any unreasonable action or delay on the part of the County.

END OF OKALOOSA COUNTY STANDARD CLAUSES

BID FORM

PROJECT IDENTIFICATION:

CONSTRUCT BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION
AT VPS

CONTRACT IDENTIFICATION AND NUMBER:

Okaloosa County Bid No.: **ITB AP 59-20**
FAA AIP No.: TBD

THIS BID IS SUBMITTED TO:

OKALOOSA COUNTY BOARD OF COUNTY COMMISSIONERS

1. The undersigned Contractor proposes and agrees, if this Bid is accepted, to enter into an agreement with Owner in the form included in these documents to perform and furnish all Work as specified or indicated in these documents for the Bid Price and within the Bid Times indicated in this Bid and in accordance with the other terms and conditions of these documents.

2. Contractor accepts all of the terms and conditions of the Invitation to Bid and Instructions to Contractors, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for one-hundred twenty (120) days after the day of Bid opening. Contractor will sign and deliver the required number of counterparts of the Agreement with the Bonds and other documents required by the Project Requirements within fifteen (15) days after the date of Owner's Notice of Award.

3. In submitting this Bid, Contractor represents as more fully set forth in the Agreement, that:

(a) Contractor has examined and carefully studied the Project Documents and the following Addenda receipt of all which is hereby acknowledged: (List Addenda by Addendum Number and Date)

Addendum No. _____ Date _____

Addendum No. _____ Date _____

Addendum No. _____ Date _____

Addendum No. _____ Date _____

(b) Contractor has visited the site and become familiar with and is satisfied as to the general, local, and site conditions that may affect cost, progress, performance, and furnishing of the Work.

(c) Contractor is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, performance, and furnishing of the Work.

Contractor has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to the site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except underground facilities) which have been identified in the Bid Documents. Contractor acknowledges that such reports and drawings are not Contract Documents and may not be complete for Contractor's purposes. Contractor acknowledges that Owner and Architect/Engineer do not assume responsibility for the accuracy or completeness of information and data shown or indicated in the Project Documents with respect to underground facilities at or contiguous to the site. Contractor has obtained and carefully studied (or assumes responsibility for having done so) all such additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and underground facilities) at or contiguous to the site or otherwise which may affect cost progress, performance or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto. Contractor does not consider that any additional examinations, investigations, explorations, tests, studies or data are necessary for the determination of this Bid for performance and furnishing of the Work in accordance with the times, price, and other terms and conditions of these Documents.

(e) Contractor is aware of the general nature of Work to be performed by Owner and others at the site that relates to Work for which this Bid is submitted as indicated in these documents.

(f) Contractor has correlated the information known to Contractor, information and observation obtained from visits to the site, reports and drawings identified in these documents and all additional examinations, investigations, explorations, tests, studies, and data with these documents.

(g) Contractor has given Architect/Engineer written notice of all conflicts, errors, ambiguities or discrepancies that Contractor has discovered in these documents and the written resolution thereof by Architect/Engineer is acceptable to Contractor, and these documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work for which this Bid is submitted.

(h) This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm, or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation; Contractor has not directly or indirectly induced or solicited any other Contractor to submit a false or sham Bid; Contractor has not solicited or induced any person, firm or corporation to refrain from Project; and Contractor has not sought by collusion to obtain for itself any advantage over any other Contractor or over Owner.

4. Contractor will complete the Work in accordance with these documents for the price found in the Bid Schedule:

5. **Contract Time**: Contractor agrees that Work will be substantially complete **420** calendar days after the date when the (NTP) Contract Time commences to run, and will be completed and ready for final inspection and final payment within **450** calendar days after the date when the (NTP) Contract Time commences to run.

6. **Liquidated Damages**: Contractor accepts the provisions of the Agreement as to liquidated damages identified in the Okaloosa County Standard Clauses, in the event of failure to achieve substantial completion of the Work and the Concession Shell spaces within the Substantial Completion time and achieve final completion of the work within the Final Completion time as specified in the Agreement.

The following documents are attached to and made a condition of this Bid:

Bid Schedule (BF-8)

Bid Affidavit (BF-10)

Bid Bond. (BF-12)

Required Contractor's Qualification Questionnaire (BF-16)

Form of Non-collusion Affidavit (BF-19)

Certification of Non-Segregated Facilities (BF-21)

Public Entity Crimes (BF-23)

Certificate as to Corporate Principal (BF-27)

Certified Copy of Resolution of Board of Directors (BF-29)

Conflict of Interest Disclosure Form (BF-31)

Drug-Free Workplace Certification (BF-33)

Certification of Contractor Regarding Trench Safety (BF-35)

Indemnification and Hold Harmless (BF-37)

Insurance Compliance (BF-39)

Affidavit – Worker’s Compensation (BF-41)

Recycled Content Form (BF-43)

Disadvantaged Business Enterprise Program (BF-45)

DBE Certificate of Compliance Form (BF-49)

Performance of Work by Subcontractors (BF-57)

E-Verify Compliance Certification (BF-59)

Cone of Silence (BF-61)

Buy American Certificate (BF-63)

Lobbying – 31 USC 1352 (BF-65)

Equal Employment Opportunity Report Statement (BF-67)

Vendors On Scrutinized Companies Lists (BF-69)

System Awards Management (BF-71)

Certification of Offeror/Contractor Regarding Tax Delinquency and Felony Convictions (BF-73)

Government Debarment and Suspension (BF-75)

Certification regarding Debarment & Suspension (BF-77)

Company Data (BF-79)

7. Communications concerning this Bid shall be addressed to the address of Contractor indicated below.

8. Terms used in this Bid which are defined in the Instructions to Contractors will have the meanings indicated in the Instructions.

9. Contractor acknowledges that the Basis of Award shall be the Total Bid Amount, price and other factors considered. The bid bond amount shall be in the amount of the Total Bid Amount.

SUBMITTED on _____, 20__

State Contractor License No. _____

If Contractor is:

An Individual

By _____ (SEAL)

(Individual's Name)

doing business as _____

Business address: _____

Phone No.: _____

A Partnership

By _____ (SEAL)

(Firm Name)

(General Partner)

Business address: _____

Phone No.: _____

A Corporation

By _____ (SEAL)

(Corporation Name)

(State of Incorporation)

By _____ (SEAL)

(Name of person authorized to sign)

(Title)

(Corporate Seal)

Attest _____

(Secretary)

Business address: _____

Phone No.: _____

Date of Qualification to do business is _____

A Joint Venture

By _____ (SEAL)
(Name)

(Address)

By _____ (SEAL)
(Name)

(Address)

Phone Number and Address for receipt of official communications

(Each joint venture must sign. The manner of signing for each individual, partnership and corporation that is a party to the joint venture should be in the manner indicated above).



Bid Schedule
ITB AP 59-20 CONSTRUCT OF BAGGAGE HANDLING
SYSTEM AND WEST TERMINAL EXPANSION at
Destin – Fort Walton Beach Airport (VPS)



Item Description	Quantity	Unit	Amount
BASE BID	1	Each	

Note: Bid alternates will be discussed at the pre-bid meeting and any scope of work that may be separated from the based bid will be clearly identified in addenda as necessary.

****If a contractor would like to have a copy of this bid sheet in Excel format, please email jdarr@myokaloosa.com to request a copy.****

FOR ALL WORK REQUIRED TO PERFORM IN ACCORDANCE WITH THE CONSTRUCTION DRAWINGS, SPECIFICATIONS AND OTHER CONTRACT DOCUMENTS, INCLUDING ALL COSTS RELATED TO THE WORK, AND ANY REQUIRED PERMITS, TAXES, BONDS AND INSURANCE, THE UNDERSIGNED SUBMITS A TOTAL BID AMOUNT OF:

BASE BID = TOTAL BID (amount in words):

_____ Dollars and
 _____ cents

(\$ _____)
(Total Amount Bid in numbers)

The Contractor represents that it has examined the site of the Work and informed itself fully in regard to all conditions pertaining to the place where the work is to be done; that it has examined the plans and specifications for the work and other Contract Documents relative thereto and has read all of the Addenda furnished prior to the opening of the Bids, as acknowledged below; and that it has otherwise fully informed itself regarding the nature, extent, scope and details of the Work to be performed.

If provided with a Notice of Intent to Award the Contract by the Owner, the Contractor shall execute and deliver to the Owner all of the documents required by the Contract Documents, including but not limited to, the Addendum to the Agreement and the Performance and Payment Bonds in the form contained in the Contract Documents, furnish the required evidence of the specified insurance coverages, furnish all necessary permits, license, materials, equipment, machinery, maintenance, tools, apparatus, means of transportation and labor necessary to complete the Work.

Dated and signed at _____, _____, this ____ day of _____, 2020.

(Name of Contractor)

(Authorized Signature)

(Title)

(Mailing Address)

(City, State, Zip)

(Federal ID No. or SS No.)

BID AFFIDAVIT

The following affidavit must be executed in order that your quotation may be considered.

STATE OF _____

COUNTY OF _____

_____ of lawful age, being first duly sworn, upon his oath deposes and says: That he executed the accompanying Quotation of behalf of the Contractor therein named, and that he had lawful authority so to do, and said Contractor has not directly or indirectly, entered into any agreement, expressed or implied, with any Contractor or Contractors, having to its object the controlling of the price or amount of such quotation or any quotations, the limiting of the Quotation or Contractors, the parceling or farming out to any Contractor or Contractors, to other persons of any part of the contract or any of the subject matter or the Quotations, or of the profits thereof, and that he has not and will not divulge the sealed Quotation to any person whomsoever, except those having a partnership or other financial interest with him in said Quotation or Quotations, until after the sealed Quotation or Quotations are opened.

[signature]

[date]

STATE OF _____ COUNTY OF _____

PERSONALLY APPEARED BEFORE ME, the undersigned authority, *[name of individual signing]* who, after first being sworn by me, affixed his/her signature in the space provided above on this ___ day of _____, 20__.

Subscribed and sworn to before me this _____ day of _____, 2020.

My Commission Expires:

Notary Public

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BID BOND

CONTRACTOR *(Name and Address):*

SURETY *(Name and Address of Principal Place of Business):*

OWNER *(Name and Address):*

Okaloosa County
1250 North Eglin Parkway
Shalimar, FL 32579

BID:

BID DUE DATE: _____

PROJECT *(Brief Description Including Location):* _____

ITB AP 59-20 Construct Baggage Handling System and West Terminal Expansion as Depicted in Contract Drawings and Specifications at Destin-Fort Walton Beach Airport

BOND:

BOND NUMBER: _____

DATE: *(Not later than Bid Due Date):* _____

PENAL SUM: _____

IN WITNESS WHEREOF, Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each because this Bid bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR

SURETY

Contractor's Name and Corporate Seal

Surety's Name and Corporate Seal

By: _____
Signature and Title

By: _____
Signature and Title
(Attach Power of Attorney)

Attest: _____
Signature and Title

Attest: _____
Signature and Title

Note: (1) Above addresses are to be used for giving required notice.

- (2) Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

EJCDC NO. 1910-28-C (1990 Edition)

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to pay to OWNER upon default of Contractor the penal sum set forth on the face of this Bond.
2. Default of Contractor shall occur upon the failure of Contractor to deliver within the time required by the Project Documents the executed Agreement required by the Project Documents and any performance and payment bonds required by the Project Documents and Contract Documents.
3. This obligation shall be null and void if:
 - 3.1. OWNER accepts Contractor's Bid and Contractor delivers within the time required by the Project Documents (or any extension thereof agreed to in writing by OWNER) the executed Agreement required by the Project Documents and any performance and payment bonds required by the Project Documents and Contract Documents, or
 - 3.2 All Bids are rejected by OWNER, or
 - 3.3 OWNER fails to issue a notice of award to Contractor within the time specified in the Project Documents (or any extension thereof agreed to in writing by Contractor and, if applicable, consented to by Surety when required by paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Contractor and within 30 calendar days after receipt by Contractor and Surety of written notice of default from OWNER, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of and any and all defenses based on or arising out of any time extension to issue notice of award agreed to in writing by OWNER and Contractor, provided that the time for issuing notice of award including extensions shall not in the aggregate exceed 60 days from Bid Due Date without Surety's written consent.
6. No suit or action shall commence under this Bond prior to 30 calendar days after the notice of default required in paragraph 4 above is received by Contractor and Surety, and in no case later than one year after Bid Due Date.
7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notice required hereunder shall be in writing and sent to Contractor and Surety at their respective addresses shown on the face of this Bond. such notices may be sent by personal delivery, commercial courier or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent or representative who executed this Bond on behalf of Surety to execute, seal and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of any Bond conflicts with any applicable provision of any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

5. Do you plan to sublet any part of this work? If so, give details.

6. What equipment do you own that is available for this work?

7. What equipment do you plan to rent or purchase for this work?

8. Have you ever performed work under the direction of a Professional Architect/Engineer or Registered Architect? If so, list up to three (3) such firms giving the name of the firm, its address, telephone number and the name of the project. (List most recent projects).

9. Give the name, address and telephone number of an individual who represents each of the following and whom the Owner may contact to investigate your financial responsibility: a surety, a bank, and a major material supplier.

10. Provide a financial statement for your company. This should include a balance and income statement for your most recent fiscal year. A certified audit is preferred but not required. Use an insert sheet, if needed. Only three (3) lowest contractors shall submit this information (if requested by Owner) to the Owner within two (2) business days of the opening of the Bids.

11. State the true, exact, correct and complete name of the partnership, corporation or trade name under which you do business, and the address of the place of business. (If a corporation, state the name of all partners. If a trade name, state the names of the individuals who do business under the trade name.) It is absolutely necessary that information be furnished.

Correct Name of Contractor _____

(a) The business is a _____

(b) The address of principal place of business is:

(c) The names of the corporate officers, or partners, or individuals doing business under a trade name, are as follows:

FORM OF NONCOLLUSION AFFIDAVIT

(This Affidavit is Part of Bid)

STATE OF _____

COUNTY OF _____

_____ Being

first duly sworn, deposes and says that he is

_____ (Sole owner, a partner, president, secretary, etc.) of

_____ the party making the foregoing Proposal or BID that such BID is genuine and not collusive or sham; that said CONTRACTOR has not colluded, conspired, connived, or agreed, directly or indirectly, with any CONTRACTOR or person, to put in a sham BID, or that such other person shall refrain from the project, and has not in any manner, directly or indirectly sought by agreement or collusion, or communication or conference, with any person, to fix the Bid Price of affiant or any other CONTRACTOR, or to fix any overhead, profit or cost element of said Bid Price, or of that of any other CONTRACTOR, or to secure any advantage against OWNER any person interested in the proposed Contract; and that all statements in said Proposal or Bid are true; and further, that such CONTRACTOR has not, directly or indirectly submitted this BID, or the contents thereof, or divulged information or data relative thereto to any association or to any member or agent thereof.

_____ (Contractor)

Sworn to and subscribed before me this _____ day of

_____, 20__.

Notary Public in and for

_____ County,

_____.

My Commission Expires:

_____, 20__.

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CERTIFICATION OF NON-SEGREGATED FACILITIES

(Must be completed and submitted with the Bid)

The Contractor certifies that it does not maintain or provide for its employee any segregated facilities at any segregated facilities at any of its establishments, and that it does not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor certifies further that it will not maintain or provide for its employees segregated facilities at any of its establishments, and that it will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor agrees that a breach of this certification is a violation of the equal opportunity clause in this contract. As used in this certification, the term “segregated facilities” means any waiting room, work areas, restrooms and washrooms, restaurants and other eating areas, parking lots, drinking fountains, recreation or entertainment areas, transportation and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on basis of race, color, religion, or national origin, because of habit, local custom, or any other reason. The Contractor agrees that (except where it has obtained identical certification from proposed subcontractors for the specific time period) it will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the equal opportunity clause, and that it will retain such certification in its files.

(Name of Contractor) _____

By: _____

Title: _____

Dated: _____

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**SWORN STATEMENT UNDER SECTION 287.133 (3) (a),
FLORIDA STATUTES, ON PUBLIC ENTITY CRIMES**

**THIS FORM MUST BE SIGNED AND SWORN IN THE PRESENCE OF A NOTARY
PUBLIC OR OTHER OFFICIAL AUTHORIZED TO ADMINISTER OATHS.**

1. This sworn statement is submitted to _____
[print name of public entity]
by _____
[print individuals name and title]
for _____
[print name of entity submitting sworn statement]

whose business is _____ and (if applicable) its Federal Employer Identification Number (FEIN) is _____ (If the entity has no FEIN, include the Social Security Number of the individual signing this sworn statement: _____.)

2. I understand that a "public entity crime" as defined in Section 287.133 (1) (g), Florida Statutes, means a violation of any state or federal law by a person with respect to and directly related to the transaction of business with any public entity or with an agency or political subdivision of any other state or of the United States, including, but not limited to, any bid or contract for goods or services to be provided to any public entity or an agency or political subdivision of any other state or of the United States and involving antitrust, fraud, theft, bribery, collusion, racketeering, conspiracy, or material misrepresentation.
3. I understand that "convicted" or "conviction" as defined in Section 287.133 (1) (b), Florida Statutes, means a finding of guilt or a conviction of a public entity crime, with or without an adjudication of guilt, in any federal or state trial court of record relating to charges brought by indictment or information after July 1, 1989, as a result of a jury verdict, non-jury trial, or entry of a plea of guilty or nolo contendere.
4. I understand that an "affiliate" as defined in Section 287.133 (1) (a), Florida Statutes, means:
- A. A predecessor or successor of a person convicted of a public entity crime; or
 - B. An entity under the control of any natural person who is active in the management of the entity and who has been convicted of a public entity crime. The term "affiliate" includes those officers, directors, executives, partners, shareholders, employees, members and agents who are active in the management of an affiliate. The ownership by one person of shares constituting a controlling interest in another person, or a pooling of equipment or income among persons when not for fair market value under an arm's length agreement, shall be a prima facie case that one person controls another person. A person who knowingly enters into a joint venture with a person who has been convicted of a public entity crime in Florida during the preceding 36 months shall be considered an affiliate.

5. I understand that a "person" as defined in Section 287.133 (1) (e) Florida Statutes, means any natural person or entity organized under the laws of any state or of the United States with the legal power to enter into a binding contract and which bids or applies to bid on contracts for the provision of goods or services let by a public entity, or which otherwise transacts or applies to transact business with a public entity. The term "person" includes those officers, directors, executives, partners, shareholders, and employees, members, and agents who are active in management of an entity.
6. Based on information and belief, the statement which I have marked below is true and in relation to the entity submitting this sworn statement. [Indicate which statement applies.]

Neither the entity submitting this sworn statement, nor any of its officers, directors, executives, partners, shareholders, employees, members, or agents who are active in the management of the entity, nor any affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989.

The entity submitting this sworn statement, or one or more of its officers, directors, executives, partners, shareholders, employees, members, or agents who are active in the management of the entity, or an affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989.

The entity submitting this sworn statement, or one or more of its officers, directors, executives, partners, shareholders, employees, members, or agents who are active in the management of the entity, or an affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989. However, there has been a subsequent proceeding before a Hearing Officer of the State of Florida, Division of Administrative Hearings and the Final Order entered by the Hearing Officer determined that it was not in the public interest to place the submitting this sworn statement on the convicted vendor list. [attach a copy of the final order]

I UNDERSTAND THAT THE SUBMISSION OF THIS FORM TO THE CONTRACTING OFFICER FOR THE PUBLIC ENTITY IDENTIFIED IN PARAGRAPH 1 (ONE) ABOVE IS FOR THAT PUBLIC ENTITY ONLY AND, THAT THIS FORM IS VALID THROUGH DECEMBER 31 OF THE CALENDAR YEAR IN WHICH IT IS FILED. I ALSO UNDERSTAND THAT I AM REQUIRED TO INFORM THE PUBLIC ENTITY PRIOR TO ENTERING INTO A CONTRACT IN EXCESS OF THE THRESHOLD AMOUNT PROVIDED IN SECTION 287.107, FLORIDA STATUTES FOR CATEGORY TWO ON ANY CHANGE IN THE INFORMATION CONTAINED IN THIS FORM.

[signature]

[date]

STATE OF _____ COUNTY OF _____

PERSONALLY APPEARED BEFORE ME, the undersigned authority,

[name of individual signing] _____

who, after first being sworn by me, affixed his/her signature in the space provided above on this day of _____, 20__.

Subscribed and sworn to before me this _____ day of _____, 20_.

My Commission Expires:

Notary Public

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CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the Secretary of the Corporation named as Principal in the within bond; that _____ who signed the bond on behalf of the Principal, was then _____ of said Corporation; that I know his/her signature, and his/her signature hereto is genuine; and that said bond was duly signed, sealed, and attested for and in behalf of said Corporation by authority of its governing body.

Secretary (Corporate Seal)

**STATE OF FLORIDA
COUNTY OF**

Before me, a Notary Public, duly commissioned, qualified and acting, personally appeared _____ to me well known, who being my first duly sworn upon oath, says that he/she is the Attorney-in-Fact, for the _____ and that he has been authorized by _____ to execute the foregoing bond on behalf of the Contractor named therein in favor of Okaloosa County.

Subscribed and sworn to before me this ____ day of __, 20 __, A.D.

[Attach Power of Attorney to Original Bid Bond and Financial Statement from Surety Company]

Notary Public
State of Florida-at-Large

My commission Expires:

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**CERTIFIED COPY OF RESOLUTION OF
BOARD OF DIRECTORS OF**

(NAME OF CORPORATION)

"RESOLVED that, _____
(Title) (Person Authorized to Sign)
(Title)

of _____
(Name of Corporation)

is authorized to sign and submit the Bid of this corporation for the following Project:

**CONSTRUCT BAGGAGE HANDLING SYSTEM AND WEST TERMINAL
EXPANSION AT VPS**

and to include in such bid the certificate as to non-collusion, and for any inaccuracies or misstatements in such certificate this corporate Contractor shall be liable under the penalties of perjury.

The foregoing is a true and correct copy of the resolution adopted by

(NAME OF CORPORATION)

at a meeting of its Board of Directors held on the _____ day of _____,
20__.

By _____

Title _____

(SEAL)

The above form must be completed if the Contractor is a Corporation.

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CONFLICT OF INTEREST DISCLOSURE FORM

For purposes of determining any possible conflict of interest, all contractors/proposers, must disclose if any Okaloosa Board of County Commissioner, employee(s), elected officials(s), or if any of its agencies is also an owner, corporate officer, agency, employee, etc., of their business.

Indicate either “yes” (a county employee, elected official, or agency is also associated with your business), or “no.” If yes, give person(s) name(s) and position(s) with your business.

YES _____ NO _____

NAME(S)

POSITION(S)

FIRM NAME: _____

BY (PRINTED): _____

BY (SIGNATURE): _____

TITLE: _____

ADDRESS: _____

EMAIL: _____

PHONE NO.: _____

DATE: _____

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DRUG-FREE WORKPLACE CERTIFICATION

THE BELOW SIGNED CONTRACTOR CERTIFIES that it has implemented a drug-free workplace program. In order to have a drug-free workplace program, a business shall:

1. Publish a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the workplace and specifying the actions that will be taken against employees for violations of such prohibition.
2. Inform employees about the dangers of drug abuse in the workplace, the business's policy of maintaining a drug-free workplace, any available drug counseling, rehabilitation and employee assistance programs, and the penalties that may be imposed upon employees for drug abuse violations.
3. Give each employee engaged in providing the commodities or contractual services that are under bid a copy of the statement specified in subsection 1.
4. In the statement specified in subsection 1, notify the employees that, as a condition of working on the commodities or contractual services that are under bid, the employee will abide by the terms of the statement and will notify the employer of any conviction of, or plea of guilty or nolo contendere to, to any violation of Chapter 893 or of any controlled substance law of the United States or any state, for a violation occurring in the workplace no later than five (5) days after such conviction.
5. Impose a sanction on, or require the satisfactory participation in drug abuse assistance or rehabilitation program if such is available in the employee's community, by any employee who is convicted.
6. Make a good faith effort to continue to maintain a drug-free workplace through implementation of this section.

As the person authorized to sign this statement, I certify that this firm complies fully with the above requirements.

DATE: _____

COMPANY: _____ SIGNATURE: _____

ADDRESS: _____ NAME: _____
(Typed or Printed)

TITLE: _____

PHONE #: _____

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CERTIFICATION OF CONTRACTOR REGARDING TRENCH SAFETY

This certification is required pursuant to the Trench Safety Act, Chapter90-98, Florida Statutes regarding Trench Safety. The Act specifically incorporates the Occupational Safety and Health Administration's excavation safety standards, 29 CFR S. 1928.650 Subpart P as the state standard. Any revision to OSHA's safety standards that are consistent with the Florida Statutes shall also be complied with upon its effective date. The act requires that any contractor or prospective contractor, or any of their proposed subcontractors, shall provide written assurance that the contractor will comply with the applicable trench safety standards

NAME AND ADDRESS OF CONTRACTOR (Include Zip Code)

1. Contractor agrees that he is aware of the Trench Safety Act and the requirements of the Act.

Yes _____ No _____

2. Contractors agrees to comply with all applicable trench safety standards as set forth in the Act and as referenced in the Act.

Yes _____ No _____

NAME AND TITLE OF SIGNER (Please Print or Type)

SIGNATURE _____ DATE _____

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INDEMNIFICATION AND HOLD HARMLESS

CONTRACTOR shall indemnify and hold harmless COUNTY, its officers and employees from liabilities, damages, losses, and costs including but not limited to reasonable attorney fees, to the extent caused by the negligence, recklessness, or intentional wrongful conduct of the CONTRACTOR and other persons employed or utilized by the CONTRACTOR in the performance of this Agreement.

Contractor's Company Name

Authorized Signature – Manual

Physical Address

Authorized Signature – Typed

Mailing Address

Title

Phone Number

FAX Number

Cellular Number

After-Hours Number(s)

Date

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INSURANCE COMPLIANCE

This form is to be completed and signed the Contractor and by your insurance agent/carrier certifying that your policy either meets the insurance requirements (as specified in page BOC-2 to BOC-6) or that the insurance company has reviewed the bid requirements and certifies that you were bid any price increase due to required coverage.

CONTRACTOR

I certify that the insurance requirements have been reviewed.

Company Name _____

Address _____

Representative

Name _____

Title _____

Phone Number _____

INSURANCE COMPANY

I certify that the insurance requirements have been reviewed with the above contractor.

Company Name _____

Address _____

Representative

Name _____

Title _____

Phone Number _____

[PAGE INTENTIONALLY LEFT BLANK]

AFFIDAVIT - WORKER'S COMPENSATION

State of _____

County of _____

SS: _____

of _____

being duly sworn, deposes and says that he now carries or that he has applied for a Worker's Compensation Policy to cover the operations, as set forth in the preceding contract, and to comply with the provisions thereof.

Signed: _____

Subscribed and sworn to before me this _____ day of __, 20 __

Notary Public

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RECYCLED CONTENT FORM

RECYCLED CONTENT INFORMATION:

1. Is the material in the above: VIRGIN _____ or RECYCLED _____
(Check the applicable blank)
If RECYCLED, what percentage _____ %.

Product Description: _____

2. Is your product packaged and/or shipped in material containing recycled content?

Yes _____ No _____

Specify: _____

3. Is your product recyclable after it has reached its intended end use?

Yes _____ No _____

Specify: _____

The above is not applicable if there is only a personal service involved with no product involvement.

Name of Contractor:

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DISADVANTAGED BUSINESS ENTERPRISE PROGRAM

The following bid condition applies to this Department of Transportation (DOT) assisted contract. Submission of a bid/proposal by a prospective contractor shall constitute full acceptance of these bid conditions.

1. **DEFINITION** - Disadvantaged Business Enterprise (DBE) as used in this contract shall have the same meaning as defined in 49 CFR Part 26.
2. **POLICY** - It is the policy of DOT that DBE's as: defined in 49 CFR Part 26 shall have the maximum opportunity to participate in the performance of contracts and subcontracts financed in whole or in part with Federal funds. Consequently, the DBE requirements of 49 CFR Part 26 apply to this contract.
3. **OBLIGATION** - The contractor agrees to ensure that DBE's as defined In 49 CFR Part 26 have the maximum opportunity to participate in the performance of contracts and subcontracts financed in whole or in part with Federal funds. In this regard, all contractors shall take all necessary and reasonable steps in accordance with 49 CFR Part 26 to ensure that DBE's have the maximum opportunity to compete for and perform contracts. Contractors shall not discriminate on the basis of race, color, national origin, or sex in the award and performance of DOT assisted contracts.
4. **COMPLIANCE** - All contractors, potential contractors, or subcontractors for this DOT assisted contract are hereby notified that failure to carry out the DOT policy and the DBE obligation, as set forth above, shall constitute a breach of contract which may result in termination of the contract or such other remedy as deemed appropriate by the owner.
5. **CONTRACT CLAUSE** - All contractors and potential contractors hereby assure that they will include the above clauses in all subcontracts, which offer further subcontracting opportunities.
6. **CONTRACT AWARD** - Contractors are hereby advised that meeting the DBE subcontract goal (if applicable) or making an acceptable good faith effort to meet said goal are conditions of being awarded this DOT assigned contract.

The owner proposes to award the contract to the lowest responsive and responsible contractor submitting a reasonable bid provided he has met the goal for DBE participation or, if failing to meet the goal, he has made an acceptable good faith effort to meet the established goal for DBE participation. Contractor is advised that the owner reserves the right to reject any or all bids submitted.

7. **DBE PARTICIPATION GOAL** – The attainment of the goal established for this contract is to be measured as a percentage of the total dollar value of the contract. The DBE goal established for this contract is **7.85%**
8. **AVAILABLE DBE'S** – The FDOT maintains an online searchable database of DBE

firms at <https://www3.dot.state.fl.us/equalopportunityoffice/biznet>. This program contains listing of DBE's (certified and noncertified). Contractors are encouraged to inspect this list to assist in locating DBEs for the work. Other DBEs may be added to the list in accordance with the owner's approved DBE program. Credit toward the DBE goal will not be counted unless the DBE to be used can be certified by the owner.

9. CONTRACTOR'S REQUIRED SUBMISSION - The owner requires the submission of the following information with the bid:

(DBE percentage should reflect price plus any alternates)

(CONTRACTOR/FIRM NAME) _____

The undersigned, hereinafter called "Contractor", lists below the names of the DBE subcontractors who will perform the indicated scope of work for the amounts listed.

<u>Name, Address, and Telephone Number of DBE Subcontractor</u>	<u>Scope of Work</u>	<u>Dollar Amount of Subcontract</u>
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____

Only 60% of the dollars spent with a DBE Supplier will be counted toward participation in any category, and this amount can only satisfy 60% of the total needed to fulfill any goal.

Total DBE Dollars: \$ _____

Total Project Bid (includes alternates): \$ _____

DBE Percentage of Total Bid: _____ %

If the Contractor fails to meet the contract goal established in Section 7 above, the following information must be submitted with the bid to assist the owner in determining whether or not the contractor made acceptable good faith efforts to meet the contract goal. This information (when applicable), as well as the DBE information, should be submitted as specified in Section 9 above. Use the "Statement of Good Faith Efforts" form provided herein.

Suggested guidance for use in determining if good faith efforts were made by a contractor are included in 49 CFR Part 26.

A list of the efforts that a contractor may make and the owner may use in making a determination as to the acceptability of a contractor's efforts to meet the goal as included in 49 CFR Part 26 are as follows:

- a. Whether the contractor attended any pre-solicitation or pre-bid meetings that were scheduled by the recipient to inform DBE's of contracting and subcontracting opportunities;
- b. Whether the contractor advertised in general circulation, trade association, and minority-focus media concerning the subcontracting opportunities;
- c. Whether the contractor provided written notice to a reasonable number of specific DBE's that their interest in the contract was being solicited in sufficient time to allow the DBE's to participate effectively;
- d. Whether the contractor followed up initial solicitations of interest by contacting DBE's to determine with certainty whether the DBE's were interested;
- e. Whether the contractor selected portions of work to be performed by DBE's in order to increase the likelihood of meeting the DBE goal (including, where appropriate, breaking down contracts into economically feasible units to facilitate DBE participation);
- f. Whether the contractor provided interested DBE's with adequate information about the plans, specifications, and requirements of the contract;
- g. Whether the contractor negotiated in good faith with interested DBE's, not rejecting DBE's as unqualified without sound reasons based on a thorough investigation of their capabilities.

- h. Whether the contractor made efforts to assist interested DBE's in obtaining bonding, lines of credit, or insurance required by the recipient or contractor; and
- i. Whether the contractor effectively used the services of available minority community organizations; minority contractors' groups; local and state Federal Minority Business Assistance Offices; and other organizations that provide assistance in the recruitment and placement of DBE's.

NOTE: The nine items set forth above are merely suggested criteria and the owner may specify that you submit information on certain other actions a contractor took to secure DBE participation in an effort to meet the goals. A contractor may also submit to the owner other information on efforts to meet the goals.

10. CONTRACTOR ASSURANCE - The contractor hereby assures that he will meet one of the following as appropriate:

- a. The DBE participation goal as established on page BF-45.
- b. The DBE participation percentage as shown in BF-49, which was submitted as a condition of contract award.

Agreements between contractor/proposer and a DBE in which the DBE promises not to provide subcontracting quotations to other contractors/proposers are prohibited. The contractor shall make a good faith effort to replace a DBE subcontract that is unable to perform successfully with another DBE subcontractor. Substitution must be coordinated and approved by the owner.

The contractor shall establish and maintain records and submit regular reports, as required, which will identify and assess progress in achieving DBE subcontract goals and other DBE affirmative action efforts.

11. PROMPT PAYMENT - The prime contractor agrees to pay each subcontractor under this prime contract for satisfactory performance of its contract no later than **10** days from the receipt of each payment the prime contractor receives from the owner. The prime contractor agrees further to return retainage payments to each subcontractor within **10** days after the subcontractor's work is satisfactorily completed. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval of the owner. This clause applies to both DBE and non-DBE subcontractors.

DBE CERTIFICATE OF COMPLIANCE FORM

The Florida Department of Transportation maintains an online searchable database of DBE firms at (<https://www3.dot.state.fl.us/equalopportunityoffice/biznet>).

Okaloosa County intends to utilize and implement this program in the awarding of this contract.

This is to certify that I have reviewed the plan, bid evaluation procedure, and DBE directory and will make all reasonable efforts to include DBE Contractors as outlined in this document.

Contractor's Signature

Date

Title

Notary Public

[PAGE INTENTIONALLY LEFT BLANK]

DBE STATEMENT OF GOOD FAITH EFFORTS

BIDDER: _____

DATE: _____

This form is to be completed if bidder fails to achieve the DBE goals established for this project. The bidder is allowed to use an alternate method that demonstrates the good faith efforts made to meet the goals established as long as all of the requested information is included. Failure to include all requested information shall result in the bid being determined as nonresponsive to the DBE requirements.

The following list is not intended to be exclusive or exhaustive and the City will look not only at the different kinds of efforts the bidder has made, but also the quality, quantity, intensity and timeliness of those efforts. It is the responsibility of the bidder to exercise good faith efforts. Any act or omission by the City shall not relieve the bidder of this responsibility.

Criteria listed below are excerpted from Appendix A of 49 CFR93, as amended. A response is required to address each cited paragraph. Additional pages may be added as necessary.

1. **Attendance at Pre-Bid conference, if held:**

___ Yes ___ No ___ Not Held

2. **Whether and when the bidder provided written notice to all certified DBE's listed on the Florida Department of Transportation's BizNet website that perform the type of work to be subcontracted and advising the DBE's of the specific work the bidder intend to subcontract; that their interest in the contract is being solicited; and how to obtain information for the review and inspection of contract plans and specifications.**

All letters from bidders to prospective DBE subcontractors must be post marked or fax recorded a minimum of 12 calendar days prior to bid opening.

- Provide complete list of all DBE's solicited.
- Provide **DATE** letters were mailed (DBE's will be canvassed as to who sent them letters and what date they were received.) Provide a copy of solicitation and all other letters sent to DBE's. Recommended information in your solicitation letter can include, but not limited to, the following:
 - Project specific information.
 - Your willingness to assist with supply purchases.
 - Bonding requirements of your firm.
 - Any assistance your firm will be giving regarding bonding requirements, lines of credit and insurance requirements.
 - Availability of specifications and plans through your office.
 - Best time to reach you by phone (DBE firms will be canvassed regarding your responsiveness to their calls and project information they received from your firm.)

- Bid opening date and all addendum information.
- Your requirements/time frames/payment schedules.

Attachment 3.A may be used to record the information required to show compliance with this section.

3. **Whether the bidder selected feasible portions of work to be performed by DBE’s, including, where appropriate, breaking contracts or combining elements of work into feasible units. The ability of the bidder to perform the work with its own work force will not in itself excuse a contractor from making positive efforts to meet the established goals.**

If appropriate, detail any subcontracting category that you have broken down to assist DBE firms and list firms that have been made aware of this reduced scope.

<u>Subcontracting Category</u>	<u>DBE Firm</u>
_____	_____
_____	_____
_____	_____
_____	_____

4. **Whether the bidder considered all quotations received from DBE’s and for those quotations not accepted, the bidder shall provide an explanation of why the DBE will not be used during the course of the contract. Receipt of lower quotation from non-DBE will not in itself excuse a bidder’s failure to meet project goals.**

List all DBE firms who quoted this project; the amount quoted, and the successful subcontractor (if not the DBE firm) and their quote:

<u>Name of DBE</u>	<u>DBE’s Quote vs.</u>	<u>Name of non-DBE Subcontractor Chosen</u>	<u>Subcontractor’s Quote</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

5. **Whether the bidder provided interested DBE’s assistance in reviewing the contract plans and specifications.**

Name the DBE firms provided assistance and describe how your firm provided such assistance.

6. **Whether the bidder assisted interested DBE firms in obtaining required bonding, lines of credit or insurance if such assistance was necessary.**

If the project was above \$200,000 or exempt from the County's Bond Waiver Program, name the DBE's assisted and describe the assistance provided.

7. **Whether the bidder advertised in general circulation, trade association, and/or minority/women - focus media concerning the subcontracting opportunities**

List which papers carried your ad and attach a copy of the ad.

8. **Whether the bidders followed up initial solicitations of interest by contacting DBE's to determine with certainty whether the DBE was interested.**

Name the DBE's you followed up with and describe your follow up efforts.

9. **Whether the bidder negotiated in good faith with interested DBE's, not rejecting DBE's as unqualified without sound reasons based on a thorough investigation of their capabilities.**

a) Provide a detailed statement of reasons why subcontracts were not entered into with a sufficient number of DBE's to meet the established goals.

b) Provide a list of DBE subcontractors you deemed unqualified and provide an explanation for the construction you reached.

c) For those DBE subcontractors contacted but determined to be unavailable, provide either:

i) a signed letter to the bidder from the DBE stating they are unavailable;

or

- ii) a statement from the bidder that the DBE subcontractor refused to submit a letter after reasonable requests; and detailed statement from the Bidder of the reasons for the bidder's conclusion.

10. **Whether the bidder effectively used the services of available minority/women community organizations; minority/women contractors' groups; local, state and federal minority/women business assistance offices; and other organizations that provide assistance in the recruitment and placement of minority/women business enterprises.**

**List minority/women organizations contacted.
(A minimum of three organizations must be contacted.)**

Organization	Person Contacted	Date Contacted
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

11. **Whether the bidder has utilized DBE subcontractors on other County contracts within the past six months.**

List any local projects your firm has performed in the last six (6) months, the DBE subcontractors utilized and the dollar value of the DBE's subcontractor.

<u>Project Name</u>	<u>DBE Firms Used</u>	<u>Dollar Value</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

12. **Describe any additional efforts or circumstances which may assist the City in Determining Good Faith Efforts.**

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PERFORMANCE OF WORK BY SUBCONTRACTORS

The CONTRACTOR hereby states that he proposes, if awarded the Contract, to use the following subcontractors on this project: List below all proposed subcontractors and trade specialties. (List only one subcontractor for each item.) This document shall be submitted to the County within 24 hours after requested by the County.

	<u>Items of Work (Describe)</u>	<u>Subcontractors</u>
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

Estimated Total Cost of Items that CONTRACTOR states will be performed by Subcontractor:

(\$ _____)

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E-VERIFY COMPLIANCE CERTIFICATION

In accordance with Okaloosa County Policy and Executive Order Number 11-116 from the office of the Governor of the State of Florida, Contractor hereby certifies that the U.S. Department of Homeland Security's E-Verify system will be used to verify the employment eligibility of all new employees hired by the contractor during the contract term, and shall expressly require any subcontractors performing work or providing services pursuant to the contract to likewise utilize the U.S. Department of Homeland Security's E-Verify system to verify the employment eligibility of all new employees hired by the subcontractor during the contract term; and shall provide documentation of such verification to the OWNER upon request.

As the person authorized to sign this statement, I certify that this company complies/will comply fully with the above requirements.

DATE: _____

SIGNATURE: _____ NAME: _____
(Typed or Printed)

TITLE: _____

COMPANY: _____

ADDRESS: _____

EMAIL: _____

PHONE NO.: _____

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CONE OF SILENCE

The Board of County Commissioners have established a solicitation silence policy (**Cone of Silence**) that prohibits oral and written communication regarding all formal solicitations for goods and services (ITB, RFP, ITQ, ITN, and RFQ) or other competitive solicitation between the contractor (or its agents or representatives) or other entity with the potential for a financial interest in the award (or their respective agents or representatives) regarding such competitive solicitation, and any County Commissioner or County employee, selection committee member or other persons authorized to act on behalf of the Board including the County's Architect, Architect/Engineer or their sub consultants, or anyone designated to provide a recommendation to award a particular contract, other than the Purchasing Department Staff.

The period commences from the time of advertisement until all parties have signed the contract.

Any information thought to affect the committee or staff recommendation submitted after bids are due, should be directed to the Purchasing Manager or an appointed representative. It shall be the Purchasing Manager's decision whether to consider this information in the decision process.

Any violation of this policy shall be grounds to disqualify the contractor from consideration during the selection process.

All contractors must agree to comply with this policy by signing the following statement and including it with their submittal.

I _____ (Signature) representing _____
(Company Name) on this ____ day of _____, 20____ hereby
agree to abide by the County's "Cone of Silence Clause" and understand violation of this policy
shall result in disqualification of my proposal/submittal.

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BUY AMERICAN CERTIFICATE

Except for those items listed by the Contractor below or on a separate and clearly identified attachment to this Bid, the Contractor hereby certifies that steel and each manufactured product, is produced in the United States and that components of unknown origin are considered to have been produced or manufactured outside the United States.

PRODUCT ORIGIN COUNTRY OF

(Name of Contractor)

By: _____

Title: _____

Dated: _____

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LOBBYING- 31 U.S.C. 1352, 49 CFR PART 19, 49 CFR PART 20

APPENDIX A, 49 CFR PART 20—CERTIFICATION REGARDING LOBBYING

Certification for Contracts, Grants, Loans, and Cooperative Agreements

The undersigned (Contractor) certifies, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for making the lobbying contacts to an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form—LLL, “Disclosure Form to Report Lobbying,” in accordance with its instructions [as amended by ”Government wide Guidance for New Restrictions on Lobbying,” 61 Fed. Reg. 1413 (1/19/96). Note: Language in paragraph (2) herein has been modified in accordance with Section 10 of the Lobbying Disclosure Act of 1995 (P.L. 104-65, to be codified at 2 U.S.C. 1601, et seq.)
3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31, U.S.C. 1352 (as amended by the Lobbying Disclosure Act of 1995). Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Note: Pursuant to 31 U.S.C. 1352(c)(1)-(2)(A), any person who makes a prohibited expenditure or fails to file or amend a required certification or disclosure form shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such expenditure or failure.

The Contractor, _____, certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.C. A 3801, *et seq*, apply to this certification and disclosure, if any.

Signature of Contractor’s Authorized Official _____

Name & Title of Contractor’s Authorized Official _____ Date _____

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EQUAL EMPLOYMENT OPPORTUNITY REPORT STATEMENT

Section 60-1.7(b) of the Regulations of the Secretary of Labor requires each contractor or prospective prime Contractor and proposed Subcontractor, where appropriate, to state in the bid or at the outset of negotiations for the Contract whether it has participated in any previous Contract or Subcontract subject to the equal opportunity clause; and if so, whether it has filed with the Joint Reporting Committee, the Director, an agency, or the former President's Committee on Equal Employment Opportunity all reports due under the applicable filing requirements. In any case in which a contractor or prospective prime Contractor or proposed Subcontractor which participated in a previous Contract subject to Executive Order 10925, 11114 or 111246 has not filed a report due under the applicable filing documents, no Contract or Subcontract shall be awarded unless such Contractor submits a report covering the delinquent period or such other period specified by the FAA or the Director, OFCCP.

The Proposer shall complete the following statement by checking the appropriate boxes. Failure to complete these blanks may be grounds for rejection of bid.

1. The Proposer has () has not () developed and has on file at each establishment Affirmative Action Programs pursuant to 41 CFR 60-1.4 and 41 CFR 60-2.
2. The Proposer has () has not () participated in any previous Contract or Subcontract subject to the Equal Opportunity Clause prescribed by Executive Order 10925, or Executive Order 11114, or Executive Order 11246.
3. The Proposer has () has not () filed with the Joint Reporting Committee the annual compliance report on Standard Form 100 (EEO-1 Report).
4. The Proposer has () has not () submitted all compliance reports in connection with any such Contract due under the application filing requirements; and that representations indicating submission of required compliance reports signed by proposed Subcontractors will be obtained prior to award of Subcontractors.

5. The Proposer does () does not () employ fifty (50) or more employees.

If the Proposer has participated in a previous Contract subject to the equal opportunity clause and has not submitted compliance reports due under applicable filing requirements, the Contractor Proposer shall submit a compliance report on Standard Form 100. "Employee Information EEO-1" prior to the award of Contract. Standard Form 100 is normally furnished to Contractors annually, based on a mailing list currently maintained by the Joint Reporting Committee. In the event a Contractor has not received the form, he may obtain it by writing to the following address: Joint Reporting Committee, 1800 G Street, Washington, D.C. 20506.

Name of Proposer

Title

By: _____

Signature **Must be the same Signature on Bid Proposal*

Date

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VENDORS ON SCRUTINIZED COMPANIES LISTS

By executing this Certificate _____, the bid proposer, certifies that it is not: (1) listed on the Scrutinized Companies that Boycott Israel List, created pursuant to section 215.4725, Florida Statutes, (2) engaged in a boycott of Israel, (3) listed on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List, created pursuant to section 215.473, Florida Statutes, or (4) engaged in business operations in Cuba or Syria. Pursuant to section 287.135(5), Florida Statutes, the County may disqualify the bid proper immediately or immediately terminate any agreement entered into for cause if the bid proposer is found to have submitted a false certification as to the above or if the Contractor is placed on the Scrutinized Companies that Boycott Israel List, is engaged in a boycott of Israel, has been placed on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List, or has been engaged in business operations in Cuba or Syria, during the term of the Agreement. If the County determines that the bid proposer has submitted a false certification, the County will provide written notice to the bid proposer. Unless the bid proposer demonstrates in writing, within 90 calendar days of receipt of the notice, that the County’s determination of false certification was made in error, the County shall bring a civil action against the bid proposer. If the County’s determination is upheld, a civil penalty shall apply, and the bid proposer will be ineligible to bid on any Agreement with a Florida agency or local governmental entity for three years after the date of County’s determination of false certification by bid proposer.

As the person authorized to sign this statement, I certify that this firm complies fully with the above requirements.

DATE: _____

SIGNATURE: _____

COMPANY: _____

NAME: _____

(Typed or Printed)

ADDRESS: _____

TITLE: _____

E-MAIL: _____

PHONE NO.: _____

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SYSTEM FOR AWARD MANAGEMENT (OCT 2016)

(a) Definitions. As used in this provision.

“Electronic Funds Transfer (EFT) indicator” means a four-character suffix to the unique entity identifier. The suffix is assigned at the discretion of the commercial, nonprofit, or Government entity to establish additional System for Award Management records for identifying alternative EFT accounts (see [subpart 32.11](#)) for the same entity.

“Registered in the System for Award Management (SAM) database” means that.

- (1) The Offeror has entered all mandatory information, including the unique entity identifier and the EFT indicator, if applicable, the Commercial and Government Entity (CAGE) code, as well as data required by the Federal Funding Accountability and Transparency Act of 2006 (see [subpart 4.14](#)) into the SAM database;
- (2) The offeror has completed the Core, Assertions, and Representations and Certifications, and Points of Contact sections of the registration in the SAM database;
- (3) The Government has validated all mandatory data fields, to include validation of the Taxpayer Identification Number (TIN) with the Internal Revenue Service (IRS). The offeror will be required to provide consent for TIN validation to the Government as a part of the SAM registration process; and
- (4) The Government has marked the record “Active”. “Unique entity identifier” means a number or other identifier used to identify a specific commercial, nonprofit, or Government entity. See www.sam.gov for the designated entity for establishing unique entity identifiers.

(b)

- (1) By submission of an offer, the offeror acknowledges the requirement that a prospective awardee shall be registered in the SAM database prior to award, during performance, and through final payment of any contract, basic agreement, basic ordering agreement, or blanket purchasing agreement resulting from this solicitation.
- (2) The Offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation “Unique Entity Identifier” followed by the unique entity identifier that identifies the Offeror’s name and address exactly as stated in the offer. The Offeror also shall enter its EFT indicator, if applicable. The unique entity identifier will be used by the Contracting Officer to verify that the Offeror is registered in the SAM database.

(c) If the Offeror does not have a unique entity identifier, it should contact the entity designated at www.sam.gov for establishment of the unique entity identifier directly to obtain one. The

Offeror should be prepared to provide the following information:

- (1) Company legal business name.
- (2) Tradestyle, doing business, or other name by which your entity is commonly recognized.
- (3) Company Physical Street Address, City, State, and Zip Code.
- (4) Company Mailing Address, City, State and Zip Code (if separate from physical).

- (5) Company telephone number.
 - (6) Date the company was started.
 - (7) Number of employees at your location.
 - (8) Chief executive officer/key manager.
 - (9) Line of business (industry).
 - (10) Company Headquarters name and address (reporting relationship within your entity).
- (d) If the Offeror does not become registered in the SAM database in the time prescribed by the Contracting Officer, the Contracting Officer will proceed to award to the next otherwise successful registered Offeror.
- (e) Processing time, which normally takes 48 hours, should be taken into consideration when registering. Offerors who are not registered should consider applying for registration immediately upon receipt of this solicitation.
- (f) Offerors may obtain information on registration at <https://www.acquisition.gov> .

Offerors SAM information:

Entity Name: _____

Entity Address: _____

Duns Number: _____

CAGE Code: _____

CERTIFICATION OF OFFERER/CONTRACTOR REGARDING TAX DELINQUENCY AND FELONY CONVICTIONS

The applicant must complete the following two certification statements. The applicant must indicate its current status as it relates to tax delinquency and felony conviction by inserting a checkmark (✓) in the space following the applicable response. The applicant agrees that, if awarded a contract resulting from this solicitation, it will incorporate this provision for certification in all lower tier subcontracts.

Certifications

- 1) The applicant represents that it is () is not () a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.
- 2) The applicant represents that it is () is not () is not a corporation that was convicted of a criminal violation under any Federal law within the preceding 24 months.

Note

If an applicant responds in the affirmative to either of the above representations, the applicant is ineligible to receive an award unless the sponsor has received notification from the agency suspension and debarment official (SDO) that the SDO has considered suspension or debarment and determined that further action is not required to protect the Government's interests. The applicant therefore must provide information to the owner about its tax liability or conviction to the Owner, who will then notify the FAA Airports District Office, which will then notify the agency's SDO to facilitate completion of the required considerations before award decisions are made.

Term Definitions

Felony conviction: Felony conviction means a conviction within the preceding twenty-four (24) months of a felony criminal violation under any Federal law and includes conviction of an offense defined in a section of the U.S. code that specifically classifies the offense as a felony and conviction of an offense that is classified as a felony under 18 U.S.C. § 3559.

Tax Delinquency: A tax delinquency is any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

DATE: _____ SIGNATURE: _____

COMPANY: _____ NAME: _____
(Typed or Printed)

TITLE: _____

Government Debarment & Suspension

Instructions

1. By signing and submitting this form, the prospective lower tier participant is providing the certification set out in accordance with these instructions.
2. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension or debarment.
3. The prospective lower tier participant shall provide immediate written notice to the person(s) to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
4. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of the rules implementing Executive Orders 12549, at Subpart C of OMB 2 C.F.R. Part 180 and 3000.332. You may contact the department or agency to which this proposal is being submitted for assistance in obtaining a copy of those regulations.
5. The prospective lower tier participant agrees by submitting this form that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.
6. The prospective lower tier participant further agrees by submitting this form that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
7. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the System for Award Management (SAM) database.
8. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
9. Except for transactions authorized under paragraph (5) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation

in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

**Certification Regarding Debarment, Suspension,
Ineligibility and Voluntary Exclusion
Lower Tier Covered Transactions**

The following statement is made in accordance with the Privacy Act of 1974 (5 U.S.C. § 552(a), as amended). This certification is required by the regulations implementing Executive Orders 12549, Debarment and Suspension, and OMB 2 C.F.R. Part 180, Participants' responsibilities. The regulations were amended and published on August 31, 2005, in 70 Fed. Reg. 51865-51880.

**[READ INSTRUCTIONS ON PREVIOUS PAGE BEFORE COMPLETING
CERTIFICATION]**

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal or State department or agency;
2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal

Printed Name and Title of Authorized Representative

Signature

Date

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COMPANY DATA

Contractor's Company Name: _____

Physical Address & Phone #: _____

Contact Person (Typed-Printed): _____

Phone #: _____

Cell #: _____

Email: _____

Federal ID or SS #: _____

Contractor's License #: _____

Contractor's DUNS #: _____

Fax #: _____

Emergency #'s After Hours,
Weekends & Holidays: _____

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Draft Contract

Please note: this contract is a draft for bidder to view and understand the County’s standard terms and conditions, it is subject to revisions. By submitting a bid/proposal bidder/respondent understands and acknowledges that the draft contract is not an offer. Bidders/respondents are not to sign this draft contract.

EXHIBIT “A”

To be inserted later once submittals have been made- Initiation to Bid and Respondents Acknowledgement solicited for **CONSTRUCT BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION AT DESTIN-FORT WALTON BEACH AIRPORT (VPS)** date of opening **June 17th 2020 at 3:30 P.M.** and any addendums thereto.

THIS AGREEMENT is dated as of the _____ day of _____ in the year 20__ by and between The Board of County Commissioners of Okaloosa County, Florida (hereinafter called Owner) and _____ (hereinafter called Contractor), whose principal address is _____, states as follows:

WITNESSETH:

WHEREAS, the County through an Invitation to Bids has solicited for **CONSTRUCT BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION AT DESTIN-FORT WALTON BEACH AIRPORT (VPS)**; and

WHEREAS, after due review of all bids, _____ has been selected for the **CONSTRUCT BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION AT DESTIN-FORT WALTON BEACH AIRPORT (VPS)**; and

WHEREAS, the County, as a recipient of federal assistance, is required to incorporate specific provisions in all contracts, regardless of funding source, with additional provisions being required for federally funded projects. These provisions are being incorporated per this amendment as stated in Exhibit “B “attached hereto; and

WHEREAS, the County desires the services of the Contractor and the Contractor is willing and able to perform all services in accordance with this Contract.

NOW, THEREFORE, the parties hereto agree as follows:

Article 1. WORK.

Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

CONSTRUCT BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION AT DESTIN-FORT WALTON BEACH AIRPORT (VPS)

The project consists of providing all labor, materials and other means of construction necessary for the expansion and modification of the existing baggage handling system, expansion of the public use lobby area, restrooms, and airline ticket counters to include all supporting infrastructure.

Article 2. ENGINEER.

The Project has been designed by **Graef-USA Inc.** who is hereinafter called Engineer and who is to act as Owner's representative, assume all duties and responsibilities and have the rights and authority assigned to Engineer in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

Article 3. CONTRACT TIMES.

3.1 The Work will be substantially completed within **420** calendar days after the date when the Contract Times commence to run as provided in paragraph 2.3 of the General Conditions, and completed and ready for final payment in accordance with paragraph 14.13 of the General Conditions within **450** calendar days after the date when the Contract Times commence to run.

3.2 *Liquidated Damages.* Owner and Contractor recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the Work is not completed within the times specified in paragraph 3.1 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. They also recognize the delays, expense and difficulties involved in proving the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring of such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty) Contractor shall pay Owner the amount specified in Paragraph 3.3 for each day that expires after the time specified in paragraph 3.1 for Substantial Completion until the Work is substantially complete. After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the time specified in paragraph 3.1 for completion and readiness for final payment or any proper extension thereof granted by Owner, Contractor shall pay Owner the amount specified in Paragraph 3.3 for each day that expires after the time specified in paragraph 3.1 for completion and readiness for final payment. The Contractor hereby expressly waives and relinquishes any right which it may have to seek to characterize the liquidated damages as a penalty, which the parties agree represents a fair and reasonable estimate of the Owner's actual damages at the time of contracting if the Contractor fails to substantially complete the Work in a timely manner.

3.3.1 Liquidated Damages are based upon the original contract amount, as established by Okaloosa County. Liquidated damages, based upon the original contract amount of \$ _____, will be dollars (\$ _____) per calendar day.

Article 4. CONTRACT PRICE.

Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the established unit price for each separately identified item of Unit Price Work times the estimated quantity of that item as indicated in the Bid Schedule submitted in the Bid Form. The cost of this project is \$ _____ as per the attached Contractor bid.

As provided in paragraph 11.9 of the General Conditions estimated quantities are not guaranteed, and determinations of actual quantities and classification are to be made by Engineer as provided in paragraph 9.10 of the General Conditions. Unit prices have been computed as provided in paragraph 11.9.2 of the General Conditions.

Article 5. PAYMENT PROCEDURES:

Contractor shall submit Application for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

5.1 *Progress Payments; Retainage.* Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment as recommended by Engineer, on or about the fifteenth (15th) day of each month during construction as provided in paragraphs 5.1.1 and 5.1.2 below. All such payments will be measured based on the number of units completed. Payments to the Contractor shall in no way imply approval or acceptance of Contractor's work

5.1.1 Prior to Substantial completion, payments will be made in an amount equal to the percentage indicated below, but, in each case, less the aggregate of payments previously made and less such amounts as Engineer shall determine, or Owner may withhold, in accordance with paragraph 14.7 of the General Conditions.

90 % of Work completed (with the balance being retainage). Once the Contractor completes at least 50% of the Work based on approved pay applications, the retainage will be reduced from 10% to 5% for the remainder of the project. Therefore, following completion of at least 50% of the Work, the Contractor may be paid 95 % of Work completed (with the balance being retainage).

90 % (with the balance being retainage) of materials and equipment not incorporated in the Work (but delivered, suitably stored and accompanied by documentation satisfactory to Owner as provided in paragraph 14.2 of the General Conditions). Once the Contractor completes at least 50% of the Work based on approved pay applications, the retainage will be reduced from 10% to 5% for the remainder of the project. Therefore, following completion of at least 50% of the Work, the Contractor may be paid 95 % of materials and equipment not incorporated in the Work (but delivered, suitably stored and accompanied by documentation satisfactory to Owner as provided in paragraph 14.2 of the General Conditions).

5.1.2 Upon Substantial Completion, in an amount sufficient to increase total payments to Contractor to 95 % of the Contract Price (with the balance being retainage), less such amounts as Engineer shall determine, or Owner may withhold, in accordance with paragraph 14.7 of the General Conditions.

5.1.3 Retainage requirements may be changed to reflect a proposed change to state regulatory statutes.

5.2 *Final Payment.* Upon final completion and acceptance of the Work in accordance with paragraph 14.13 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said paragraph 14.13.

5.2.1 Contractor's acceptance of final payment shall constitute a full waiver of any and all claims by Contractor against the County arising out of this Agreement or otherwise relating to the Project, except those previously made in writing and identified by Contractor as unsettled at the time of the final Application for Payment. Neither the acceptance of the Work nor payment by the County shall be deemed to be a waiver of the County's right to enforce any obligations of the

Contractor hereunder or to the recovery of damages for defective Work not discovered by the Engineer or the County at the time of final inspection.

5.3 Payments Withheld

5.3.1 The Engineer or the County may decline to approve any Applications for Payment, or portions thereof, because of subsequently discovered evidence or subsequent inspections. The Engineer or the County may nullify the whole or any part of any inspections. The Engineer or the County may nullify the whole or any part of any approval for payment previously issued and the County may withhold any payments otherwise due Contractor under this Agreement or any other agreement between the County and the Contractor, to such extent as may be necessary in the County's opinion to protect it from loss because of:

5.3.1.1 Defective Work not remedied;

5.3.1.2 Third party claims filed or reasonable evidence indicating probable filing of such claims;

5.3.1.3 Failure of Contractor to make payment properly to subcontractors or for labor, materials or equipment;

5.3.1.4 Reasonable doubt that the Work can be completed for the unpaid balance of the Contract Amount;

5.3.1.5 Reasonable indication that the Work will not be completed within the Contract Time;

5.3.1.6 Unsatisfactory prosecution of the Work by the Contractor;

5.3.1.7 Failure to provide accurate and current "As-Builts"; or

5.3.1.8 Any other material breach of the Contract Documents.

5.3.2 If these conditions in Subsection 5.3.1 are not remedied or removed, the County may after three (3) days written notice, rectify the same at Contractor's expense. The County also may offset against any sums due Contractor the amount of any liquidated or unliquidated obligations of Contractor to the County, whether relating to or arising out of his Agreement or any other agreement between Contractor and the County.

Article 6. CONTRACTOR'S REPRESENTATIONS.

In order to induce Owner to enter into this Agreement Contractor makes the following representations:

6.1 Contractor has examined and carefully studied the Contract Documents (including the Addenda listed in Article 7) and the other related data identified in the Project Documents including "technical data."

6.2 Contractor has visited the site and become familiar with and is satisfied as to the general, local, and site conditions that may affect cost, progress, performance or furnishing of the Work.

6.3 Contractor is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, performance and furnishing of the Work.

6.4 Contractor has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except Underground Facilities) which have been identified in the

Supplementary Conditions as provided in paragraph 4.2.1 of the General Conditions. Contractor accepts the determination of the extent of the "technical data" contained in such reports and drawings upon which Contractor is entitled to rely as provided in paragraph 4.2 of the General Conditions. Contractor acknowledges that such reports and drawings are not Contract Documents and may not be complete for Contractor's purposes. Contractor acknowledges that Owner and Engineer do not assume responsibility for the accuracy or completeness of information and data shown or indicated in the Contract Documents with respect to Underground Facilities at or contiguous to the site. Contractor has obtained and carefully studied (or assumes responsibility for having done so) all such additional supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance, or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor and safety precautions, and programs incident thereto. Contractor does not consider that any additional examinations, investigations, explorations, tests, studies, or data are necessary for the performance and furnishing of the Work at the Contract Price, within the Contract Times and in accordance with the other terms and conditions of the Contract Documents.

6.5 Contractor is aware of the general nature of work to be performed by Owner and others at the site that relates to the Work as indicated in the Contract Documents.

6.6. Contractor has correlated the information known to Contractor, information and observation obtained from visits to the site, reports, and drawings identified in the Contract Documents and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.

6.7. Contractor has given Engineer written notice of all conflicts, errors, ambiguities or discrepancies that Contractor has discovered in the Contract Documents and the written resolution thereof by Engineer is acceptable to Contractor, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

Article 7. CONTRACT DOCUMENTS

The Contract Documents that comprise the entire agreement between Owner and Contractor concerning the Work consist of the following:

7.1 **Attachment "A", Invitation to Bid & Respondent's Acknowledgment/Contractor's Submittal, ITB AP 59-20, CONSTRUCT BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION AT DESTIN-FORT WALTON BEACH AIRPORT (VPS) date of opening June 17th, 2020 at 3:30 P.M. and any addendums thereto.**

7.2 **Attachment "B", Federal Regulations**, attached hereto and made a part of the contract. All terms within the above referenced documents are in full force and effect and shall be binding upon both parties.

7.3 **Attachment "C" - Title VI List of Pertinent Nondiscrimination Acts and Authorities**

7.4 Plans, Drawings, and Technical Specifications

7.5 Any other documents necessary to clarify and memorialize the agreement between Contractor and Owner

Article 8. PUBLIC RECORDS

Any record created by either party in accordance with this Contract shall be retained and maintained in accordance with the public records law, Florida Statutes, Chapter 119.

IF THE CONSULTANT HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE CONTRACTOR'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS CONTRACT, CONTACT THE CUSTODIAN OF PUBLIC RECORDS AT OKALOOSA COUNTY RISK MANAGEMENT DEPARTMENT 5479 OLD BETHEL ROAD CRESTVIEW, FL 32536 PHONE: (850) 689-5977 riskinfo@myokaloosa.com.

Consultant must comply with the public records laws, Florida Statute chapter 119, specifically Consultant must:

- 8.1 Keep and maintain public records required by the County to perform the service.
- 8.2 Upon request from the County's custodian of public records, provide the County with a copy of the requested records or allow the records to be inspected or copied within a reasonable time at a cost that does not exceed the cost provided in chapter 119 Florida Statutes or as otherwise provided by law.
- 8.3 Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the duration of the contract term and following completion of the contract if the consultant does not transfer the records to the County.
- 8.4 Upon completion of the contract, transfer, at no cost, to the County all public records in possession of the contractor or keep and maintain public records required by the County to perform the service. If the consultant transfers all public records to the public agency upon completion of the contract, the consultant shall destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. If the consultant keeps and maintains public records upon completion of the contract, the consultant shall meet all applicable requirements for retaining the public records. All records stored electronically must be provided to the public agency, upon the request from the public agency's custodian of public records, in a format that is compatible with the information technology systems of the public agency.

Article 9. AUDIT

The County and/or its designee shall have the right from time to time at its sole expense to audit the compliance by the Contractor with the terms, conditions, obligations, limitations, restrictions, and requirements of this Contract and such right shall extend for a period of three (3) years after termination of this Contract.

Article 10. TERMINATION FOR CONVENIENCE

Owner may at any time and for any reason terminate Contractor's services and work at Owner's convenience. Upon receipt of such notice, Contractor shall, unless the notice directs otherwise, immediately discontinue the work and placing of orders for materials, facilities and supplies in connection with the performance of this Agreement.

Upon such termination, Contractor shall be entitled to payment only as follows: (1) the actual cost of the work completed in conformity with this Agreement; plus, (2) such other costs actually incurred by Contractor as are permitted by the prime contract and approved by Owner; (3) plus ten percent (10%) of the cost of the work referred to in subparagraph (1) above for overhead and profit. There shall be deducted from such sums as provided in this subparagraph the amount of any payments made to Contractor prior to the date of the termination of this Agreement. Contractor shall not be entitled to any claim or claim of lien against Owner for any additional compensation or damages in the event of such termination and payment. Further, Owner may terminate this contract immediately for failure of contractor to comply with Chapter 119, Florida Statutes.

Article 11. VIOLATIONS OF CHAPTER 119 FLORIDA STATUTES

The County reserves the right to terminate this agreement immediately for failure of Contractor to adhere to the requirements of Florida Statutes Chapter 119.

Article 12. MISCELLANEOUS.

- 12.1 Terms used in this Agreement which are defined in Article 1 of the General Conditions will have the meanings indicated in the General Conditions.
- 12.2 No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.
- 12.3 Owner and Contractor each binds itself, its partners, successors, assigns and legal representatives to the other party hereto, its partners, successors, assigns and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.
- 12.4 Any provisions or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision
- 12.5 All documents prepared by the Contractor pursuant to this Agreement and related Services to this Agreement are intended and represented for the ownership of the County only. Any other use by Contractor or other parties shall be approved in writing by the County. If requested, Contractor shall deliver the documents to the County within fifteen (15) calendar days.

Article 13. GOVERNING LAW, VENUE AND WAIVER OF JURY TRIAL.

This Agreement shall be interpreted and construed in accordance with and governed by the laws of the State of Florida. All parties agree and accept that jurisdiction of any dispute or controversy arising out of this Agreement, and any action involving the enforcement or interpretation of any rights hereunder shall be brought

exclusively in the First Judicial Circuit in and for Okaloosa County, Florida, and venue for litigation arising out of this Agreement shall be exclusively in such state courts, forsaking any other jurisdiction which either party may claim by virtue of its residency or other jurisdictional device. In the event it becomes necessary for the County to file a lawsuit to enforce any term or provision under this Agreement, then the County shall be entitled to its costs and attorney's fees at the pretrial, trial and appellate levels. BY ENTERING INTO THIS AGREEMENT, CONTRACTOR AND COUNTY HEREBY EXPRESSLY WAIVE ANY RIGHTS EITHER PARTY MAY HAVE TO A TRIAL BY JURY OF ANY CIVIL LITIGATION RELATED TO THIS AGREEMENT. Nothing in this Agreement is intended to serve as a waiver of sovereign immunity, or of any other immunity, defense, or privilege enjoyed by the County pursuant to Section 768.28, Florida Statutes.

Article 14. CIVIL RIGHTS.

The Contractor agrees to comply with pertinent statutes, Executive Orders and such rules as are promulgated to ensure that no person shall, on the grounds of race, creed, color, national origin, sex, age, or disability be excluded from participating in any activity conducted with or benefiting from Federal assistance. This provision binds the Contractor and subcontractors from the bid solicitation period through the completion of the contract. This provision is in addition to that required by Title VI of the Civil Rights Act of 1964.

ARTICLE 15. COMPLIANCE WITH NONDISCRIMINATION REQUIREMENTS.

During the performance of this Agreement, the Contractor, for itself, its assignees, and successors in interest, agrees as follows:

- a. Compliance with Regulations: The Contractor will comply with the Title VI List of Pertinent Nondiscrimination Acts and Authorities, as they may be amended from time to time, which are herein incorporated and attached hereto as Attachment "C".
- b. Nondiscrimination: The Contractor, with regard to the work performed by it during the Agreement, will not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The Contractor will not participate directly or indirectly in the discrimination prohibited by the Nondiscrimination Acts and Authorities, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR part 21.
- c. Solicitations for Subcontracts, including Procurements of Materials and Equipment: In all solicitations, either by competitive bidding or negotiation made by the Contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the Contractor of the contractor's obligations under this contract and the Nondiscrimination Acts and Authorities on the grounds of race, color, or national origin.
- d. Information and Reports: The Contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the County or other governmental entity to be pertinent to ascertain compliance with such Nondiscrimination Acts and Authorities and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the Contractor will so certify to

the County or the other governmental entity, as appropriate, and will set forth what efforts it has made to obtain the information.

e. Sanctions for Noncompliance: In the event of a Contractor's noncompliance with the non-discrimination provisions of this contract, the County will impose such contract sanctions as it or another applicable state or federal governmental entity may determine to be appropriate, including, but not limited to:

a. Withholding payments to the Contractor under the Agreement until the Contractor complies; and/or

b. Cancelling, terminating, or suspending the Agreement, in whole or in part.

f. Incorporation of Provisions: The Contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations, and directives issued pursuant thereto. The Contractor will take action with respect to any subcontract or procurement as the County may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the Contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the Contractor may request the County to enter into any litigation to protect the interests of the County. In addition, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

ARTICLE 16. COMPLIANCE WITH LAWS.

Contractor shall secure any and all permits, licenses and approvals that may be required in order to perform the Services, shall exercise full and complete authority over Contractor's personnel, shall comply with all workers' compensation, employer's liability and all other federal, state, county, and municipal laws, ordinances, rules and regulations required of an employer performing services such as the Services, and shall make all reports and remit all withholdings or other deductions from the compensation paid to Contractor's personnel as may be required by any federal, state, county, or municipal law, ordinance, rule, or regulation.

ARTICLE 17. CONFLICT OF INTEREST.

The Contractor covenants that it presently has no interest and shall not acquire any interest, directly or indirectly which could conflict in any manner or degree with the performance of the Services. The Contractor further covenants that in the performance of this Agreement, no person having any such interest shall knowingly be employed by the Contractor. The Contractor guarantees that he/she has not offered or given to any member of, delegate to the Congress of the United States, any or part of this contract or to any benefit arising therefrom.

ARTICLE 18. INDEPENDENT CONTRACTOR.

Contractor enters into this Agreement as, and shall continue to be, an independent contractor. All services shall be performed only by Contractor and Contractor's employees. Under no circumstances shall Contractor or any of Contractor's employees look to the County as his/her employer, or as partner, agent or principal. Neither Contractor, nor any of Contractor's employees, shall be entitled to any benefits accorded to the

County's employees, including without limitation worker's compensation, disability insurance, vacation or sick pay. Contractor shall be responsible for providing, at Contractor's expense, and in Contractor's name, unemployment, disability, worker's compensation and other insurance as well as licenses and permits usual and necessary for conducting the services to be provided under this Agreement.

ARTICLE 19. THIRD PARTY BENEFICIARIES.

It is specifically agreed between the parties executing this Agreement that it is not intended by any of the provisions of any part of the Agreement to create in the public or any member thereof, a third-party beneficiary under this Agreement, or to authorize anyone not a party to this Agreement to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of this Agreement.

ARTICLE 20. INDEMNIFICATION AND WAIVER OF LIABILITY.

The Contractor agrees, to the fullest extent permitted by law, to defend, indemnify and hold harmless the County, its agents, representatives, officers, directors, officials and employees from and against claims, damages, losses and expenses (including but not limited to attorney's fees, court costs and costs of appellate proceedings) relating to, arising out of or resulting from the Contractor's negligent acts, errors, mistakes or omissions relating to professional Services performed under this Agreement. The Contractor's duty to defend, hold harmless and indemnify the County its agents, representatives, officers, directors, officials and employees shall arise in connection with any claim, damage, loss or expense that is attributable to bodily injury; sickness; disease; death; or injury to impairment, or destruction of tangible property including loss of use resulting therefrom, caused by any negligent acts, errors, mistakes or omissions related to Services in the performance of this Agreement including any person for whose acts, errors, mistakes or omissions the Contractor may be legally liable. The parties agree that TEN DOLLARS (\$10.00) represents specific consideration to the Contractor for the indemnification set forth herein.

The waiver by a party of any breach or default in performance shall not be deemed to constitute a waiver of any other or succeeding breach or default. The failure of the County to enforce any of the provisions hereof shall not be construed to be a waiver of the right of the County thereafter to enforce such provisions.

ARTICLE 21. TAXES AND ASSESSMENTS.

Contractor agrees to pay all sales, use, or other taxes, assessments and other similar charges when due now or in the future, required by any local, state or federal law, including but not limited to such taxes and assessments as may from time to time be imposed by the County in accordance with this Agreement. Contractor further agrees that it shall protect, reimburse and indemnify County from and assume all liability for its tax and assessment obligations under the terms of the Agreement.

The County is exempt from payment of Florida state sales and use taxes. The Contractor shall not be exempted from paying sales tax to its suppliers for materials used to fulfill contractual obligations with the County, nor is the Contractor authorized to use the County's tax exemption number in securing such materials.

The Contractor shall be responsible for payment of its own and its share of its employees' payroll, payroll taxes, and benefits with respect to this Agreement.

ARTICLE 22. PROHIBITION AGAINST CONTRACTING WITH SCRUTINIZED COMPANIES.

Pursuant to Florida Statutes Section 215.4725, contracting with any entity that is listed on the Scrutinized Companies that Boycott Israel List or that is engaged in the boycott of Israel is prohibited. Contractors must certify that the company is not participating in a boycott of Israel. Any contract for goods or services of One Million Dollars (\$1,000,000) or more shall be terminated at the County's option if it is discovered that the entity submitted false documents of certification, is listed on the Scrutinized Companies with Activities in Sudan List, the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List, or has been engaged in business operations in Cuba or Syria after July 1, 2018.

Any contract entered into or renewed after July 1, 2018 shall be terminated at the County's option if the company is listed on the Scrutinized Companies that Boycott Israel List or engaged in the boycott of Israel. Contractors must submit the certification that is attached to this agreement as Attachment "D". Submitting a false certification shall be deemed a material breach of contract. The County shall provide notice, in writing, to the Contractor of the County's determination concerning the false certification. The Contractor shall have ninety (90) days following receipt of the notice to respond in writing and demonstrate that the determination was in error. If the Contractor does not demonstrate that the County's determination of false certification was made in error, then the County shall have the right to terminate the contract and seek civil remedies pursuant to Florida Statute Section 215.4725.

ARTICLE 23. INCONSISTENCIES AND ENTIRE AGREEMENT.

If there is a conflict or inconsistency between any term, statement, requirement, or provision of any attachment attached hereto, any document or events referred to herein, or any document incorporated into this Agreement, the term, statement, requirement, or provision contained in this Agreement shall prevail and be given superior effect and priority over any conflicting or inconsistent term, statement, requirement or provision contained in any other document or attachment, including but not limited to Attachments listed in Section 1.

ARTICLE 24. SEVERABILITY.

If any term or condition of this Contract shall be deemed, by a court having appropriate jurisdiction, invalid or unenforceable, the remainder of the terms and conditions of this Contract shall remain in full force and effect. This Contract shall not be more strictly construed against either party hereto by reason of the fact that one party may have drafted or prepared any or all the terms and provisions hereof.

ARTICLE 25. ENTIRE AGREEMENT.

This Agreement and Exhibits _____ contains the entire agreement of the parties, and may be amended, waived, changed, modified, extended or rescinded only by in writing signed by the party against whom any such amendment, waiver, change, modification, extension and/or rescission is sought.

ARTICLE 26. REPRESENTATION OF AUTHORITY TO CONTRACTOR/SIGNATORY.

The individual signing this Agreement on behalf of Contractor represents and warrants that he or she is duly authorized and has legal capacity to execute and deliver this Agreement. The signatory represents and warrants to the County that the execution and delivery of this Agreement and the performance of the Services and obligations hereunder have been duly authorized and that the Agreement is a valid and legal agreement binding on the Contractor and enforceable in accordance with its terms.

IN WITNESS WHEREOF, Owner, and Contractor have signed this Agreement in triplicate. One counterpart each has been delivered to Owner, Contractor, and Engineer. All portions of the Contract Documents have been signed, initialed or identified by Owner, and Contractor, or identified by Engineer on their behalf.

This Agreement will be effective on _____, 20__ (which is the Effective Date of the Agreement).

OWNER

CONTRACTOR

Okaloosa County, Florida

By: _____
Robert A. "Trey" Goodwin, III
Chairman, Board of County Commissioners

By: _____

Signed: _____

Signed: _____

[CORPORATE SEAL}

[CORPORATE SEAL]

Attest _____

Attest _____

Signed: _____

Signed: _____

Address for giving notices

Address for giving notices

(If Owner is a public body, attached evidence of authority to sign and resolution or other documents authorizing execution of Agreement).

License No. _____

Agent for services of process: _____

If Contractor is a corporation, attach evidence of authority to sign).

Attachment "B"

Special Conditions Federal Requirements Over \$150,000.00 w/Work Safety

The following special conditions apply to the Agreement and are incorporated herein by reference:

Clean Air Act (42 U.S.C. 7401-7671q.) and Federal Water Pollution Control Act (33 U.S.C. 1251-1387) Contractor agrees to comply with all applicable standards, orders, and regulations issued pursuant to the Clean Air Act (42 USC § 740-7671q) and the Federal Water Pollution Control Act as amended (33 USC § 1251-1387). The Contractor agrees to report any violation to the Owner immediately upon discovery. The County assumes responsibility for notifying the Environmental Protection Agency (EPA) and the.

Contractor must include this requirement in all subcontracts that exceeds \$150,000.

Byrd Anti Lobbying Amendment (31 U.S. C. 1352). The Certification regarding Lobbying executed by Contractor and attached as part of Attachment "A" to the Agreement is hereby acknowledged and made part of the Agreement by reference.

Work Hour and Safety Standards (40 U.S.C. 3701-3708). The Certification regarding Work Hours and Safety Standards executed by Contractor and attached as part of Attachment "A" to the Agreement is hereby acknowledged and made part of the Agreement by reference.

Equal Employment Opportunity (2 CFR Part 200, Appendix II(C); 41 CFR § 61-1.4; 41 CFR 61-4.3; Executive Order 11246). During the performance of this contract, the Contractor agrees as follows:

- (1) The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, sexual orientation, gender identify, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff, or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.
- (2) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive considerations for employment without regard to race, color, religion, sex, or national origin.
- (3) The Contractor will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the Contractor's commitments under

this section and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The Contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance. *Provided, however,* that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

Davis-Bacon Act (2 CFR Part 200; 29 CFR Part 5).

1. Minimum Wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by the Secretary of Labor under the Copeland Act (29 CFR Part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalent thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR Part 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided* that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under (1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can easily be seen by the workers.

(ii)(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

- (1) The work to be performed by the classification requested is not performed by a classification in the wage determination;
- (2) The classification is utilized in the area by the construction industry; and
- (3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that

additional time is necessary.

(C) In the event the Contractor, the laborers, or mechanics to be employed in the classification, or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs (1)(ii) (B) or (C) of this paragraph, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program: *Provided* that the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account asset for the meeting of obligations under the plan or program.

2. Withholding.

The _____ or the County shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any

apprentice, trainee, or helper, employed or working on the site of work, all or part of the wages required by the contract, _____ may, after written notice to the Contractor, County, Applicant, or Owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

3. Payrolls and Basic Records.

(i) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker; his or her correct classification; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in 1(b)(2)(B) of the Davis-Bacon Act); daily and weekly number of hours worked; deductions made; and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records that show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and that show the costs anticipated or the actual costs incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the _____ if the agency is a party to the contract, but if the agency is not such a party, the Contractor will submit the payrolls to the applicant, County, or Owner, as the case may be, for transmission to the _____. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (*e.g.* the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at

www.dol.gov/whd/forms/wh347instr.htm or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker and shall provide them upon request to the _____ if the agency is a party to the contract, but if the agency is not such a party, the Contractor will submit them to the applicant, County, or Owner, as the case may be, for transmission to the _____, the Contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the County government agency (or the applicant, County, or Owner).

(1) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following: The payroll for the payroll period contains the information required to be provided under 29 CFR § 5.5(a)(3)(ii), the appropriate information is being maintained under 29 CFR § 5.5 (a)(3)(i), and that such information is correct and complete;

(2) Each laborer and mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations 29 CFR Part 3;

(3) Each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code.

(iii) The Contractor or subcontractor shall make the records required under paragraph (3)(i) of

this section available for inspection, copying, or transcription by authorized representatives of the County, _____, or the Department of Labor and shall permit such representatives to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to the Contractor, County, applicant, or Owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and Trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that

determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination that provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate that is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal Employment Opportunity. The utilization of apprentices, trainees, and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

5. Compliance with Copeland Act Requirements.

The Contractor shall comply with the requirements of 29 CFR Part 3, which are incorporated by reference in this contract.

6. Subcontracts.

The Contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR Part 5.5(a)(1) through (10) and such other clauses as _____ may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR Part 5.5.

7. Contract Termination: Debarment.

A breach of the contract clauses in paragraph 1 through 10 of this section may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act Requirements.

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are herein incorporated by reference in this contract.

9. Disputes Concerning Labor Standards.

Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR Parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of Eligibility.

(i) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 USC 1001.

Attachment “C”

Title VI List of Pertinent Nondiscrimination Acts and Authorities

During the performance of this Agreement, the Contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the “Contractor”), as applicable, agrees to comply with the following non-discrimination statutes and authorities; including but not limited to:

- Title VI of the Civil Rights Act of 1964 (42 USC § 2000d *et seq.*, 78 stat. 252) (prohibits discrimination on the basis of race, color, national origin);
- 49 CFR part 21 (Non-discrimination in Federally-assisted programs of the Department of Transportation—Effectuation of Title VI of the Civil Rights Act of 1964);
- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 USC § 4601) (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);
- Section 504 of the Rehabilitation Act of 1973 (29 USC § 794 *et seq.*), as amended (prohibits discrimination on the basis of disability); and 49 CFR part 27;
- The Age Discrimination Act of 1975, as amended (42 USC § 6101 *et seq.*) (prohibits discrimination on the basis of age);
- Airport and Airway Improvement Act of 1982 (49 USC § 471, Section 47123), as amended (prohibits discrimination based on race, creed, color, national origin, or sex);
- The Civil Rights Restoration Act of 1987 (PL 100-209) (broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, the Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms “programs or activities” to include all of the programs or activities of the Federal-aid recipients, sub-recipients and contractors, whether such programs or activities are Federally funded or not);
- Titles II and III of the Americans with Disabilities Act of 1990, which prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 USC §§ 12131 – 12189) as implemented by U.S. Department of Transportation regulations at 49 CFR parts 37 and 38;
- The Federal Aviation Administration’s Nondiscrimination statute (49 USC § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex);
- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures nondiscrimination against minority populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations;

- Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100);
- Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 USC 1681 et seq).

Draft Contract

Please note: this contract is a draft for contractor to view and understand the County's standard terms and conditions, it is subject to revisions. By submitting a bid/proposal contractor/contractor understands and acknowledges that the draft contract is not an offer. Contractors/contractors are not to sign this draft contract.

[REMAINDER OF PAGE LEFT BLANK INTENTIONALLY]

PERFORMANCE BOND

KNOW ALL MEN by these presents; That we (1) _____

_____ a (2) _____

hereinafter called "Principal" and (3) _____

of _____, State of _____, hereinafter called the

"Surety", are held and firmly bound unto (4) _____

of _____, hereinafter called "OWNER", in the penal sum

of _____ dollars (\$ _____)

in lawful money of the United States for the payment of which sum well and truly to be made, we bind

ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain

contract with the Owner, dated the ___ day of _____, 20___, a copy of which is hereto

attached and make a part hereof for the construction of:

CONSTRUCT BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the Owner, with or without notice to the Surety, and if he shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the Owner from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the work to be performed thereunder or the Specifications accompanying the same shall in any way affect its obligations on this bond, and it does not hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work or to the Specifications.

PROVIDED, FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in six (6) counterparts, each one of which shall be deemed an original, this the _____ day of _____, 20__.

ATTEST:

Principal

(Principal) Secretary

By: _____

Witness as to Surety

Address

Address

SEAL:

ATTEST:

Surety

(Surety) Secretary

Attorney-in-Fact

Witness as to Surety

Address

Address

SEAL:

Date of bond must not be prior to date of Contract

1. Correct name of Contractor.
2. A Corporation, A Partnership or an Individual as case may be.
3. Correct name of Surety.
4. Correct name of Owner.
5. If Contractor is Partnership, all partners should execute bond.

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PAYMENT BOND

KNOW ALL MEN by these presents; That we (1) _____
_____ a (2) _____
hereinafter called "Principal" and (3) _____
of _____, State of _____, hereinafter call the
"Surety", are held and firmly bound unto (4) _____
of _____ State of Florida _____, hereinafter called "OWNER", in the penal sum of _
_____ dollars (\$ _____) in
lawful money of the United States for the payment of which sum well and truly to be made, we
bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly
by these presents.

THE CONDITION OF THIS OBLIGATION is such that Whereas, the Principal entered into a
certain contract with the Owner, dated the __ day of _____, 20__, a
copy of which is hereto attached and make a part hereof for the construction of:

CONSTRUCT BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION

NOW, THEREFORE, if the Principal shall promptly make payments to all persons, firms,
subcontractors, and corporations furnishing materials for or performing labor in the prosecution of
the work provided for in such contract, and any authorized extension or modification thereof,
including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on
machinery, equipment and tools, consumed or used in connection with the construction of such
work, and all insurance premiums on said work, and for all labor, performed in such work, whether

by subcontractor or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the work to be in any wise affect its obligation on this bond, and it does hereby waive notice of any such changes, extension of time, alteration or addition to the terms of the contractor or to the work or to the Specifications.

PROVIDED, FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in six (6) counterparts, each one of which shall be deemed an original, this the _____ day of _____, 20__.

ATTEST:

Principal

(Principal) Secretary

By: _____

Witness as to Surety

Address

Address

SEAL:

ATTEST:

Surety

(Surety) Secretary

Attorney-in-Fact

Witness as to Surety

Address

Address

SEAL:

CONTRACTOR'S RELEASE OF LIENS

STATE OF: _____

COUNTY OF: _____

Before me, the undersigned Notary Public in and for the said County and State personally appeared _____, representing the Contractor

_____, who being duly sworn according to law deposes and says that all labor, materials, and outstanding claims and indebtedness of whatever nature arising out of the performance of the Contract with _____, the Owner, for _____, Contract No. , have been paid in full and that for the final payment in the amount of \$ _____, the Contractor releases and discharges the Owner and his authorized representatives from any liens or claims or any nature because of or arising from this Contract and/or its performance, which it has had, has or may have in the future.

By: _____

Sworn to and subscribed before me this

_____ day of _____

(Notary Public)

My Commission Expires: _____

ADVERTISEMENT OF COMPLETION

_____ (Contractor)

_____ (Address)

gives notice of completion of _____ (Project)

and sets _____ as the date of final settlement.

All persons and firms should file all claims for payment to the below address prior to the settlement date:

**Okaloosa County
5479A Old Bethel Road
Crestview, FL 32536**

By: _____ (Name)

_____ (Title)

Leg: _____ (Publication Dates)

Standard Additional Contract Clauses

Title VI Clauses for Compliance with Nondiscrimination Requirements

Compliance with Nondiscrimination Requirements

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the “contractor”) agrees as follows:

2. **Compliance with Regulations:** The contractor (hereinafter includes consultants) will comply with the Title VI List of Pertinent Nondiscrimination Acts And Authorities, as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.
3. **Non-discrimination:** The contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor will not participate directly or indirectly in the discrimination prohibited by the Nondiscrimination Acts and Authorities, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR part 21.
4. **Solicitations for Subcontracts, Including Procurements of Materials and Equipment:** In all solicitations, either by competitive bidding, or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the contractor of the contractor’s obligations under this contract and the Nondiscrimination Acts And Authorities on the grounds of race, color, or national origin.
5. **Information and Reports:** The contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the sponsor or the Federal Aviation Administration to be pertinent to ascertain compliance with such Nondiscrimination Acts And Authorities and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the contractor will so certify to the sponsor or the Federal Aviation Administration, as appropriate, and will set forth what efforts it has made to obtain the information.
6. **Sanctions for Noncompliance:** In the event of a contractor’s noncompliance with the Non-discrimination provisions of this contract, the sponsor will impose such contract sanctions as it or the Federal Aviation Administration may determine to be appropriate, including, but not limited to:

- a. Withholding payments to the contractor under the contract until the contractor complies; and/or
 - b. Canceling, terminating, or suspending a contract, in whole or in part.
7. **Incorporation of Provisions:** The contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations and directives issued pursuant thereto. The contractor will take action with respect to any subcontract or procurement as the sponsor or the Federal Aviation Administration may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the contractor may request the sponsor to enter into any litigation to protect the interests of the sponsor. In addition, the contractor may request the United States to enter into the litigation to protect the interests of the United States.

Title VI List of Pertinent Nondiscrimination Acts and Authorities

Title VI List of Pertinent Nondiscrimination Acts and Authorities

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the “contractor”) agrees to comply with the following non-discrimination statutes and authorities; including but not limited to:

- Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d *et seq.*, 78 stat. 252), (prohibits discrimination on the basis of race, color, national origin);
- 49 CFR part 21 (Non-discrimination In Federally-Assisted Programs of The Department of Transportation—Effectuation of Title VI of The Civil Rights Act of 1964);
- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 U.S.C. § 4601), (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);
- Section 504 of the Rehabilitation Act of 1973, (29 U.S.C. § 794 *et seq.*), as amended, (prohibits discrimination on the basis of disability); and 49 CFR part 27;
- The Age Discrimination Act of 1975, as amended, (42 U.S.C. § 6101 *et seq.*), (prohibits discrimination on the basis of age);
- Airport and Airway Improvement Act of 1982, (49 USC § 471, Section 47123), as amended, (prohibits discrimination based on race, creed, color, national origin, or sex);
- The Civil Rights Restoration Act of 1987, (PL 100-209), (Broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, The Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of

the terms “programs or activities” to include all of the programs or activities of the Federal-aid recipients, sub-recipients and contractors, whether such programs or activities are Federally funded or not);

- Titles II and III of the Americans with Disabilities Act of 1990, which prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 U.S.C. §§ 12131 – 12189) as implemented by Department of Transportation regulations at 49 CFR parts 37 and 38;
- The Federal Aviation Administration’s Non-discrimination statute (49 U.S.C. § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex);
- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures non-discrimination against minority populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations;
- Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100);
- Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 U.S.C. 1681 et seq).

FEDERAL FAIR LABOR STANDARDS ACT (FEDERAL MINIMUM WAGE)

All contracts and subcontracts that result from this solicitation incorporate by reference the provisions of 29 CFR part 201, the Federal Fair Labor Standards Act (FLSA), with the same force and effect as if given in full text. The FLSA sets minimum wage, overtime pay, recordkeeping, and child labor standards for full and part time workers.

The *contractor* has full responsibility to monitor compliance to the referenced statute or regulation. The *contractor* must address any claims or disputes that arise from this requirement directly with the U.S. Department of Labor – Wage and Hour Division

OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970

All contracts and subcontracts that result from this solicitation incorporate by reference the requirements of 29 CFR Part 1910 with the same force and effect as if given in full text. Contractor must provide a work environment that is free from recognized hazards that may cause death or serious physical harm to the employee. The Contractor retains full responsibility to monitor its compliance and their subcontractor’s compliance with the applicable requirements of

the Occupational Safety and Health Act of 1970 (20 CFR Part 1910). Contractor must address any claims or disputes that pertain to a referenced requirement directly with the U.S. Department of Labor – Occupational Safety and Health Administration.

E-VERIFY

Enrollment and verification requirements.

- (1) If the Contractor is not enrolled as a Federal Contractor in E-Verify at time of contract award, the Contractor shall-
 - a. Enroll. Enroll as a Federal Contractor in the E-Verify Program within thirty (30) calendar days of contract award;
 - b. Verify all new employees. Within ninety (90) calendar days of enrollment in the E-Verify program, begin to use E-Verify to initiate verification of employment eligibility of all new hires of the Contractor, who are working in the United States, whether or not assigned to the contract, within three (3) business days after the date of hire (but see paragraph (b)(3) of this section); and,
 - c. Verify employees assigned to the contract. For each employee assigned to the contract, initiate verification within ninety (90) calendar days after date of enrollment or within thirty (30) calendar days of the employee's assignment to the contract, whichever date is later (but see paragraph (b)(4) of this section.)
- (2) If the Contractor is enrolled as a Federal Contractor in E-Verify at time of contract award, the Contractor shall use E-Verify to initiate verification of employment eligibility of
 - a. All new employees.
 - a. Enrolled ninety (90) calendar days or more. The Contractor shall initiate verification of all new hires of the Contractor, who are working in the United States, whether or not assigned to the contract, within three (3) business days after the date of hire (but see paragraph (b)(3) of this section); or
 - b. Enrolled less than ninety (90) calendar days. Within ninety (90) calendar days after enrollment as a Federal Contractor in E-Verify, the Contractor shall initiate verification of all new hires of the contractor, who are working in the United States, whether or not assigned to the contract, within three (3) business days after the date of hire (but see paragraph (b)(3) of this section); or
 - c. Employees assigned to the contract. For each employee assigned to the contract, the Contractor shall initiate verification within ninety (90) calendar

days after date of contract award or within thirty (30) days after assignment to the contract, whichever date is later (but see paragraph (b)(4) of this section.)

- (3) If the Contractor is an institution of higher education (as defined at 20 U.S.C. 1001(a)); a State of local government or the government of a Federally recognized Indian tribe, or a surety performing under a takeover agreement entered into with a Federal agency pursuant to a performance bond, the Contractor may choose to verify only employees assigned to the contract, whether existing employees or new hires. The Contractor shall follow the applicable verification requirements of (b)(1) or (b)(2), respectively, except that any requirement for verification of new employees applies only to new employees assigned to the contract.
- (4) Option to verify employment eligibility of all employees. The Contractor may elect to verify all existing employees hired after November 6, 1986 (after November 27, 2009, in the Commonwealth of the Northern Mariana Islands), rather than just those employees assigned to the contract. The Contractor shall initiate verification for each existing employee working in the United States who was hired after November 6, 1986 (after November 27, 2009, in the Commonwealth of the Northern Mariana Islands), within one hundred eighty (180) calendar days of-
 - a. Enrollment in the E-Verify program; or
 - b. Notification to E-Verify Operations of the Contractor's decision to exercise this option, using the contract information provided in the E-Verify program Memorandum of Understanding (MOU)
- (5) The Contractor shall comply, for the period of performance of this contract, with the requirements of the E-Verify program MOU.
 - a. The Department of Homeland Security (DHS) or the Social Security Administration (SSA) may terminate the Contractor's MOU and deny access to the E-Verify system in accordance with the terms of the MOU. In such case, the Contractor, will be referred to a suspension or debarment official.
 - b. During the period between termination of the MOU and a decision by the suspension or debarment official whether to suspend or debar, the contractor is excused from its obligations under paragraph (b) of this clause. If the suspension or debarment official determines not to suspend or debar the Contractor, then the Contractor must reenroll in E-Verify.
 - c. Web site. Information on registration for and use of the E-Verify program can be obtained via the Internet at the Department of Homeland Security Web site: <http://www.dhs.gov/E-Verify>.

- d. Individuals previously verified. The Contractor is not required by this clause to perform additional employment verification using E-Verify for any employee
 - i. Whose employment eligibility was previously verified by the Contractor through the E-Verify program;
 - ii. Who has been granted and holds an active U.S. Government security clearance for access to confidential, secret, or top secret information in accordance with the National Industrial Security Program Operating Manual; or
 - iii. Who has undergone a completed background investigation and been issued credentials pursuant to Homeland Security Presidential Directive (HSPD)-12. Policy for a Common Identification Standard for Federal Employees and Contractors.

Subcontracts. The Contractor shall include the requirements of this clause, including this paragraph € (appropriately modified for identification of the parties in each subcontract that-

(1) Is for-

- i. Commercial and noncommercial services (except for commercial services that are part of the purchase of a COTS item (or an item that would be a COTS item, but for minor modifications), performed by the COTS provider, and are normally provided for that COTS item); or
- ii. Construction;

(2) Has a value of more than \$3,500; and

(3) Includes work performed in the United States

GENERAL SERVICES INSURANCE REQUIREMENTS

CONTRACTORS INSURANCE

1. The Contractor shall not commence any work in connection with this Agreement until he has obtained all required insurance and such insurance has been approved by the Okaloosa County Risk Manager or designee.
2. All insurance policies shall be with insurers authorized to do business in the State of Florida.
3. All insurance shall include the interest of all entities named and their respective officials, employees & volunteers of each and all other interests as may be reasonably required by Okaloosa County. The coverage afforded the Additional Insured under this policy shall be primary insurance. If the Additional Insured have other insurance that is applicable to the loss, such other insurance shall be on an excess or contingent basis. The amount of the company's liability under this policy shall not be reduced by the existence of such other insurance.
4. The County and the State of Florida Department of Transportation shall be shown as an Additional Insured with a Waiver of Subrogation on the Certificate of Insurance.
5. The County shall retain the right to reject all insurance policies that do not meet the requirement of this Agreement. Further, the County reserves the right to change these insurance requirements with 60-day notice to the Contractor.
6. The County reserves the right at any time to require the Contractor to provide copies (redacted if necessary) of any insurance policies to document the insurance coverage specified in this Agreement.
7. The designation of Contractor shall include any associated or subsidiary company which is involved and is a part of the contract and such, if any associated or subsidiary company involved in the project must be named in the Workers' Compensation coverage.
8. Any exclusions or provisions in the insurance maintained by the Contractor that excludes coverage for work contemplated in this agreement shall be deemed unacceptable and shall be considered breach of contract.

WORKERS' COMPENSATION INSURANCE

1. The Contractor shall secure and maintain during the life of this Agreement Workers' Compensation insurance for all of his employees employed for the project or any site connected with the work, including supervision, administration or management, of this project and in case any work is sublet, with the approval of the

County, the Contractor shall require the Subcontractor similarly to provide Workers' Compensation insurance for all employees employed at the site of the project, and such evidence of insurance shall be furnished to the County not less than ten (10) days prior to the commencement of any and all sub-contractual Agreements which have been approved by the County.

2. Contractor must be in compliance with all applicable State and Federal workers' compensation laws, including the U.S. Longshore Harbor Workers' Act or Jones Act, if applicable.
3. No class of employee, including the Contractor himself, shall be excluded from the Workers' Compensation insurance coverage. The Workers' Compensation insurance shall also include Employer's Liability coverage.

BUSINESS AUTOMOBILE LIABILITY

Coverage must be afforded for all Owned, Hired, Scheduled, and Non-Owned vehicles for Bodily Injury and Property Damage in an amount not less than \$15,000,000 combined single limit each accident. If the contractor does not own vehicles, the contractor shall maintain coverage for Hired & Non-Owned Auto Liability, which may be satisfied by way of endorsement to the Commercial General Liability policy or separate Business Auto Policy. Contractor must maintain this insurance coverage throughout the life of this Agreement.

COMMERCIAL GENERAL LIABILITY INSURANCE

1. The Contractor shall carry other Commercial General Liability insurance against all other Bodily Injury, Property Damage and Personal and Advertising Injury exposures.
2. All liability insurance (other than Professional Liability) shall be written on an occurrence basis and shall not be written on a claims-made basis. If the insurance is issued with an aggregate limit of liability, the aggregate limit of liability shall apply only to the locations included in this Agreement. If, as the result of any claims or other reasons, the available limits of insurance reduce to less than those stated in the Limits of Liability, the Contractor shall notify the County representative in writing. The Contractor shall purchase additional liability insurance to maintain the requirements established in this Agreement. Umbrella or Excess Liability insurance can be purchased to meet the Limits of Liability specified in this Agreement.
3. Commercial General Liability coverage shall include the following:
 - 1.) Premises & Operations Liability
 - 2.) Bodily Injury and Property Damage Liability
 - 3.) Independent Contractors Liability
 - 4.) Contractual Liability

5.) Products and Completed Operations Liability

4. Contractor shall agree to keep in continuous force Commercial General Liability coverage for the length of the contract.

LIMITS OF LIABILITY

The insurance required shall be written for not less than the following, or greater if required by law and shall include Employer’s liability with limits as prescribed in this contract:

	<u>LIMIT</u>
1. Worker’s Compensation	
1.) State	Statutory
2.) Employer’s Liability	\$500,000 each accident
2. Business Automobile	\$15,000,000.00 each accident (A combined single limit)
3. Commercial General Liability	\$15,000,000.00 each occurrence for Bodily Injury & Property Damage
	\$15,000,000.00 each occurrence Products and completed operations
4. Personal and Advertising Injury	\$15,000,000.00 each occurrence

NOTICE OF CLAIMS OR LITIGATION

The Contractor agrees to report any incident or claim that results from performance of this Agreement. The County representative shall receive written notice in the form of a detailed written report describing the incident or claim within ten (10) days of the Contractor’s knowledge. In the event such incident or claim involves injury and/or property damage to a third party, verbal notification shall be given the same day the Contractor becomes aware of the incident or claim followed by a written detailed report within ten (10) days of verbal notification.

INDEMNIFICATION & HOLD HARMLESS

Contractor shall indemnify and hold harmless the County, its officers and employees from liabilities, damages, losses, and costs including but not limited to reasonable attorney fees, to the extent caused by the negligence, recklessness, or wrongful conduct of the Contractor and other persons employed or utilized by the Contractor in the performance of this contract.

CERTIFICATE OF INSURANCE

1. Certificates of insurance indicating the job site and evidencing all required coverage must be submitted not less than 10 days prior to the commencement of any of the work. The certificate holder(s) shall be as follows: Okaloosa County, 5479A Old Bethel Road, Crestview, Florida, 32536.
2. The contractor shall provide a Certificate of Insurance to the County with a thirty (30) day notice of cancellation; ten (10) days' notice if cancellation is for nonpayment of premium.
3. In the event that the insurer is unable to accommodate the cancellation notice requirement, it shall be the responsibility of the contractor to provide the proper notice. Such notification shall be in writing by registered mail, return receipt requested, and addressed to the Okaloosa County Purchasing Department at 5479-A Old Bethel Road, Crestview, FL 32536.
4. In the event the contract term goes beyond the expiration date of the insurance policy, the contractor shall provide the County with an updated Certificate of insurance no later than ten (10) days prior to the expiration of the insurance currently in effect. The County reserves the right to suspend the contract until this requirement is met.
5. The certificate shall indicate if coverage is provided under a claims-made or occurrence form. If any coverage is provided on a claims-made form, the certificate will show a retroactive date, which should be the same date of the initial contract or prior.
6. All certificates shall be subject to Okaloosa County's approval of adequacy of protection and the satisfactory character of the Insurer.
7. All deductibles whether approved by Okaloosa County or not, shall be the Contractor's full responsibility. In particular, the Contractor shall afford full coverage as specified herein to entities listed as Additional Insured. There are no self-insured retentions (SIR) allowable for this requirement and contract.
8. In no way will the entities listed as Additional Insured be responsible for, pay for, be damaged by, or limited to coverage required by this schedule due to the existence of a deductible.

GENERAL TERMS

Any type of insurance or increase of limits of liability not described above which, the Contractor required for its own protection or on account of statute shall be its own responsibility and at its own expense.

Any exclusions or provisions in the insurance maintained by the contractor that excludes coverage for work contemplated in this contract shall be deemed unacceptable and shall be considered breach of contract.

The carrying of the insurance described shall in no way be interpreted as relieving the Contractor of any responsibility under this contract.

Should the Contractor engage a subcontractor or sub-subcontractor, the same conditions will apply under this Agreement to each subcontractor and sub-subcontractor.

The Contractor hereby waives all rights of subrogation against Okaloosa County and its consultants and other indemnities of the Contractor under all the foregoing policies of insurance.

UMBRELLA INSURANCE

The Contractor shall have the right to meet the liability insurance requirements with the purchase of an umbrella insurance policy. In all instances, the combination of primary and umbrella liability coverage must equal or exceed the minimum liability insurance limits stated in this Agreement

GENERAL CONDITIONS

ARTICLE 1 – DEFINITIONS

Wherever used in these General Conditions or in the other Contract Documents the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

- 1.1. AASHTO – The American Association of State Highway and Transportation Officials, the successor association AASHO.
- 1.2. Access Road – The right-of-way, the roadway and all improvements constructed thereon connecting the airport to a public highway.
- 1.3. Addenda – Written or graphic instruments issued prior to the opening of Bids which clarify, correct or change the Project Requirements or the Contract Documents.
- 1.4. Advertisement – A public announcement, as required by local law, inviting bids for work to be performed and materials to be furnished.
- 1.5. Agreement – The written contract between Owner and Contractor covering the Work to be performed; other Contract Documents are attached to the Agreement and made a part thereof as provided therein.
- 1.6. AIP – The Airport Improvement Program, a grant-in-aid program, administered by the Federal Aviation Administration.
- 1.7. Air Operations Area – For the purpose of these specifications, the term air operations area shall mean any area of the airport used or intended to be used for the landing, takeoff, or surface maneuvering of aircraft. An air operation area shall include such paved or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runway, taxiway, or apron.
- 1.8. Airport – Airport means the area of land or water which is used or intended to be used for the landing and takeoff of aircraft, and includes its buildings and facilities, if any.
- 1.9. Application for Payment – The form accepted by Engineer which is to be used by Contractor in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
- 1.10. Asbestos – Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.
- 1.11. ASTM – The American Society for Testing and Materials.
- 1.12. Award – The acceptance, by the Owner, of the successful contractor's proposal.
- 1.13. Bid – The offer or proposal of the contractor submitted on the prescribed form setting forth the prices for the Work to be performed.

- 1.14. Contractor – Any individual, partnership, firm, or corporation, acting directly or through a duly authorized representative, who submits a proposal for the work contemplated.
- 1.15. Project Documents – The advertisement or invitation to Bid, instructions to contractors, the Bid Form, and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).
- 1.16. Project Requirements – The advertisement or invitation to Bid, instructions to contractors, and the Bid Form.
- 1.17. Building Area – An area on the airport to be used, considered, or intended to be used for airport buildings, or other facilities or rights-of-way together with all airport buildings and facilities located thereon.
- 1.18. Bonds – Performance and Payment bonds and other instruments of security.
- 1.19. Calendar Day – Every day shown on the calendar.
- 1.20. Certificates of Compliance – Written statements by the manufacturer stating the material furnished is in conformance with the Specifications.
- 1.21. Change Order – A document recommended by Engineer, which is signed by Contractor and Owner and authorizes an addition, deletion or revision in the Work, or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement. The work covered by a change order shall be within the scope of the contract.
- 1.22. Contract Documents – The Agreement, Addenda (which pertain to the Contract Documents), Contractor's Bid (including documentation accompanying the Bid and any post Bid documentation submitted prior to the Notice of Award) when attached as an exhibit to the Agreement, the Notice to Proceed, the Bonds, these General Conditions, the Supplementary Conditions, the Specifications and the Drawings as the same are more specifically identified in the Agreement, together with all Written Amendments, Change Orders, Work Change Directives, Field Orders and Engineer's written interpretations and clarifications issued pursuant to paragraphs 3.5, 3.6.1, and 3.6.3 on or after the Effective Date of the Agreement. Shop Drawing submittals approved pursuant to paragraphs 6.19 and 6.20 and the reports and drawings referred to in paragraphs 4.2.1.1 and 4.2.2.2 are not Contract Documents.
- 1.23. Contract Price – The money payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of paragraph 11.9.1 in the case of Unit Price Work).
- 1.24. Contract Times – The numbers of days or the dates stated in the Agreement: (i) to achieve Substantial Completion, and (ii) to complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment in accordance with paragraph 14.13.
- 1.25. Contract Item (Pay Item) – A specific unit of work for which a price is provided in the Contract.
- 1.26. Contractor – The person, firm or corporation with whom Owner has entered into the Agreement.

- 1.27. Defective – An adjective which when modifying the word Work refers to Work that is unsatisfactory, faulty or deficient, in that it does not conform to the Contract Documents, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with paragraph 14.8 or 14.10).
- 1.28. Drainage System – The system of pipes, ditches, and structures by which surface or subsurface waters are collected and conducted from the airport area.
- 1.29. Drawings – The drawings which show the scope, extent, and character of the Work to be furnished and performed by Contractor and which have been prepared or approved by Engineer and are referred to in the Contract Documents. Shop drawings are not Drawings as so defined.
- 1.30. Effective Date of the Agreement – The date indicated in the Agreement on which it becomes effective, but if no such date is indicated it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.
- 1.31. Engineer – The person, firm, or corporation named as such in the Agreement.
- 1.32. Engineer's Consultant – A person, firm, or corporation having a contract with Engineer to furnish services as Engineer's independent professional associate or consultant with respect to the Project and who is identified as such in the Supplementary Conditions. The following list of independent professional associates and consultants are considered the Engineer's consultant for this Construction Contract: GRAEF-USA Inc.
- 1.33. Equipment – All machinery, together with the necessary supplies for upkeep and maintenance, and also all tools and apparatus necessary for the proper construction and acceptable completion of the work.
- 1.34. Extra Work – An item of work not provided for in the awarded contract as previously modified by change order or supplemental agreement, but which if found by the Engineer to be necessary to complete the work within the intended scope of the contract as previously modified.
- 1.35. FAA – The Federal Aviation Administration of the U.S. Department of Transportation. When used to designate a person, FAA shall mean the Administrator or his duly authorized representative.
- 1.36. Federal Specifications – The Federal Specifications and Standards, and supplements, amendments, and indices thereto are prepared and issued by the General Services Administration of the Federal Government. They may be obtained from the Specifications Activity, Printed Materials Supply Division, Building 197, Naval Weapons Plant, Washington, D.C. 20407.
- 1.37. Field Order – A written order issued by Engineer which orders minor changes in the Work in accordance with paragraph 9.5 but which does not involve a change in the Contract Price or the Contract Times.
- 1.38. General Requirements – Sections of Division 1 of the Specifications.

- 1.39. Hazardous Waste – The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.
- 1.40. Inspector – An authorized representative of the Engineer assigned to make all necessary inspections and/or tests of the work performed or being performed, or of the materials furnished or being furnished by the Contractor.
- 1.41. Intention of Terms – Whenever, in these specifications or on the plans, the words, "directed," "required," "permitted," "ordered," "designated," "prescribed," or words of the like import are used, it shall be understood that the direction, requirement, permission, order, designation, or prescription of the Engineer is intended; and similarly, the words "approved," "acceptable," "Satisfactory," or words of like import, shall mean approved by, or acceptable to, or satisfactory to the Engineer, subject in each case to the final determination of the Owner.
- 1.42. Laboratory – The official testing laboratories of the Owner or such other laboratories as may be designated by the Engineer.
- 1.43. Laws and Regulations; Laws or Regulations – Any and all applicable laws, rules, regulations, ordinances, codes and orders of any and all governmental bodies, agencies, authorities and courts having jurisdiction.
- 1.44. Liens – Liens, charges, security interests, or encumbrances upon real property or personal property.
- 1.45. Lighting – A system of fixtures providing or controlling the light sources used on or near the airport or within the airport buildings. The field lighting includes all luminous signals, markers, floodlights, and illuminating devices used on or near the airport or to aid in the operation of aircraft landing at, taking off from, or taxiing on the airport surface.
- 1.46. Major and Minor Contract Items – A major contract item shall be any item that is listed in the proposal, the total cost of which is equal to or greater than 25 percent of the total amount of the award contract. All other items shall be considered minor contract items.
- 1.47. Materials – Any substance specified for use in the construction of the Contract work.
- 1.48. Mil Specifications – The Military Specifications and Standard, and indices thereto, that are prepared and issued by the Department of Defense.
- 1.49. Milestone – A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.
- 1.50. Notice of Award – The written notice by Owner to the apparent successful contractor stating that upon compliance by the apparent successful contractor with the conditions precedent enumerated therein, within the time specified, Owner will sign and deliver the Agreement.
- 1.51. Notice to Proceed – A written notice given by Owner to Contractor (with a copy to Engineer) fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform Contractor's obligations under the Contract Documents.
- 1.52. FDOT – The Florida State Department of Transportation. When used to designate a person, FDOT shall mean the commissioner or his duly authorized representative.

- 1.53. Owner – The public body or authority, corporation, association, firm, or person with whom Contractor has entered into the Agreement and for whom the Work is to be provided.
- 1.54. Partial Utilization – Use by Owner of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work.
- 1.55. Pavement – The combined surface course, base course, and subbase course, if any, considered as a single unit.
- 1.56. Payment Bond – The approved form of security furnished by the Contractor and his/her surety as a guaranty that he will pay in full all bills and accounts for materials and labor used in the construction of the work.
- 1.57. PCBs – Polychlorinated biphenyls.
- 1.58. Performance Bond – The approved form of security furnished by the Contractor and his/her surety as a guaranty that the Contractor will complete the work in accordance with the terms of the contract.
- 1.59. Petroleum – Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Wastes and crude oils.
- 1.60. Plans – The official drawings or exact reproductions which show the location, character, dimensions, and details of the airport and the work to be done and which are to be considered as a part of the contract, supplementary to the specifications.
- 1.61. Project – The total construction of which the Work to be provided under the Contract Documents may be the whole, or a part as indicated elsewhere in the Contract Documents.
- 1.62. Proposal – (See Bid).
- 1.63. Radioactive Material – Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.
- 1.64. Resident Project Representative - The authorized representative of Engineer who may be assigned to the site or any part thereof.
- 1.65. Runway – The area on the airport prepared for the landing and takeoff of aircraft.
- 1.66. Samples – Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.
- 1.67. Shop Drawings – All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.

- 1.68. Special Provisions – The specific clauses setting forth conditions or requirements peculiar to the project under consideration, covering work or materials involved in the proposal and estimate, which are not thoroughly or satisfactorily stipulated in these specifications.
- 1.69. Specifications – Those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards, and workmanship as applied to the Work and certain administrative details applicable thereto.
- 1.70. Sponsor – For AIP Contracts, the term Sponsor shall have the meaning as the term Owner.
- 1.71. Structures – Airport facilities such as bridges; culverts; catch basins; inlets; retaining walls; cribbing; storm and sanitary sewer lines; water lines; underdrains; electrical ducts, manholes, handholes, lighting fixtures and bases; transformers; flexible and rigid pavements; navigational aids; buildings; vaults; and, other manmade features of the airport that may be encountered in the work and not otherwise classified herein.
- 1.72. Subcontractor – An individual, firm, or corporation having a direct contract with Contractor or with any other Subcontractor for performance of a part of the Work at the site.
- 1.73. Subgrade – The soil which forms the pavement foundation.
- 1.74. Superintendent – The Contractor's executive representative who is present on the work during progress, authorized to receive and fulfill instruction from the Engineer, and who shall supervise and direct the construction.
- 1.75. Substantial Completion – The Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer as evidenced by Engineer's definitive certificate of Substantial Completion, it is sufficiently complete, in accordance with the Contract Documents, so that the Work (or specified part) can be utilized for the purposes for which it is intended; or if no such certificate is issued, when the Work is complete and ready for final payment as evidenced by Engineer's written recommendation of final payment in accordance with paragraph 14.13. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.
- 1.76. Supplemental Agreement – A written agreement between the Contractor and the Owner covering: (1) work that would increase or decrease the total amount of the awarded contract, or any major contract item, by more than 25 percent, such increased or decreased work being within the scope of the originally awarded contract; or (2) work that is not within the scope of the originally awarded contract.
- 1.77. Supplementary Conditions – The part of the Contract Documents which amends or supplements these General Conditions.
- 1.78. Supplier – A manufacturer, fabricator, supplier, distributor, materialman, or vendor having direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or any Subcontractor.
- 1.79. Surety – The corporation, partnership, or individual, other than the Contractor, executing payment or performance bonds which are furnished to the Owner by the Contractor.

- 1.80. Taxiway – For the purpose of this document, the term taxiway means the portion of the air operations area of an airport that has been designated by competent airport authority for movement of aircraft to and from the airport's runways or aircraft parking areas.
- 1.81. Underground Facilities – All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone, or other communications, cable television, sewage and drainage removal, traffic or other control systems or water.
- 1.82. Unit Price Work – Work to be paid for on the basis of unit prices.
- 1.83. Work – The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work includes and is the result of performing or furnishing labor and furnishings and incorporating materials and equipment into the construction, and performing or furnishing services and furnishing documents, all as required by the Contract Documents.
- 1.84. Work Change Directive - A written directive to Contractor, issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen physical conditions under which the Work is to be performed as provided in paragraph 4.2 or 4.3 or to emergencies under paragraph 6.18. A Work Change Directive will not change the Contract Price or the Contract Times, but is evidence that the parties expect that the change directed or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times as provided in Article 10.
- 1.85. Working Day – A working day shall be any day other than a legal holiday, Saturday, or Sunday on which the normal working forces of the Contractor may proceed with regular work for at least 6 hours toward completion of the Contract. Unless work is suspended for causes beyond the Contractor's control, Saturdays, Sundays and holidays on which the Contractor's forces engage in regular work, requiring the presence of an inspector, will be considered as working days.
- 1.86. Work Period – A work period shall consist of any designated block of time on which the normal working forces of the Contractor may proceed with regular work for at least 5 hours toward completion of the contract. Unless work is suspended for causes beyond the Contractor's control, work occurring on any day, regardless of it being a weekend or holiday, which requires an Inspector, will be considered a work period. Work periods are limited to between 7:00 a.m. and 5:00 p.m. local time Monday through Friday. Weekend work will not be permitted unless contractor obtains written permission from Owner.
- 1.87. Written Amendment – A written amendment of the Contract Documents, signed by Owner and Contractor on or after the Effective Date of the Agreement and normally dealing with the non-engineering or nontechnical rather than strictly construction-related aspects of the Contract Documents.

ARTICLE 2 – PRELIMINARY MATTERS

Delivery of Bonds:

- 2.1. When Contractor delivers the executed Agreements to Owner, Contractor shall also deliver to Owner such Bonds as Contractor may be required to furnish in accordance with paragraph 5.1.

Copies of Documents:

- 2.2. Owner shall furnish to Contractor up to five copies (unless otherwise specified in the Supplementary Conditions) of the Contract Documents as are reasonably necessary for the execution of the Work. Additional copies will be furnished, upon request, at the cost of reproduction.

Commencement of Contract Times; Notice to Proceed:

- 2.3. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement, or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within thirty days after the Effective Date of the Agreement. In no event will the Contract Time commence to run later than the *one-hundred twentieth (120th)* day after the day of Bid opening or the *ninetieth (90th)* day after the Effective Date of the Agreement, whichever date is earlier.

Starting the Work:

- 2.4. Contractor shall start to perform the Work on the date when the Contract Times commence to run, but no Work shall be done at the site prior to the date on which the Contract Times commence to run.

Before Starting Construction:

- 2.5. Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity or discrepancy which Contractor may discover and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby; however, Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity or discrepancy in the Contract Documents, unless Contractor knew or reasonably should have known thereof.
- 2.6. Within ten days after the Construction Notice to Proceed contractor shall submit to Engineer for review:
 - 2.6.1. a preliminary progress schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;
 - 2.6.2. a preliminary schedule of Shop Drawings and Sample submittals which will list each required submittal and the times for submitting, reviewing and processing such submittal;
 - 2.6.3. a preliminary schedule of values for all of the Work which will include quantities and prices of items aggregating the Contract Price and will subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Such prices will include and appropriate amount of overhead and profit applicable to each item of Work.
- 2.7. Before any Work at the site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and

other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with paragraphs 5.4 and 5.6.

Preconstruction Conference:

2.8. Within twenty (20) days *prior to Construction Notice to Proceed*, but before any Work at the site is started, a conference attended by Contractor, Engineer and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in paragraph 2.6, procedures for handling Shop Drawings, and other submittals, processing Applications for Payment and maintaining required records.

Initially Acceptable Schedules:

2.9. Unless otherwise provided in the Contract Documents, at least ten days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with paragraph 2.6. Contractor shall have an additional ten days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until the schedules are submitted to and acceptable to Engineer as provided below. The progress schedule will be acceptable to Engineer as providing an orderly progression of the Work to completion within any specified Milestones and the Contract Times, but such acceptance will neither impose on Engineer responsibility for the sequencing, scheduling, or progress of Work nor interfere with or relieve Contractor from Contractor's full responsibility therefore, Contractor's schedule of Shop Drawing and Sample submissions will be acceptable to Engineer as providing a workable arrangement for reviewing and processing the required submittals. Contractor's schedule of values will be acceptable to Engineer as to form and substance.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

Intent:

3.1. The Contract Documents comprise the entire agreement between Owner and Contractor concerning the Work. The Contract Documents are complementary: what is called for by one is as binding as if called for by all. The Contract Documents will be construed in accordance with the law of the place of the Project.

3.2. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any Work, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be furnished and performed whether or not specifically called for. When words or phrases, which have a well-known technical or construction industry or trade meaning are used to describe Work, materials, or equipment, such words or phrases shall be interpreted in accordance with the meaning. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in paragraph 9.4.

3.3. Reference to Standards and Specifications of Technical Societies: Reporting and Resolving Discrepancies:

3.3.1. Reference to standards, specifications, manuals or codes of any technical society, organization, or association, or to the Laws or Regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard, specification, manual, code or Laws or Regulations in effect at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

3.3.2. If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any such Law or Regulation applicable to the performance of the Work or of any such standard, specification, manual, or code or of any instruction of any Supplier referred to in paragraph 6.5., Contractor shall report it to Engineer in writing at once, and, Contractor shall not proceed with the Work affected thereby (except in an emergency as authorized by paragraph 6.18) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in paragraph 3.5 or 3.6; provide, however, that Contractor shall not be liable to Owner or Engineer for failure to report any such conflict, error, ambiguity or discrepancy unless Contractor knew or reasonably should have known thereof.

3.3.3. Except as otherwise specifically stated in the Contract Documents or as may be provided by amendment or supplement thereto issued by one of the methods indicated in paragraph 3.5 or 3.6, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

3.3.3.1. the provisions of any such standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents): or

3.3.3.2. the provisions of any such Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

No provision of any such standard, specification, manual, code, or instruction shall be effective to change the duties and responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall it be effective to assign to Owner, Engineer, or any of Engineer's Consultants, agents, or employees any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of paragraph 9.13 or any other provision of the Contract Documents.

3.3.4. Whenever the plans or specifications are in conflict, resolution of such conflict shall be in the following order of precedence subject to agreement by Engineer:

- Contract Agreement
- Addenda, with those of later date having precedence over those of earlier dates
- Bid Documents
- Supplementary Conditions
- General Conditions
- Construction Drawings
- Technical Specifications
- FAA General Provisions
- Florida DOT Standard Specifications

In case of our inconsistency within the Contract Drawings, the order of procedure is as follows:

- Schedules
- Specific Details
- Typical Details

Construction Drawings

3.4. Whenever in the Contract Documents the terms "as ordered," "as directed," "as required," "as allowed," "as approved" or terms of like effect or import are used, or the adjectives "reasonable," "suitable," "acceptable," "proper," or "satisfactory" or adjectives of like effect or import are used to describe a requirement, direction, review or judgment of Engineer as to the Work, it is intended that such requirement, direction, review, or judgment will be solely to evaluate, in general, the completed Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective shall not be effective to assign to Engineer any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraph 9.13 or any other provision of the Contract Documents.

Amending and Supplementing Contract Documents:

3.5. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways:

- 3.5.1. a formal Written Amendment.
- 3.5.2. a Change Order (pursuant to paragraph 10.4) or
- 3.5.3. a Work Change Directive (pursuant to paragraph 10.1).

3.6. In addition, the requirements of the Contract Documents may be supplemented and minor variations, and deviations of the Work may be authorized, in one or more of the following ways:

- 3.6.1. a Field Order (pursuant to paragraph 9.5).
- 3.6.2. Engineer's approval of a Shop Drawing or Sample (pursuant to paragraphs 6.19 and 6.20), or
- 3.6.3. Engineer's written interpretation or clarification (pursuant to paragraph 9.4).

Reuse of Documents:

3.7. Contractor and any Subcontractor or Supplier or other person or organization performing or furnishing any of the Work under a direct or indirect contract with Owner (i) shall not have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or Engineer's Consultant, and (ii) shall not reuse any of such Drawings, Specifications, other documents, or copies on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaption by Engineer.

ARTICLE 4 – AVAILABILITY OF LANDS: SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

4.1 Availability of Lands:

Owner shall furnish, as indicated in the Contract Documents, the lands upon which the Work is to be performed, rights-of-way and easements for access thereto, and such other lands which are designated for

the use of Contractor. Upon reasonable written request, Owner shall furnish Contractor with a correct statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's lien against such lands in accordance with applicable Laws and Regulations. Owner shall identify any encumbrances or restrictions not of general application but specifically related to use of lands so furnished with which Contractor will have to comply in performing the Work. Easements for permanent structures or permanent in existing facilities will be obtained and paid for by Owner, unless otherwise provided in the Contract Documents. If Contractor and Owner are unable to agree on entitlement to or the amount or extent of any adjustments in the Contract Price or the Contract Times as a result of any delay in Owner's furnishing these lands, rights-of-way or easements. Contractor may make a claim therefore as provided in Articles 11 and 12. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.2. Subsurface and Physical Conditions:

4.2.1. Reports and Drawings: Reference is made to the *Information Available to Contractors* for identification of:

4.2.1.1. **Subsurface Conditions:** Those reports of explorations and tests of subsurface conditions at or contiguous to the site that have been utilized by Engineer in preparing the Contract Documents; and

4.2.1.2. **Physical Conditions:** Those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except Underground Facilities) that have been utilized by Engineer in preparing the Contract Documents.

4.2.2. Limited Reliance by Contractor Authorized; Technical Data: Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the *Information Available to Contractors*. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner, Engineer, or any of Engineer's Consultants with respect to:

4.2.2.1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto, or

4.2.2.2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings, or

4.2.2.3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such data, interpretations, opinions, or information.

4.2.3. Notice of Differing Subsurface or Physical Conditions: If Contractor believes that any subsurface or physical condition at or contiguous to the site that is uncovered or revealed either:

4.2.3.1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in paragraphs 4.2.1 and 4.2.2 is materially inaccurate, or

4.2.3.2. is of such a nature as to require a change in the Contract Documents, or

4.2.3.3. differs materially from that shown or indicated in the Contract Documents, or

4.2.3.4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents; then Contractor shall, promptly, but in no event later than fifteen (15) days, after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as permitted by paragraph 6.18), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such conditions or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

4.2.4. **Engineer's Review:** Engineer will promptly review the pertinent conditions, determine the necessity of Owner's obtaining additional exploration or tests with respect thereto and advise Owner in writing (with a copy to Contractor) of Engineer's findings and conclusions.

4.2.5. **Possible Contract Documents Change:** If Engineer concludes that a change in the Contract Documents is required as a result of a condition that meets one or more of the categories in paragraph 4.2.3., a Work Change Directive or a Change Order will be issued as provided in Article 10 to reflect and document the consequences of such change.

4.2.6. **Possible Price and Times Adjustments:** An equitable adjustment in the Contract Price or in the Contract Times, or both, will be allowed to the extent that the existence of such uncovered or revealed condition causes an increase or decrease in Contractor's cost of, or time required for performance of the Work; subject, however, to the following:

4.2.6.1. such condition must meet any one or more of the categories described in paragraphs 4.2.3.1 through 4.2.3.4. inclusive;

4.2.6.2. a change in the Contract Documents pursuant to paragraph 4.2.5 will not be an automatic authorization of nor a condition precedent to entitlement to any such adjustment:

4.2.6.3. with respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract price will be subject to the provisions of Article 10 and Paragraph 11.9; and

4.2.6.4. Contractor shall not be entitled to any adjustment in the Contract Price or Times if;

4.2.6.4.1. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner in respect of Contract Price and Contract Times by the submission of a bid or becoming bound under a contract: or

4.2.6.4.2. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the site and contiguous areas required by the Project Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or

4.2.6.4.3. Contractor failed to give the written notice within the time and as required by paragraph 4.2.3.

If Owner and Contractor are unable to agree on entitlement to or as to the amount or length of any such equitable adjustment in the Contract Price or Contract Times, a claim may be made therefore as provided

in Articles 11 and 12. However, Owner, Engineer, and Engineer's Consultants shall not be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

4.3. Physical Conditions – Underground Facilities:

4.3.1. Shown or Indicated: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities or by others. Unless it is otherwise expressly provided in the *Information Available to Contractors*:

4.3.1.1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data; and

4.3.1.2. The cost of all of the following will be included in the Contract Price and Contractor shall have full responsibility for: (i) reviewing and checking all such information and data, (ii) locating all Underground Facilities shown or indicated in the Contract Documents, (iii) coordination of the Work with the owners of such Underground Facilities during construction, and (iv) the safety and protection of all such Underground Facilities as provided in paragraph 6.20 and repairing any damage thereto resulting from the Work.

4.3.2. Not Shown or Indicated: If an Underground Facility is uncovered or revealed at or contiguous to the site which was not shown or indicated in the Contract Documents. Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by paragraph 6.18), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence of the Underground Facility. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued as provided in Article 10 to reflect and document such consequences. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility as provided in paragraph 6.15. Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, to the extent that they are attributable to the existence of any Underground Facility that was not shown or indicated in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or the amount or length of any such adjustment in Contract Price or Contract Times, Contractor may make a claim, therefore, as provided in Articles 11 and 12. However, Owner, Engineer, and Engineer's Consultants shall not be liable to Contractor for any claims, costs, losses or damages incurred or sustained by Contractor on or in connection with any other project or anticipated project.

Reference Points:

4.4. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of Owner, Contractor shall report to Engineer whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points by professionally qualified personnel.

4.5. Asbestos, PCBs, Petroleum, Hazardous Waste or Radioactive Material:

4.5.1. Owner shall be responsible for any Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material uncovered or revealed at the site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work and which may present a substantial danger to persons or property exposed thereto in connection with the Work at the site. Owner shall not be responsible for any such materials brought to the site by Contractor, Subcontractor, Suppliers, or anyone else for whom Contractor is responsible.

4.5.2. Contractor shall immediately: (i) stop all Work in connection with such hazardous condition and in any area affected thereby (except in an emergency as required by paragraph 6.18), and (ii) notify Owner and Engineer (and thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such hazardous condition to take corrective action, if any. Contractor shall not be required to resume Work in connection with such hazardous condition or in any such affected area until after Owner has obtained any required permits related thereto and delivered to Contractor special written notice: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or the amount or extent of an adjustment, if any, in Contract Price or Contract Times as a result of such Work stoppage or such special conditions under which Work is agreed by Contractor to be resumed, either party may make a claim therefore as provided in Articles 11 and 12.

4.5.3. If after receipt of such special written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order such portion of the Work that is in connection with such hazardous condition or in such affected area to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or the amount or extent of an adjustment, if any, in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a claim therefore as provided in Articles 11 and 12. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.

4.5.4. The provisions of paragraphs 4.2 and 4.3 are not intended to apply to Asbestos, PCBs, Petroleum, Hazardous Waste or Radioactive Material uncovered or revealed at the site.

ARTICLE 5 – BONDS AND INSURANCE

Performance, Payment, and Other Bonds:

5.1. Contractor shall furnish Performance and Payment Bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all Contractor's obligations under the Contract Documents. These Bonds shall remain in effect at least until one year after the date when final payment becomes due, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other Bonds as are required by the Supplementary Conditions. All Bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as

Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff. Bureau of Government Financial Operations, U.S. Treasury Department. All Bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act.

5.2. If the surety on any Bond furnished by Contractor is declared a bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of paragraph 5.1. Contractor shall within ten days thereafter substitute another bond and surety, both of which must be acceptable to Owner.

5.3. Licensed Sureties and Insurers; Certificates of Insurance:

5.3.1. All Bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue Bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.3.2. Contractor shall deliver to Owner, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain in accordance with paragraph 5.4.

Contractor's Liability Insurance:

5.4. Contractor shall purchase and maintain such liability and other insurance as is appropriate for the Work being performed and furnished and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance and furnishing of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed or furnished by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform or furnish any of the Work, or by anyone for whose acts any of them may be liable:

5.4.1. claims under workers' compensation, disability benefits and other similar employee benefit acts;

5.4.2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;

5.4.3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;

5.4.4. claims for damages insured by customary personal injury liability coverage which are sustained: (i) by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or by any other person for any other reason;

5.4.5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and

5.4.6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

The policies of insurance so required by this paragraph 5.4 to be purchased and maintained shall:

5.4.7. with respect to insurance required by paragraphs 5.4.3 through 5.4.6 inclusive, include as additional insureds (subject to any customary exclusion in respect of professional liability) Owner, Engineer, Engineer's Consultants and any other persons or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers and employees of all such additional insureds;

5.4.8. include the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;

5.4.8.1 Contractor's Liability Insurance and the Owner's Protective Liability Insurance specified above shall be provided in not less than the following amount:

*All limits of liability and insurance coverages are covered under Okaloosa County Standard Clauses specified earlier in the bid documents.

All policies shall be drawn to cover a period of not less than one (1) year from the date of issue.

5.4.9. include contractual liability insurance covering Contractor's indemnity obligations under paragraphs 6.9, 6.13.1, and 6.22.1 through 6.22.2.8;

5.4.10. contain a provision or endorsement that the coverage afforded will not be cancelled, materially changed or renewal refused until at least thirty days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to paragraph 5.3.2 will so provide);

5.4.11. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing or replacing defective Work in accordance with paragraph 13.12; and

5.4.12. with respect to completed operations insurance, and any insurance coverage written on an occurrence basis, remain in effect for at least two years after final payment (and Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter).

Owner's Liability Insurance:

5.5. In addition to the insurance required to be provided by Contractor under paragraph 5.4, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents. Any liability insurance carried by Owner is excess and non-contributory to any and all other coverage whether collectable or not.

Property Insurance:

5.6 Contractor shall purchase and maintain property insurance upon the Work at the site in amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in these Supplementary Conditions or required by Laws and Regulations). This insurance shall:

- 5.6.1 include the interests of Owner, Contractor, Subcontractors, Engineer, Engineer's Consultants and any other persons or entities identified in the Supplementary Conditions each of whom is deemed to have an insurable interest shall be listed as an insured or additional insured;
- 5.6.2 include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);
- 5.6.3 cover materials and equipment in transit for incorporation in the Work or stored at the site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer; and
- 5.6.4 be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with thirty days written notice to each other additional insured to whom a certificate of insurance has been issued.

5.7. NOT USED

5.8. NOT USED

5.9. Owner shall not be responsible for purchasing and maintaining any property insurance to protect the interests of Contractor, Subcontractors or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount, will be borne by Contractor, Subcontractor, or others suffering any such loss and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

5.10. NOT USED

5.11. NOT USED

Receipt and Application of Insurance Proceeds:

5.12. Any insureds loss under the policies of insurance required by paragraphs 5.5 and 5.6 will be adjusted with Owner and made payable to Owner as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and of paragraph 5.13. Owner shall deposit in a separate account any money so received, and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof and the Work and the cost thereof covered by an appropriate Change Order or Written Amendment.

5.13. Owner as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within fifteen days after the occurrence of loss to Owner's exercise of this power. If such objection be made, Owner as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement

among the parties in interest is reached, Owner as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Owner as fiduciary shall give bond for the proper performance of such duties.

Acceptance of Bonds and Insurance; Option to Replace:

5.14. If either party (Owner or Contractor) has any objection to the coverage afforded by or other provisions of the Bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within ten days after receipt of the certificates (or other evidence requested) required by paragraph 2.7. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the Bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent Bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

Partial Utilization – Property Insurance:

5.15. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, such use or occupancy may be accomplished in accordance with paragraph 14.10; provided that no such use or occupancy shall commence before the insurers providing the property insurance have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be cancelled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES

Supervision and Superintendence:

6.1. Contractor shall supervise, inspect and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences and procedures of construction, but Contractor shall not be responsible for the negligence of others in the design or specification of a specific means, method, technique, sequence or procedure of construction which is shown or indicated in and expressly required by the Contract Documents. Contractor shall be responsible to see that the completed Work complies accurately with the Contract Documents.

6.2. Contractor shall keep on the Work at all times during its progress a competent resident superintendent, who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances. The superintendent will be Contractor's representative at the site and shall have authority to act on behalf of Contractor. All communications to the superintendent shall be as binding as if given to CONTRACTOR.

Labor, Materials and Equipment:

6.3. Contractor shall provide competent, suitably qualified personnel to survey, lay out and construct the Work as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the site. Except as otherwise required for the safety or protection of persons or the Work or property at the site or adjacent thereto, and except as otherwise indicated in the Contract Documents, all Work at the site shall be performed during regular working hours and Contractor will not permit overtime work or the performance of Work on Saturday, Sunday or any legal holiday without Owner's written consent given after prior written notice to Engineer.

6.4. Unless otherwise specified in the General Requirements, Contractor shall furnish and assume full responsibility for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities and all other facilities and incidentals necessary for the furnishing, performance, testing, start-up and completion of the Work.

6.5. All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. All warranties and guarantees specifically called for by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with instructions of the applicable Supplier, except as otherwise provided in the Contract Documents.

Progress Schedule:

6.6. Contractor shall adhere to the progress schedule established in accordance with paragraph 2.9 as it may be adjusted from time to time as provided below:

6.6.1. Contractor shall submit to Engineer for acceptance (to the extent indicated in paragraph 2.9) proposed adjustments in the progress schedule that will not change the Contract Times (or Milestones). Such adjustments will conform generally to the progress schedule then in effect and additionally will comply with any provisions of the General Requirements applicable thereto.

6.6.2. Proposed adjustments in the progress schedule that will change the Contract Times (or Milestones) shall be submitted in accordance with the requirements of paragraph 12.1. Such adjustments may only be made by a Change Order or Written Amendment in accordance with Article 12.

6.7. Substitutes and "Or-Equal" Items:

6.7.1. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be accepted by Engineer under the following circumstances:

6.7.1.1. "Or-Equal": If in Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for acceptance of proposed substitute items.

6.7.1.2. Substitute Items: If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under subparagraph 6.7.2, it will be considered a proposed substitute item. Contractor shall submit sufficient information as provided below to allow Engineer to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefore. The procedure for review by the Engineer will include the following as supplemented in the General Requirements and as Engineer may decide is appropriate under the circumstances. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor. If Contractor wishes to furnish or use a substitute item of material or equipment, Contractor shall first make written application to Engineer for acceptance thereof, certifying that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar in substance to that specified and be suited to the same use as that specified. The application will state the extent, if any, to which the evaluation and acceptance of the proposed substitute will prejudice Contractor's achievement of Substantial Completion on time, whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for work on the Project) to adapt the design to the proposed substitute and whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute from that specified will be identified in the application and available maintenance, repair and replacement service will be indicated. The application will also contain an itemized estimate of all costs or credits that will result directly or indirectly from acceptance of such substitute, including costs of redesign and claims of other contractors affected by the resulting change, all of which will be considered by Engineer in evaluating the proposed substitute. Engineer may require Contractor to furnish additional data about the proposed substitute.

6.7.1.3. Contractor's Expense: All data to be provided by Contractor in support of any proposed "or-equal" or substitute item will be at Contractor's expense.

6.7.2. Substitute Construction Methods or Procedures: If a specific means, method, technique, sequence or procedure of construction is shown or indicated in an expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence or procedure of construction acceptable to Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The procedure for review by Engineer will be similar to that provided in subparagraph 6.7.3.

6.7.3. Engineer's Evaluation: Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to paragraphs 6.7.1.1 and 6.7.1.2. Engineer will be the sole judge of acceptability. No "or-equal" or substitute will be ordered, installed or utilized without Engineer's prior written acceptance which will be evidenced by either a Change Order or an approved Shop Drawing. Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any "or-equal" or substitute. Engineer will record time required by Engineer and Engineer's Consultants in evaluating substitutes proposed or submitted by Contractor pursuant to paragraphs 6.7.1.1 and 6.7.1.2 and in making changes in the Contract Documents (or in the provisions of any other direct contract with Owner for work on the Project) occasioned thereby. Whether or not Engineer accepts a substitute item so proposed or submitted by Contractor, Contractor shall reimburse Owner for the changes of Engineer and Engineer's Consultants for evaluating each such proposed substitute item.

6.8. Concerning Subcontractors, Suppliers and Others:

The Contractor shall submit a list of Subcontractors and major Material Suppliers for the Owner's approval within (24) hours after Bid Opening. Such list shall be accompanied by an experience statement with pertinent information as to similar projects and other evidence of qualifications from each such Subcontractor, person and organization requested by Owner. If Owner, after due investigation has reasonable objections to any proposed Subcontractor, other person or organization, the Owner may before giving the Notice of Award request the apparent successful Contractor to submit an acceptable Subcontractor without an increase in Bid Price. If the apparent successful Contractor declines to make any such substitution, the Contract shall not be awarded to such Contractor, but his declining to make any such substitution will not constitute grounds for sacrificing his Bid Security. Any Subcontractor, other person or organization so listed and to whom Owner does not make written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner.

6.8.1. Contractor shall not employ any Subcontractor, Supplier or other person or organization (including those acceptable to Owner and Engineer as indicated in paragraph 6.8.2), whether initially or as a substitute, against whom Owner or Engineer may have reasonable objection. Contractor shall not be required to employ any subcontractor, Supplier or other person or organization to furnish or perform any of the Work against whom Contractor has reasonable objection.

6.8.2. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers or other persons or organizations (including those who are to furnish the principal items of materials or equipment) to be submitted to Owner in advance of the specified date prior to the Effective Date of the Agreement for acceptance by Owner and Engineer, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's or Engineer's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the project documents or the Contract Documents) of any such Subcontractor, Supplier or other person or organization so identified may be revoked on the basis of reasonable objection after due investigation, in which case Contractor shall submit an acceptable substitute, the Contract Price will be adjusted by the difference in the cost occasioned by such substitution and an appropriate Change Order will be issued or Written Amendment signed. No acceptance by Owner or Engineer of any such Subcontractor, Supplier or other person or organization shall constitute a waiver of any right of Owner or Engineer to reject defective Work.

6.8.3. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with Contractor just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Supplier, or other person or organization any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other person or organization, nor shall it create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier or other person or organization except as may otherwise be required by Laws and Regulations.

6.8.4. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with Contractor. Contractor shall require all Subcontractors, Suppliers and such other persons and organizations performing or furnishing any of the Work to communicate with the Engineer through Contractor.

6.8.5. The divisions and sections of the Specifications and the identifications of any drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

6.8.6. All Work performed by Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in paragraph 5.5. or 5.6. the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner, Contractor, Engineer, Engineer's Consultants and all other additional insureds for all losses and damages caused by, arising out of or resulting from any of the perils covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

6.9 Patent Fees and Royalties:

Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of Owner or Engineer its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner, Engineer, Engineer's Consultants and the officers, directors, employees, agents and other consultants of each and any of them from and against all claims, costs, losses and damages arising out of or resulting from any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product or device not specified in the Contract Documents.

6.10. Permits:

Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work, which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Contractor shall pay all charges of utility owners for connections to the Work, and Owner shall pay all charges of such utility owners for capital costs related thereto such as plant investment fees.

6.11. Laws and Regulations:

6.11.1. Contractor shall give all notices and comply with all Laws and Regulations applicable to furnishing and performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

6.11.2. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses and damages caused by, arising out of or resulting therefrom: however, it shall not be Contractor's primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor or Contractor's obligations under paragraph 3.3.2.

6.12. Taxes:

Contractor shall pay all sales, consumer, use and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

6.13. Use of Premises:

6.13.1 Contractor shall confine construction equipment, the storage of materials and equipment and the operations of workers to the site and land and areas identified in and permitted by the Contract Documents, rights-of-way, permits and easements, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof or of any adjacent land or areas, resulting from the performance of the Work. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by dispute resolution proceeding or at law. Contractor shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner, Engineer, Engineer's Consultant and anyone directly or indirectly employed by any of them from and against all claims costs, losses and damages arising out of or resulting from any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

6.13.2. During the progress of the Work, Contractor shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work Contractor shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery and surplus materials. Contractor shall leave the site clean and ready for occupancy by Owner at Substantial Completion of the Work. Contractor shall restore to original condition all property not designated for alteration by the Contract Documents.

6.13.3. Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.14. Record Documents:

Contractor shall maintain in a safe place at the site one record copy of all Drawings, Specifications, Addenda, Written Amendments, Change Orders, Work Change Directives, Field Orders and written interpretations and clarifications (issued pursuant to paragraph 9.4) in good order and annotated to show all changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents, Samples and Shop Drawings will be delivered to Engineer for Owner.

6.15. Safety and Protection:

Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

- 6.15.1. all persons on the Work site or who may be affected by the Work;
- 6.15.2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the site; and
- 6.15.3. other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and Underground Facilities not designated for removal, relocation or replacement in the course of construction.

Contractor shall comply with all applicable Laws and Regulations of any public body having jurisdiction for safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation and replacement of their property. All damage, injury or loss to any property referred to in paragraph 6.15.2. or 6.15.3. caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier or any other person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or Engineer's Consultant or anyone employed by any of them or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier or other person or organization directly or indirectly employed by any of them). Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with paragraph 14.13. that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.16. Safety Representative:

Contractor shall designate a qualified and experienced safety representative at the site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.17. Hazard Communication Programs:

Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the site in accordance with Laws or Regulations.

6.18. Emergencies:

In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, Contractor, without special instruction or authorization from Owner or Engineer, is obligated to act to prevent threatened damage, injury or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If Engineer determines that a change in the Contract Documents is required

because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued to document the consequences of such action.

6.19. Shop Drawings and Samples:

6.19.1. Contractor shall submit Shop Drawings to Engineer for review and approval in accordance with the accepted schedule of Shop Drawings and Sample submittals (see paragraph 2.9.). All submittals will be identified as Engineer may require and in the number of copies specified in the General Requirements. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to shown Engineer the materials and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by paragraph 6.26.

6.19.2. Contractor shall also submit Samples to Engineer for review and approval in accordance with said accepted schedule of Shop Drawings and Sample submittals. Each Sample will be identified clearly as to material, Supplier, pertinent data such as catalog numbers and the use for which intended and otherwise as Engineer may require to enable Engineer to review the submittal for the limited purposes required by paragraph 6.20. The numbers of each Sample to be submitted will be as specified in the Specifications.

6.20. Submittal Procedures:

6.20.1. Before submitting each Shop Drawing or Sample, Contractor shall have determined and verified:

6.20.1.1 all field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar information with respect thereto,

6.20.1.2. all materials with respect to intended use, fabrication, shipping, handling storage, assembly and installation pertaining to the performance of the Work, and

6.20.1.3. all information relative to Contractor's sole responsibilities in respect of means, methods, techniques, sequences and procedures of construction and safety precautions and programs incident thereto.

Contractor shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

6.20.2 Each submittal will bear a stamp or specific written indication that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.

6.20.3. At the time of each submission, Contractor shall give Engineer specific written notice of such variations, if any, that the Shop Drawing or Sample submitted may have from the requirements of the Contract Documents, such notice to be in a written communication separate from the submittal; and, in addition, shall cause a specific notation to be made on each Shop Drawing and Sample submitted to Engineer for review and approval of each such variation.

6.20.4. Engineer will review and approve Shop Drawings and Samples in accordance with the schedule of Shop Drawings and Sample submittals accepted by Engineer as required by paragraph 2.9. Engineer's

review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer's review and approval will not extend to means, methods, techniques, sequences or procedures of construction (except where a particular means, method, technique, sequence or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions. Contractor shall make corrections required by Engineer, and shall return the required number of corrected copies of Shop Drawings and submit as required new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

6.20.5. Engineer's review and approval of Shop Drawings or Samples shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has in writing called Engineer's attention to each such variation at the time of submission as required by paragraph 6.20.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying Shop Drawing or Sample approval; nor will any approval by Engineer relieve Contractor from responsibility for complying with the requirements of paragraph 6.20.

6.20.6. Where a Shop Drawing or Sample is required by the Contract Documents or the schedule of Shop Drawings and Sample submissions accepted by Engineer as required by paragraph 2.9, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

6.21. Continuing the Work:

Contractor shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by paragraph 15.5 or as Owner and Contractor may otherwise agree in writing.

6.22. Contractor's General Warranty and Guarantee:

6.22.1. Contractor warrants and guarantees to Owner, Engineer and Engineer's Consultants that all Work will be in accordance with the Contract Documents and will not be defective. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

6.22.1.1. abuse, modification or improper maintenance or operation by persons other than Contractor, Subcontractors or Suppliers; or

6.22.1.2. normal wear and tear under normal usage.

6.22.2. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

6.22.2.1. observations by Engineer;

6.22.2.2. recommendation of any progress or final payment by Engineer;

- 6.22.2.3. the issuance of a certificate of Substantial Completion or any payment by Owner to Contractor under the Contract Documents;
- 6.22.2.4. use or occupancy of the Work or any part thereof by Owner;
- 6.22.2.5. any acceptance by Owner or any failure to do so;
- 6.22.2.6. any review and approval of Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer pursuant to paragraph 14.13;
- 6.22.2.7. any inspection, test or approval by others; or
- 6.22.2.8. any correction of defective Work by Owner.

6.23 Indemnification:

6.23.1. To the fullest extent permitted by Laws and Regulations. Contractor shall indemnify and hold harmless Owner, Engineer, Engineer's Consultants and the officers, directors, employees, agents and other consultants of each and any of them from and against all claims, costs, losses and damages (including but not limited to all fees and charges of engineers, architects, attorneys and other professionals and all court or dispute resolution costs) caused by, arising out of or resulting from the performance of the Work, provided that any such claim, cost, loss or damage: (i) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, and (ii) is caused in whole or in part by any negligent act or omission of Contractor, any Subcontractor, any Supplier, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, regardless of whether or not caused in part by any negligence or omission of a person or entity indemnified hereunder or whether liability is imposed upon such indemnified party by Laws and Regulations regardless of the negligence of any such person or entity.

6.23.2. In any and all claims against Owner or Engineer or any of their respective consultants, agents, officers, directors or employees by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under paragraph 6.23.1 shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for Contractor or any such Subcontractor, Supplier or other person or organization under workers' compensation acts, disability benefit acts or other employee benefit acts.

6.23.3. The indemnification obligations of Contractor under paragraph 6.23.1 shall not extend to the liability of Engineer and Engineer's Consultants, officers, directors, employees or agents caused by the professional negligence, errors or omissions of any of them.

6.24. Survival of Obligations:

All representations, indemnifications, warranties and guarantees made in, required by or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion and acceptance of the Work and termination or completion of the Agreement.

ARTICLE 7 – OTHER WORK

Related Work at Site:

7.1. Owner may perform other work related to the Project at the site by Owner's own forces, or let other direct contracts therefore which shall contain General Conditions similar to these, or have other work performed by utility owners. If the fact that such other work is to be performed was not noted in the Contract Documents, then; (i) written notice thereof will be given to Contractor prior to starting any such other work, and (ii) Contractor may make a claim therefore as provided in Articles 11 and 12 if Contractor believes that such performance will involve additional expense to Contractor or requires additional time and the parties are unable to agree as to the amount or extent thereof.

7.2. Contractor shall afford each other contractor who is a party to such a direct contract and each utility owner (and Owner if Owner is performing the additional work with Owner's employees) proper and safe access to the site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work and shall properly connect and coordinate the Work with theirs. Unless otherwise provided in the Contract Documents. Contractor shall do all cutting, fitting, and patching of the Work that may be required to make its several parts come together properly and integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating or otherwise altering their work and will only cut or alter their work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.

7.3. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7. Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure so to report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent or non-apparent defects and deficiencies in such other work.

Coordination:

7.4. If Owner contracts with others for the performance of other work on the Project at the site, the following will be set forth in Supplementary Conditions:

7.4.1. the person, firm or corporation who will have authority and responsibility for coordination of the activities among the various prime contractors will be identified;

7.4.2. the specific matters to be covered by such authority and responsibility will be itemized: and

7.4.3. the extent of such authority and responsibilities will be provided.

Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility in respect of such coordination.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

- 8.1. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.
- 8.2. In case of termination of the employment of Engineer, Owner shall appoint an engineer, whose status under the Contract Documents shall be that of the former Engineer.
- 8.3. Owner shall furnish the data required of Owner under the Contract Documents promptly and shall make payments to Contractor promptly when they are due as provided in paragraphs 14.4 and 14.13.
- 8.4. Owner's duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in paragraphs 4.1 and 4.4. Paragraph 4.2 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions at the site and drawings of physical conditions in existing structures at or contiguous to the site that have been utilized by Engineer in preparing the Contract Documents.
- 8.5. Owner's responsibilities in respect of purchasing and maintaining liability and property insurance are set forth in paragraphs 5.5 through 5.6.
- 8.6. Owner is obligated to execute Change Orders as indicated in paragraph 10.4.
- 8.7. Owner's responsibility in respect of certain inspections, tests and approvals is set forth in paragraph 13.4.
- 8.8. In connection with Owner's right to stop Work or suspend Work, see paragraphs 13.10 and 15.1. Paragraph 15.2 deals with Owner's right to terminate services of Contractor under certain circumstances.
- 8.9. The Owner shall not supervise, direct or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences or procedures of construction or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the furnishing or performance of the Work. Owner will not be responsible for Contractor's failure to perform or furnish the Work in accordance with the Contract Documents.
- 8.10. Owner's responsibility in respect of undisclosed Asbestos, PCBs, Petroleum, Hazardous Waste or Radioactive Materials uncovered or revealed at the site is set forth in paragraph 4.5.
- 8.11. If and to the extent Owner has agreed to furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents, Owner's responsibility in respect thereof will be as set forth in the Supplementary Conditions.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

Owner's Representative:

9.1. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents and shall not be extended without written consent of Owner and Engineer.

Visits to Site:

9.2. Engineer will make visits to the site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer will endeavor for the benefit of Owner to determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and on-site observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work. Engineer's visits and on-site observations are subject to all the limitations on Engineer's authority and responsibility set forth in paragraph 9.13, and particularly, but without limitation, during or as a result of Engineer's on-site visits or observations of Contractor's Work. Engineer will not supervise, direct, control or have authority over or be responsible for Contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the furnishing or performance of the Work.

Project Representative:

9.3. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more continuous observation of the Work. The responsibilities and authority and limitations thereon of any such Resident Project Representative and assistants will be as provided in paragraph 9.13 and in the Supplementary Conditions. If Owner designates another representative or agent to represent Owner at the site who is not Engineer's Consultant, agent or employee, the responsibilities and authority and limitations thereon of such other person will be as provided in the Supplementary Conditions.

9.3.1 Engineer may furnish a Resident Project Representative, assistants and other field staff as needed, to assist Owner in observing performance of the Work. The Resident Project Representative is to observe and inspect, in the Owner's interest, the materials furnished and the work done as the work progresses in order to insure full and complete compliance with the contract and to verify quantities of work completed.

9.3.2 Owner may also designate one of its employees to represent Owner for these purposes.

9.3.3 Engineer, Resident Project Representative, Owner and all such other persons referred to shall have unrestricted access to all parts of the Work. Contractor shall cooperate by supplying necessary facilities and assistance required by above persons to carry out their work of observation and inspection.

9.3.4 It is not the function of the Engineer, Resident Project Representative or Owner to supervise or direct the manner in which the work to be done under this Contract is carried on or conducted. The Engineer, Resident Project Representative or Owner is not responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the work, and they will not be responsible for the Contractor's failure to carry out the work in

accordance with the Contract Documents. Nevertheless, Contractor agrees that any method or procedure, which in the opinion of the Engineer or Owner does not achieve the required results or quality of the work specified, shall be discontinued immediately upon the order of the Engineer.

9.3.5 All communications between Contractor and Engineer or Contractor and Owner are to be through the Resident Project Representative.

9.3.6 Duties and Responsibilities of Resident Project Representative (RPR):

- 1) RPR will act as directed by and under the supervision of Engineer and/or Owner, and will confer with Engineer and Owner regarding RPR's actions. RPR's dealings in matters pertaining to the on-site work shall in general be with Engineer and Contractor keeping Owner advised as necessary. RPR's dealings with subcontractors shall only be through or with the full knowledge and approval of Contractor.
- 2) Review progress schedule, schedule of Shop Drawing submittals and schedule of values prepared by Contractor and consult with Engineer and Owner concerning acceptability.
- 3) Attend meetings with Contractor, such as pre-construction conferences, progress meetings, job conferences and other project-related meetings, and prepare and circulate copies of minutes thereof.
- 4) Serve as Engineer's and Owner's liaison with Contractor, working principally through Contractor's superintendent and assist in understanding the intent of the Contract Documents.
- 5) Advise Engineer, Owner and Contractor of the commencement of any Work requiring a Shop Drawing or sample if the submittal has not been approved by Engineer.
- 6) Conduct on-site observations of the Work in progress to assist Engineer and Owner in determining if the Work is in general proceeding in accordance with the Contract Documents. Report to Engineer and Owner whenever RPR believes that any Work is unsatisfactory, faulty or defective or does not conform to the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Engineer and Owner of Work that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.
- 7) Report to Engineer and Owner when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.
- 8) Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report with RPR's recommendations to Engineer and Owner. Transmit to Contractor decisions as issued by Engineer and/or Owner.
- 9) Maintain orderly files for correspondence, reports of job conferences, Shop Drawings and samples, reproductions of original Contract Documents including all Work Directive Changes, Addenda, Change Orders, Field Orders, additional Drawings issued subsequent to the execution of the Contract, Engineer's clarifications and interpretations of the Contract Documents, progress reports, and other Project related documents.

- 10) Keep a diary or log book, recording Contractor hours on the job site, weather conditions, data relative to questions of Work Directive Changes, Change Orders or Changed conditions, list of job site visitors, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to Engineer and Owner.
- 11) Record names, addresses and telephone numbers of all Contractors, subcontractors and major suppliers of materials and equipment.
- 12) Furnish Engineer and Owner periodic reports as required of progress of the Work and of Contractor's compliance with the progress schedule and schedule of Shop Drawing and sample submittals.
- 13) Draft proposed Change Orders and Work Directive Changes, obtaining backup material from Contractor and recommend to Engineer and Owner Change Orders, Work Directive Changes, and Field Orders.
- 14) Report immediately to Engineer and Owner upon the occurrence of any accident.
- 15) Review applications for payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the schedule of values, Work completed and materials and equipment delivered at the site but not incorporated in the Work.
- 16) During the course of the Work, verify that certificates, maintenance and operation manuals and other data required to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have this material delivered to Engineer for review and forwarding to Owner prior to final payment for the work.
- 17) Before Engineer issues a Certificate of Substantial Completion, submit to Contractor a list of observed items requiring completion or correction.
- 18) Conduct final inspection in the company of Engineer, Owner and Contractor and prepare a final list of items to be completed or corrected.
- 19) Observe that all items on final list have been completed or corrected and make recommendations to Engineer and Owner concerning acceptance.

9.3.7 Limitations of Authority of Resident Project Representative (RPR):

- 1) Shall not authorize any deviation from the Contract Documents or substitution of materials or equipment, unless authorized by Engineer or Owner.
- 2) Shall not exceed limitations of Engineer's authority as set forth in the Contract Documents.
- 3) Shall not undertake any of the responsibilities of Contractor, subcontractors or Contractor's superintendent.

- 4) Shall not advise on, issue directions relative to or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction unless such advice or directions are specifically required by the Contract Documents.
- 5) Shall not advise on, issue directions regarding or assume control over safety precautions and programs in connection with the Work.
- 6) Shall not accept Shop Drawing or sample submittals from anyone other than Contractor.

9.3.8 The Engineer and or Owner shall have the authority to reject any work, or materials, or any part thereof, which does not in his opinion conform to the plans, drawings, specifications and contract, and it shall be permissible for him to do so at any time during the progress of the work and until its acceptance.

No material of any kind shall be used upon the work until it has been inspected and accepted by the Engineer. All materials rejected shall be removed immediately from the work and not again offered for inspection. Any materials or workmanship found at any time to be defective or not of the quality or character required by the plans and specifications shall be remedied at once regardless of previous inspection.

Such inspection shall not relieve the Contractor from any obligation to perform said work strictly in accordance with the plans and specifications and work not so constructed shall be removed and made good by the Contractor at his own expense, and free from all expense to the Owner whenever so ordered by the Owner without reference to any previous oversight or error in inspection.

9.4. Clarifications and Interpretations:

Engineer will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents (in the form of Drawings or otherwise) as Engineer may determine necessary, which shall be consistent with the intent of and reasonably inferable from Contract Documents. Such written clarifications and interpretations will be binding on Owner and Contractor. If Owner or Contractor believes that a written clarification or interpretation justifies an adjustment in the Contract Price or the Contract Times and the parties are unable to agree to the amount or extent thereof, if any, Owner or Contractor may make a written claim therefore as provided in Article 11 or Article 12.

9.5. Authorized Variations in Work:

Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or the Contract Times and the parties are unable to agree as to the amount or extent thereof, Owner or Contractor may make a written claim therefore as provided in Article 11 or 12.

9.6. Rejecting Defective Work:

Engineer will have authority to disapprove or reject Work which Engineer believes to be defective, or that Engineer believes will not produce a complete Project that conforms to the Contract Documents or that will

prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in paragraph 13.9, whether or not the Work is fabricated, installed or completed.

9.7. Shop Drawings, Change Orders and Payments:

9.7.1 In connection with Engineer's authority as to Shop Drawings and Samples, see paragraphs 6.19 through 6.20.4 inclusive.

9.7.2. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.

9.7.3. In connection with Engineer's authority as to Applications for Payment, see Article 14.

9.8. Determinations for Unit Prices:

Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding upon Owner and Contractor, unless, within ten days after the date of any such decision, either Owner or Contractor delivers to the other and to Engineer written notice of intention to appeal from Engineer's decision and, a formal proceeding is instituted by the appealing party in a forum of competent jurisdiction to exercise such rights or remedies as the appealing party may have with respect to Engineer's decision, unless otherwise agreed in writing by Owner and Contractor. Such appeal will not be subject to procedures of paragraph 9.9.

9.9. Decisions on Disputes:

9.9.1. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work there under. Claims, disputes and other matters relating to the acceptability of the Work or the interpretation of the requirements of the Contract Documents pertaining to the performance and furnishing of the Work and Claims under Articles 11 and 12 in respect of changes in the Contract Price or Contract Times will be referred initially to Engineer in writing with a request for a formal decision in accordance with this paragraph. Written notice of each such claim, dispute or other matter will be delivered by the claimant to Engineer and the other party to the Agreement promptly, but in no event later than fifteen (15) days, after the start of the occurrence or event giving rise thereto, and written supporting data will be submitted to Engineer and the other party within forty-five (45) days after the start of such occurrence or event unless Engineer allows an additional period of time for the submission of additional or more accurate data in support of such claim, dispute or other matter. The opposing party shall submit any response to Engineer and the claimant within thirty days after receipt of the claimant's last submittal (unless Engineer allows additional time). Engineer will render a formal decision in writing within thirty days after receipt of the opposing party's submittal, if any, in accordance with this paragraph. Engineer's written decision on such claim, dispute or other matter will be final and binding upon Owner and Contractor unless: a written notice of intention to appeal from Engineer's written decision is delivered by Owner or Contractor to the other and to Engineer within thirty days after the date of such decision and a formal proceeding is instituted by the appealing party in a forum of competent jurisdiction to exercise such rights or remedies as the appealing party may have with respect to such claim, dispute or other matter in accordance with applicable Laws and Regulations within sixty days of the date of such decision, unless otherwise agreed in writing by Owner and Contractor.

9.9.2. When functioning as interpreter and judge under paragraph 9.9.1, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity. The rendering of a decision by Engineer pursuant to paragraphs 9.8 or 9.9 with respect to any such claim, dispute or other matter (except any which have been waived by the making or acceptance of final payment as provided in paragraph 14.15) will be a condition precedent to any exercise by Owner or Contractor of such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such claim, dispute or other matter.

9.10. Not Used

9.11. Not Used

9.12. Not Used

9.13. Limitations on Engineer's Authority and Responsibilities:

9.13.1. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise or performance of any authority or responsibility by Engineer shall create, impose or give rise to any duty owed by Engineer to Contractor, any Subcontractor, and Supplier, any other person or organization, or to any surety for employee or agent of any of them.

9.13.2. Engineer will not supervise, direct, control or have authority over or be responsible for Contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the furnishing or performance of the Work. Engineer will not be responsible for Contractor's failure to perform or furnish the Work in accordance with the Contract Documents.

9.13.3. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of the Work.

9.13.4. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds and certificates of inspection, tests, and approvals and Other documentation required to be delivered by paragraph 14.12 will only be to determine generally that their content complies with the requirements of, and in the case of, certificates of inspections, tests and approvals that the results certified indicate compliance with the Contract Documents.

9.13.5. the limitations upon authority and responsibility set forth in this paragraph 9.13 shall also apply to Engineer's Consultants, Resident Project Representative and assistants.

ARTICLE 10 – CHANGES IN THE WORK

10.1. Without invalidating the Agreement and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions or revisions in the Work. Such additions, deletions or revisions will be authorized by a Written Amendment, a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

10.2. If Owner and Contractor are unable to agree as to the extent, if any, of an adjustment in the Contract Price or an adjustment of the Contract Times that should be allowed as a result of a Work Change Directive, a claim may be made therefore as provided in Article 11 or Article 12.

10.3. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any Work performed that is not required by the Contract Documents as amended, modified and supplemented as provided in paragraphs 3.5 and 3.6 except in the case of an emergency as provided in paragraph 6.23 or in the case of uncovering Work as provided in paragraph 13.9.

10.4. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:

10.4.1. changes in the Work which are (i) ordered by Owner pursuant to paragraph 10.1, (ii) required because of acceptance of defective Work under paragraph 13.13 or correcting defective Work under paragraph 13.14, or (iii) agreed to by the parties;

10.4.2. changes in the Contract Price or Contract Times which are agreed to by the parties; and

10.4.3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to paragraph 9.9;

Provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the progress schedule as provided in paragraph 6.21.

10.5. If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be Contractor's responsibility, and the amount of each applicable Bond will be adjusted accordingly.

ARTICLE 11 – CHANGE OF CONTRACT PRICE

11.1. The Contract Price constitutes the total compensation (subject to authorized adjustments) payable to Contractor for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by Contractor shall be at Contractor's expense without change in the Contract Price.

11.2. The Contract Price may only be changed by a Change Order. Any claim for an adjustment in the Contract Price shall be based on written notice delivered by the party making the claim to the other party and to Engineer promptly (but in no event later than ten days) after the start of the occurrence or event giving rise to the claim and stating the general nature of the claim. Notice of the amount of the claim with supporting data shall be delivered within thirty days after the start of such occurrence or event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of the claim) and shall be accompanied by claimant's written statement that the adjustment claimed covers all known amounts to which the claimant is entitled as a result of said occurrence or event. All claims for adjustment in the Contract Price shall be determined by Engineer in accordance with paragraph 9.8 if Owner and Contractor cannot otherwise agree on the amount involved. No claim for an adjustment in the Contract Price will be valid if not submitted in accordance with this paragraph 11.2.

11.3 The value of any Work covered by a Change Order or of any claim for an adjustment in the Contract Price will be determined as follows:

11.3.1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of paragraphs 11.9.1. through 11.9.3. inclusive);

11.3.2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with paragraph 11.6.2):

11.3.3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under paragraph 11.3.2, on the basis of the Cost of the Work (determined as provided in paragraphs 11.4 and 11.5) plus a Contractor's fee for overhead and profit (determined as provided in paragraph 11.6).

Cost of the Work Covered by a Change Order:

11.4. The term Cost of the Work means the sum of all costs necessarily incurred and paid by Contractor in the proper performance of the Work. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items and shall not include any of the costs itemized in paragraph 11.5.

11.4.1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include without limitation superintendents, foremen and other personnel employed full-time at the site. Payroll costs for employees not employed full-time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits which shall include social security contributions, unemployment, excise and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work after regular working hours, on Saturday, Sunday or legal holidays, shall be included in the above to the extent authorized by Owner.

11.4.2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

11.4.3. Payments made by Contractor to the Subcontractors for Work performed or furnished by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner who will then determine, with the advice of Engineer, which bids, if any, will be accepted. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work Plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in paragraphs 11.4, 11.5, 11.6 and 11.7. All subcontracts shall be subject to the other provisions of the Contract Documents insofar as applicable.

11.4.4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys and accountants) employed for services specifically related to the Work.

11.4.5. Supplemental costs including the following:

11.4.5.1. The proportion of necessary transportation, travel and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

11.4.5.2. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office and temporary facilities at the site and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost less market value of such items used but not consumed which remain the property of Contractor.

11.4.5.3. Rentals of all construction equipment and machinery and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, installation, dismantling and removal thereof – all in accordance with the terms of said rental agreements. The rental of any such equipment, machinery or parts shall cease when the use thereof is no longer necessary for the Work.

11.4.5.4. Sales, consumer, use or similar taxes related to the work, and for which Contractor is liable, imposed by Laws and Regulations.

11.4.5.5. Deposits lost for causes other than negligence of Contractor, any Subcontractor or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

11.4.5.6. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance and furnishing of the Work (except losses and damages within the deductible amounts of property insurance established by Owner in accordance with paragraph 5.9), provided they have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee. If, however, any such loss or damage requires reconstruction and Contractor is placed in charge thereof, Contractor is placed in charge thereof, Contractor shall be paid for services a fee proportionate to that stated in paragraph 11.6.2.

11.4.5.7. The cost of utilities, fuel and sanitary facilities at the site.

11.4.5.8. Minor expenses such as telegrams, long distance telephone calls, telephone service at the site, expressage and similar petty cash items in connection with the Work.

11.4.5.9. Cost of premiums for additional Bonds and insurance required because of changes in the Work.

11.5. The term Cost of the Work Covered by a Change Order shall not include any of the following:

11.5.1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnership and sole proprietorships), general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks and other personnel employed by Contractor whether at the site or in Contractor's principal or a branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in paragraph 11.4.1 or specifically covered by paragraph 11.4.4 – all of which are to be considered administrative costs covered by the Contractor's fee.

11.5.2. Expenses of Contractor's principal and branch offices other than Contractor's office at the site.

11.5.3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

11.5.4. Cost of premiums for all Bonds and for all insurance whether or not Contractor is required by the Contract Documents to purchase and maintain the same (except for the cost of premiums covered by subparagraph 11.4.5.9 above).

11.5.5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied and making good any damage to property.

Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in paragraph 11.4.

11.6. The Contractor's fee allowed to Contractor for overhead and profit shall be determined as follows:

11.6.1. a mutually acceptable fixed fee; or

11.6.2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

11.6.2.1. for costs incurred under paragraphs 11.4.1 and 11.4.2, the Contractor's fee shall be ten percent;

11.6.2.2. for costs incurred under paragraph 11.4.3, the Contractor's fee shall be five percent.

11.6.2.3. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of paragraphs 11.4.1, 11.4.2, 11.4.3 and 11.6.2 is that the Subcontractor who actually performs or furnishes the Work, at whatever tier, will be paid a fee of ten percent of the costs incurred by such Subcontractor under paragraphs 11.4.1 and 11.4.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor:

11.6.2.4. no fee shall be payable on the basis of costs itemized under paragraphs 11.4.4, 11.4.5 and 11.5;

11.6.2.5. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

11.6.2.6. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with paragraphs 11.6.2.1 through 11.6.2.5, inclusive.

11.7. Whenever the cost of any work is to be determined pursuant to paragraphs 11.4 and 11.5, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in form acceptable to Engineer an itemized cost breakdown together with supporting data.

11.8. Not Used

11.9. Unit Price Work:

11.9.1. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the established unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer in accordance with paragraph 9.10.

11.9.2. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

11.9.3. Owner or Contractor may make a claim for an adjustment in the Contract Price in accordance with Article 11 if:

11.9.3.1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

11.9.3.2. there is no corresponding adjustment with respect to any other item of Work; and

11.9.3.3. if Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12 – CHANGE OF CONTRACT TIMES

12.1. The Contract Times (or Milestones) may only be changed by a Change Order or a Written Amendment. Any claim for an adjustment of the Contract Times (or Milestones) shall be based on written notice delivered by the party making the claim to the other party and to Engineer promptly (but in no event later than thirty days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the extent of the claim with supporting data shall be delivered within sixty days after such occurrence (unless Engineer allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by the claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant has reason to believe it is entitled as a result of the occurrence of said event. All claims for adjustment in the Contract Times (or Milestones) shall be determined by Engineer in accordance with paragraph 9.11 if Owner and Contractor cannot otherwise agree. No claim for an adjustment in the Contract Times (or Milestones) will be valid if not submitted in accordance with the requirements of this paragraph 12.1.

12.2. All time limits stated in the Contract Documents are of the essence of the Agreement.

12.3. Where Contractor is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of Contractor, the Contract Times (or Milestones) will be extended in an amount equal to the time lost due to such delay if a claim is made therefore as provided in paragraph 12.1. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions or acts of God. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

12.4. Should Contractor be obstructed or delayed in the prosecution of or completion of the Work as a result of unforeseeable causes beyond the control of Contractor, and not due to its fault or neglect, including but not restricted to acts of God or of the public enemy, acts of government, fires, floods, epidemics, quarantine regulation, strikes or lockouts, Contractor shall notify the Owner in writing within forty-eight (48) hours after the commencement of such delay, stating the cause or causes thereof, or be deemed to have waived any right which Contractor may have had to request a time extension.

12.5. No interruption, interference, inefficiency, suspension or delay in the commencement or progress of the Work from any cause whatever, including those for which the Owner may be responsible, in whole or in part, shall relieve Contractor of his duty to perform or give rise to any right to damages or additional compensation from the Owner. Contractor expressly acknowledges and agrees that it shall receive no damages for delay. Contractor's sole remedy, if any, against the Owner will be the right to seek an extension to the Contract Time; provided, however, the granting of any such time extension shall not be a condition precedent to the aforementioned "No Damage For Delay" provision. This paragraph shall expressly apply to claims for early completion, as well as to claims based on late completion.

ARTICLE 13 – TESTS AND INSPECTION: CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.1. **Notice of Defects:** Prompt notice of all defective Work of which Owner or Engineer have actual knowledge will be given to Contractor. All defective Work may be rejected, corrected or accepted as provided in this Article 13.

Access to Work:

13.2. Owner, Engineer, Engineer's Consultants, other representatives and personnel of Owner, independent testing laboratories and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspecting and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's site safety procedures and programs so that they may comply therewith as applicable.

Tests and Inspections:

13.3. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests or approvals, and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

13.4. Contractor shall employ and pay for services of an independent testing laboratory to perform all Quality Control inspections, test or approvals required by the contract documents. Contractor shall allow the Engineer access to all work done in the project for Acceptance Testing by the owner. This testing will be in addition to Quality Control Testing required by the Contractor. Owner shall arrange and pay all costs associated with Acceptance Testing done by an independent testing laboratory of the Owners choosing except:

13.4.1. for inspections, tests or approvals covered by paragraph 13.5 below.

13.4.2. that costs incurred in connection with tests or inspections conducted pursuant to paragraph 13.9 below shall be paid as provided in said paragraph 13.9; and

13.4.3. as otherwise specifically provided in the Contract Documents.

13.4.4. Owner shall perform the following test as part of quality assurance / acceptance testing:

All material testing included in the Bidding Documents.

All other required testing is to be completed by the contractor as part of the contractor's quality control procedures and submittals. This section shall take precedence over all other sections that describe testing requirements.

13.5. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection, or approval. Contractor shall also be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work, or of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Quality Control Testing of materials and equipment shall be the responsibility of the Contractor who shall pay all costs associated with the required testing. Contractor shall provide the Engineer adequate advance notice of intended tests to allow the Engineer to be present during the Testing.

13.6. If any Work (or the work of others) that is to be inspected, tested or approved is covered by Contractor without written concurrence of Engineer, it must, if requested by Engineer, be uncovered for observation.

13.7. Uncovering Work as provided in paragraph 13.6 shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

Uncovering Work:

13.8. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.

13.9. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose or otherwise make available for observation, inspection or testing as Engineer may require that portion of the Work in question,

furnishing all necessary labor, material and equipment. If it is found that such Work is defective, Contractor shall pay all claims, costs, losses and damages caused by, arising out of or resulting from such uncovering, exposure, observation, inspection and testing and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others; and Owner shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, may make a claim therefore as provided in Article 11. If, however, such Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times (or Milestones), or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement and reconstruction; and, if the parties are unable to agree as to the amount or extent therefore, Contractor may make a claim therefore as provided in Articles 11 and 12.

Owner May Stop the Work:

13.10. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor or any surety or other party.

Correction or Removal of Defective Work:

13.11. If required by Engineer, Contractor shall promptly, as directed, either correct all defective Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by Engineer, remove it from the site and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses and damages caused by or resulting from such correction or removal (including but not limited to all costs of repair or replacement of work of others).

13.12. Correction Period:

13.12.1. If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any Work is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instruction: (i) correct such defective Work, or, if it has been rejected by Owner, remove it from the site and replace it with Work that is not defective, and (ii) satisfactorily correct or remove and replace any damage to other Work or the work of others resulting therefrom. If Contractor does not promptly comply with the terms of such instructions, or in any emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or the rejected Work removed and replaced, and all claims, costs, losses and damages caused by or resulting from such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

13.12.2. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications or by Written Amendment.

13.12.3. Where defective Work (and damage to other Work resulting therefrom) has been corrected, removed or replaced under this paragraph 13.12, the correction period hereunder with respect to such

Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

13.13. Acceptance of Defective Work:

If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, also Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness). If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, Owner may make a claim therefore as provided in Article 11. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

13.14. Owner May Correct Defective Work:

If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work or to remove and replace rejected Work as required by Engineer in accordance with paragraph 13.11, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days' written notice to Contractor, correct and remedy any such deficiency. In exercising the rights and remedies under this paragraph Owner shall proceed expeditiously. In connection with such corrective and remedial action, Owner may exclude Contractor from all or part of the site, take possession of all or part of the Work, and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the site and incorporate in the Work all materials and equipment stored at the site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representative, agents and employees, Owner's other contractors and Engineer and Engineer's Consultants access to the site to enable Owner to exercise the rights and remedies under this paragraph. All claims, costs, losses and damages incurred or sustained by Owner in exercising such rights and remedies will be charged against Contractor and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, Owner may make a claim therefore as provided in Article 11. Such claims, costs, losses and damages will include but not be limited to all costs of repair or replacement of work of others destroyed or damaged by correction, removal or replacement of Contractor's defective Work. Contractor shall not be allowed an extension of the Contract Times (or Milestones) because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies hereunder.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

Schedule of Values:

14.1. The schedule of values established as provided in paragraph 2.9 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

Application for Progress Payment:

14.2. At least ten days before the date established for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance and other arrangements to protect Owner's interest therein, all of which will be satisfactory to Owner. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

Contractor's Warranty of Title:

14.3. Contractor warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

Review of Applications for Progress Payment:

14.4. Engineer will, within ~~ten~~ *fifteen (15)* days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application. ~~Ten~~ *Thirty (30)* days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of the last sentence of paragraph 14.7) become due and when due will be paid by Owner to Contractor.

14.5. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's on-site observations of the executed Work as an experienced and qualified design professional and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

14.5.1. the Work has progressed to the point indicated.

14.5.2. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under paragraph 9.8, and to any other qualifications stated in the recommendation), and

14.5.3. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

However, by recommending any such payment Engineer will not thereby be deemed to have represented that: (i) exhaustive or continuous on-site inspections have been made to check the quality or the quantity of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents or (ii) that there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

14.6. Engineer's recommendation of any payment, including final payment, shall not mean that Engineer is responsible for Contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the furnishing or performance of Work, or for any failure of Contractor to perform or furnish Work in accordance with the Contract Documents.

14.7. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner referred to in paragraph 14.5. Engineer may also refuse to recommend any such payment, or, because of subsequently discovered evidence or the results of subsequent inspections or tests, nullify any such payment previously recommended, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:

14.7.1. the Work is defective, or completed Work has been damaged requiring correction or replacement.

14.7.2. the Contract Price has been reduced by Written Amendment or Change Order.

14.7.3. Owner has been required to correct defective Work or complete Work in accordance with paragraph 13.14. or

14.7.4. Engineer has actual knowledge of the occurrence of any of the events enumerated in paragraphs 15.2.1 through 15.2.4 inclusive.

Owner may refuse to make payment of the full amount recommended by Engineer because:

14.7.5. claims have been made against Owner on account of Contractor's performance or furnishing of the Work.

14.7.6. Liens have been filed in connection with the Work, except where Contractor has delivered a specific Bond satisfactory to Owner to secure the satisfaction and discharge of such Liens,

14.7.7. there are other items entitling Owner to a set-off against the amount recommended, or

14.7.8. Owner has actual knowledge of the occurrence of any of the events enumerated in paragraphs 14.7.1 through 14.7.3 or paragraphs 15.2.1 through 15.2.4 inclusive;

but Owner must give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor corrects to Owner's satisfaction the reasons for such action.

Substantial Completion:

14.8. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion. Within a reasonable time thereafter, Owner, Contractor and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefore. If Engineer considers the Work substantially complete, Engineer will prepare and deliver to Owner a tentative certificate of Substantial

Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will within fourteen days after submission of the tentative certificate to Owner notify Contractor in writing, stating the reasons therefore. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will within said fourteen days execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner. At the time of delivery of the tentative certificate of Substantial Completion Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, maintenance, heat, utilities, insurance and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.

14.9. Owner shall have the right to exclude Contractor from the Work after the date of Substantial Completion, but Owner shall allow Contractor reasonable access to complete or correct items on the tentative list.

Partial Utilization:

14.10. Use by Owner at Owner's option of any substantially completed part of the Work which: (i) has specifically been identified in the Contract Documents, or (ii) Owner, Engineer and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, may be accomplished prior to Substantial Completion of all the Work subject to the following:

14.10.1. Owner at any time may request Contractor in writing to permit Owner to use any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If Contractor agrees that such part of the Work is substantially complete, Contractor will certify to Owner and Engineer that such part of the Work is substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time after either such request, Owner, Contractor and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefore. If Engineer considers that part of the Work to be substantially complete, the provisions of paragraphs 14.8 and 14.9 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

14.10.2. No occupancy or separate operation of part of the Work will be accomplished prior to compliance with the requirements of paragraph 5.6 in respect of property insurance.

Owner may at any time request Contractor in writing to permit Owner to take over operation of any such part of the work although it is not substantially complete. A copy of such request will be sent to Engineer and within a reasonable time thereafter Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion and will prepare a list of the items remaining to be

completed or corrected thereon before final payment. If Contractor does not object in writing to Owner and Engineer that such part of the Work is not ready for separate operation by Owner, Engineer will finalize the list of items to be completed or corrected and will deliver such lists to Owner and Contractor together with a written recommendation as to the division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, maintenance, utilities, insurance, warranties and guarantees for that part of the Work which will become binding upon Owner and Contractor at the time when Owner takes over such operation (unless they shall have otherwise agreed in writing and so informed Engineer). During such operation and prior to Substantial Completion of such part of the Work, Owner shall allow Contractor reasonable access to complete or correct items on said list and to complete other related Work.

Final Inspection:

14.11. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

Final Application for Payment:

14.12. After Contractor has completed all such corrections to the satisfaction of Engineer and delivered in accordance with the Contract Documents all maintenance and operating instructions, schedules, guarantees, Bonds, certificates or other evidence of insurance required by paragraph 5.4, certificates of inspection, marked-up record documents (as provided in paragraph 6.14) and other documents, Contractor may make application for final payment following the procedure for progress payments. The final Application for Payment shall be accompanied (except as previously delivered) by:

(i) consent of the surety, if any, to final payment.

(ii) complete and legally effective releases or waivers (satisfactory to Owner) of all Liens arising out of or filed in connection with the Work. In lieu of such releases or waivers of Liens and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material and equipment for which a Lien could be filed, and (ii) all payrolls, material and equipment bills and other indebtedness connected with the Work for which Owner or Owner's property might in any way be responsible have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a Bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

(iii) certification from surety that payment and performance bond shall remain in effect one (1) year following final payment.

(iv) contractor's advertisement of completion – advertisement for a period of four (4) successive weeks in the newspaper or largest circulation published within the county where the work is performed.

(v) certification from insurance company that any insurance coverage written on a claims-made basis, remain in effect for at least two (2) years following final payment.

Final Payment and Acceptance:

14.13. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final application for Payment and accompanying documentation as required by the

Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of paragraph 14.15. Otherwise, Engineer will return the Application to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application. Thirty days after the presentation to Owner of the Application and accompanying documentation, in appropriate form and substance and with Engineer's recommendation and notice of acceptability, the amount recommended by Engineer will become due and will be paid by Owner to Contractor.

14.14. If, through no fault of Contractor, final completion of the Work is significantly delayed and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment and recommendation of Engineer, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in paragraph 5.1, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

Waiver of Claims:

14.15. The making and acceptance of final payment will constitute:

14.15.1. a waiver of all claims by Owner against Contractor, except claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to paragraph 14.11, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and

14.15.12. a waiver of all claims by Contractor against Owner other than those previously made in writing and still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

Owner May Suspend Work:

15.1. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than ninety days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be allowed an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes an approved claim therefore as provided in Articles 11 and 12.

Owner May Terminate:

15.2. Upon the occurrence of any one or more of the following events:

15.2.1. if Contractor persistently fails to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the progress schedule established under paragraph 2.9 as adjusted from time to time pursuant to paragraph 6.6);

15.2.2. if Contractor disregards Laws or Regulations of any public body having jurisdiction;

15.2.3. if Contractor disregards the authority of Engineer; or

15.2.4. if Contractor otherwise violates in any substantial way any provisions of the Contract Documents;

15.2.5 if Contractor commences a voluntary case under any chapter of the Bankruptcy Code (Title 11, United States Code), as now or hereafter in effect, or if Contractor takes any equivalent or similar action by filing a petition or otherwise under any other federal or state law in effect at such time relating to the bankruptcy or insolvency;

15.2.5.1 if a petition is filed against Contractor under any chapter of the Bankruptcy Code (Title 11, United States Code), as now or hereafter in effect at the time of filing, or if a petition is filed seeking any such equivalent or similar relief against Contractor under any other federal or state law in effect at the time relating to bankruptcy or insolvency;

15.2.5.2 if Contractor makes a general assignment for the benefit of creditors;

15.2.5.3 if a trustee, receiver, custodian, or agent of Contractor is appointed under applicable law or under contract, whose appointment or authority to take charge of property of Contractor is for the purpose of enforcing a Lien against such property or for the purpose of general administration of such property for the benefit of Contractor's creditors;

15.2.5.4 if Contractor admits in writing an inability to pay its debts generally as they become due.

Owner may, after giving Contractor (and the surety, if any,) seven days' written notice and to the extent permitted by Laws and Regulations, terminate the services of Contractor, exclude Contractor from the site and take possession of the Work and of all Contractor's tools, appliances, construction equipment and machinery at the site and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion), incorporate in the Work all materials and equipment stored at the site or for which Owner has paid Contractor but which are stored elsewhere, and finish the Work as Owner may deem expedient. In such case Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds all claims, costs, losses and damages sustained by Owner arising out of or resulting from completing the Work such excess will be paid to Contractor. If such claims, costs, losses and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and when so approved by Engineer incorporated in a Change Order, provided that when exercising any rights or remedies under this paragraph Owner shall not be required to obtain the lowest price for the Work performed.

15.3. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

15.4. Upon seven days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, elect to terminate the Agreement. In such case, Contractor shall be paid (without duplication of any items):

15.4.1. for completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

15.4.2. for expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

15.4.3. for all claims, costs, losses and damages incurred in settlement of terminated contracts with Subcontractors, Suppliers and other; and

15.4.4. for reasonable expenses directly attributable to termination.

Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

Contractor May Stop Work or Terminate:

15.5. If, through no act or fault of Contractor, the Work is suspended for a period of more than ninety days by Owner or under an order of court or other public authority, or Engineer fails to act on any Application for Payment within thirty days after it is submitted or Owner fails for thirty days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Agreement and recover from Owner payment on the same terms as provided in paragraph 15.4. In lieu of terminating the Agreement and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within thirty days after it is submitted, or Owner has failed for thirty days to pay Contractor any sum finally determined to be due, Contractor may upon seven day's written notice to Owner and Engineer stop the Work until payment of all such amounts due Contractor, including interest thereon. The provisions of this paragraph 15.5 are not intended to preclude Contractor from making claim under Articles 11 and 12 for an increase in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping Work as permitted by this paragraph.

ARTICLE 16 – MISCELLANEOUS

16.1 Giving Notice:

Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

16.2 Computation of Times:

16.2.1. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

16.2.2. A calendar day of twenty-four hours measured from midnight to the next midnight will constitute a day.

16.3 Notice of Claim:

Should Owner or Contractor suffer injury or damage to person or property because of any error, omission or act of the other part or of any of the other party's employees or agents or others for whose acts the other party is legally liable, claim will be made in writing to the other party promptly, but in no event later than fifteen (15) days of the first observance of such injury or damage. The provisions of this paragraph 16.3 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or repose.

16.4 Cumulative Remedies:

The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto, and, in particular but without limitation, the warranties, guarantees and obligations imposed upon Contractor by paragraphs 6.2, 6.13, 6.22, 6.23, 13.1, 13.12, 13.14, 14.3 and 15.2 and all of the rights and remedies available to Owner and Engineer thereunder, are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee or by other provisions of the Contract Documents, and the provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply.

16.5 Professional Fees and Court Costs Included:

Whenever reference is made to "claims, costs, losses and damages," it shall include in each case, but not be limited to, all fees and charges of engineers, architects, attorneys and other professionals and all court or other dispute resolution costs.

16.6 Labor Records and Schedules:

The Department of Jurisdiction on such public work shall require all Contractors and Subcontractors to keep the following records on the site of the public work project on which such Contractors, and Subcontractors are engaged:

16.6.1 Record of hours worked by each worker, laborer, and mechanic on each day.

16.6.2 Record of days worked each week by each worker, laborer, and mechanic.

16.6.3 Schedule of occupation or occupations at which each worker, laborer, and mechanic on the project is employed during each workday and week.

16.6.4 Schedule of hourly wage rates and supplements paid to each worker, laborer, and mechanic for each occupation.

16.7. Wage Schedules:

Pursuant to the Labor Law, each laborer, worker, or mechanic employed by the Contractor, Subcontractor, or other person shall be paid not less than the prevailing rate of wages for a legal day's work and shall be provided supplements not less than the prevailing supplements as determined by the Industrial Commissioner.

The Contractor and every Subcontractor shall post in a prominent and accessible place on the site of the work a legible statement of all wage rates and supplements as specified in the Contract to be paid or provided, as the case may be, for the various classes of mechanics, workers, and laborers employed on the work.

The Owner does not represent or warrant that the accompanying schedule of wage rates and supplements with the classification of workers, mechanics, and laborers, as required the Labor Law, is complete, and it reserves the right to revise such schedule when required. If any occupation is not mentioned in the schedule of wage rates and supplements it shall be requested from the Industrial Commissioner, by the Contractor through the Engineer and such schedules, shall, upon notice to the Contractor, become and be a part of the wage and supplement schedules embodied in the Contract.

Also included is the Federal Wage Rate Determination. Laborers, workmen, and mechanics employed on the work done in performance of said Contract shall be paid not less than the rate of wages listed thereon for the trade or occupation of such laborer, etc.

GENERAL CONTRACT PROVISIONS
SECTION 10 – DEFINITION OF TERMS

When the following terms are used in these specifications, in the contract, or in any documents or other instruments pertaining to construction where these specifications govern, the intent and meaning shall be defined as follows:

Paragraph Number	Term	Definition
10-01	AASHTO	The American Association of State Highway and Transportation Officials.
10-02	Access Road	The right-of-way, the roadway and all improvements constructed thereon connecting the airport to a public roadway.
10-03	Advertisement	A public announcement, as required by local law, inviting bids for work to be performed and materials to be furnished.
10-04	Airport	Airport means an area of land or water which is used or intended to be used for the landing and takeoff of aircraft; an appurtenant area used or intended to be used for airport buildings or other airport facilities or rights of way; airport buildings and facilities located in any of these areas, and a heliport.
10-05	Airport Improvement Program (AIP)	A grant-in-aid program, administered by the Federal Aviation Administration (FAA).
10-06	Air Operations Area (AOA)	The term air operations area (AOA) shall mean any area of the airport used or intended to be used for the landing, takeoff, or surface maneuvering of aircraft. An air operation area shall include such paved or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runway, taxiway, or apron.
10-07	Apron	Area where aircraft are parked, unloaded or loaded, fueled and/or serviced.
10-08	ASTM International (ASTM)	Formerly known as the American Society for Testing and Materials (ASTM).
10-09	Award	The Owner's notice to the successful bidder of the acceptance of the submitted bid.
10-10	Bidder	Any individual, partnership, firm, or corporation, acting directly or through a duly authorized representative, who submits a proposal for the work contemplated.
10-11	Building Area	An area on the airport to be used, considered, or intended to be used for airport buildings or other airport facilities or rights-of-way together with all airport buildings and facilities located thereon.
10-12	Calendar Day	Every day shown on the calendar.
10-13	Certificate of Analysis (COA)	The COA is the manufacturer's Certificate of Compliance (COC) including all applicable test results required by the specifications.
10-14	Certificate of Compliance (COC)	The manufacturer's certification stating that materials or assemblies furnished fully comply with the requirements of the contract. The certificate shall be signed by the manufacturer's authorized representative.
10-15	Change Order	A written order to the Contractor covering changes in the plans, specifications, or proposal quantities and establishing the basis of payment and contract time adjustment, if any, for work within the scope of the contract and necessary to complete the project.
10-16	Contract	A written agreement between the Owner and the Contractor that establishes the obligations of the parties including but not limited

Paragraph Number	Term	Definition
		to performance of work, furnishing of labor, equipment and materials and the basis of payment. The awarded contract includes but may not be limited to: Advertisement, Contract form, Proposal, Performance bond, payment bond, General provisions, certifications and representations, Technical Specifications, Plans, Supplemental Provisions, standards incorporated by reference and issued addenda.
10-17	Contract Item (Pay Item)	A specific unit of work for which a price is provided in the contract.
10-18	Contract Time	The number of calendar days or working days, stated in the proposal, allowed for completion of the contract, including authorized time extensions. If a calendar date of completion is stated in the proposal, in lieu of a number of calendar or working days, the contract shall be completed by that date.
10-19	Contractor	The individual, partnership, firm, or corporation primarily liable for the acceptable performance of the work contracted and for the payment of all legal debts pertaining to the work who acts directly or through lawful agents or employees to complete the contract work.
10-20	Contractors Quality Control (QC) Facilities	The Contractor's QC facilities in accordance with the Contractor Quality Control Program (CQCP).
10-21	Contractor Quality Control Program (CQCP)	Details the methods and procedures that will be taken to assure that all materials and completed construction required by the contract conform to contract plans, technical specifications and other requirements, whether manufactured by the Contractor, or procured from subcontractors or vendors.
10-22	Control Strip	A demonstration by the Contractor that the materials, equipment, and construction processes results in a product meeting the requirements of the specification.
10-23	Construction Safety and Phasing Plan (CSPP)	The overall plan for safety and phasing of a construction project developed by the airport operator, or developed by the airport operator's consultant and approved by the airport operator. It is included in the invitation for bids and becomes part of the project specifications.
10-24	Drainage System	The system of pipes, ditches, and structures by which surface or subsurface waters are collected and conducted from the airport area.
10-25	Engineer	The individual, partnership, firm, or corporation duly authorized by the Owner to be responsible for engineering, inspection, and/or observation of the contract work and acting directly or through an authorized representative.
10-26	Equipment	All machinery, together with the necessary supplies for upkeep and maintenance; and all tools and apparatus necessary for the proper construction and acceptable completion of the work.
10-27	Extra Work	An item of work not provided for in the awarded contract as previously modified by change order or supplemental agreement, but which is found by the Owner's Engineer or Resident Project Representative (RPR) to be necessary to complete the work within the intended scope of the contract as previously modified.

Paragraph Number	Term	Definition
10-28	FAA	The Federal Aviation Administration. When used to designate a person, FAA shall mean the Administrator or their duly authorized representative.
10-29	Federal Specifications	The federal specifications and standards, commercial item descriptions, and supplements, amendments, and indices prepared and issued by the General Services Administration.
10-30	Force Account	<p>a. Contract Force Account - A method of payment that addresses extra work performed by the Contractor on a time and material basis.</p> <p>b. Owner Force Account - Work performed for the project by the Owner's employees.</p>
10-31	Intention of Terms	<p>Whenever, in these specifications or on the plans, the words “directed,” “required,” “permitted,” “ordered,” “designated,” “prescribed,” or words of like import are used, it shall be understood that the direction, requirement, permission, order, designation, or prescription of the Engineer and/or Resident Project Representative (RPR) is intended; and similarly, the words “approved,” “acceptable,” “satisfactory,” or words of like import, shall mean approved by, or acceptable to, or satisfactory to the Engineer and/or RPR, subject in each case to the final determination of the Owner.</p> <p>Any reference to a specific requirement of a numbered paragraph of the contract specifications or a cited standard shall be interpreted to include all general requirements of the entire section, specification item, or cited standard that may be pertinent to such specific reference.</p>
10-32	Lighting	A system of fixtures providing or controlling the light sources used on or near the airport or within the airport buildings. The field lighting includes all luminous signals, markers, floodlights, and illuminating devices used on or near the airport or to aid in the operation of aircraft landing at, taking off from, or taxiing on the airport surface.
10-33	Major and Minor Contract Items	A major contract item shall be any item that is listed in the proposal, the total cost of which is equal to or greater than 20% of the total amount of the award contract. All other items shall be considered minor contract items.
10-34	Materials	Any substance specified for use in the construction of the contract work.
10-35	Modification of Standards (MOS)	Any deviation from standard specifications applicable to material and construction methods in accordance with FAA Order 5300.1.
10-36	Notice to Proceed (NTP)	A written notice to the Contractor to begin the actual contract work on a previously agreed to date. If applicable, the Notice to Proceed shall state the date on which the contract time begins.
10-37	Owner	The term “Owner” shall mean the party of the first part or the contracting agency signatory to the contract. Where the term “Owner” is capitalized in this document, it shall mean airport Sponsor only. The Owner for this project is Okaloosa County, Florida Board of County Commissioners.
10-38	Passenger Facility Charge (PFC)	Per 14 Code of Federal Regulations (CFR) Part 158 and 49 United States Code (USC) § 40117, a PFC is a charge imposed

Paragraph Number	Term	Definition
		by a public agency on passengers enplaned at a commercial service airport it controls.
10-39	Pavement Structure	The combined surface course, base course(s), and subbase course(s), if any, considered as a single unit.
10-40	Payment bond	The approved form of security furnished by the Contractor and their own surety as a guaranty that the Contractor will pay in full all bills and accounts for materials and labor used in the construction of the work.
10-41	Performance bond	The approved form of security furnished by the Contractor and their own surety as a guaranty that the Contractor will complete the work in accordance with the terms of the contract.
10-42	Plans	The official drawings or exact reproductions which show the location, character, dimensions and details of the airport and the work to be done and which are to be considered as a part of the contract, supplementary to the specifications. Plans may also be referred to as 'contract drawings.'
10-43	Project	The agreed scope of work for accomplishing specific airport development with respect to a particular airport.
10-44	Proposal	The written offer of the bidder (when submitted on the approved proposal form) to perform the contemplated work and furnish the necessary materials in accordance with the provisions of the plans and specifications.
10-45	Proposal guaranty	The security furnished with a proposal to guarantee that the bidder will enter into a contract if their own proposal is accepted by the Owner.
10-46	Quality Assurance (QA)	Owner's responsibility to assure that construction work completed complies with specifications for payment.
10-47	Quality Control (QC)	Contractor's responsibility to control material(s) and construction processes to complete construction in accordance with project specifications.
10-48	Quality Assurance (QA) Inspector	An authorized representative of the Engineer and/or Resident Project Representative (RPR) assigned to make all necessary inspections, observations, tests, and/or observation of tests of the work performed or being performed, or of the materials furnished or being furnished by the Contractor.
10-49	Quality Assurance (QA) Laboratory	The official quality assurance testing laboratories of the Owner or such other laboratories as may be designated by the Engineer or RPR. May also be referred to as Engineer's, Owner's, or QA Laboratory.
10-50	Resident Project Representative (RPR)	The individual, partnership, firm, or corporation duly authorized by the Owner to be responsible for all necessary inspections, observations, tests, and/or observations of tests of the contract work performed or being performed, or of the materials furnished or being furnished by the Contractor, and acting directly or through an authorized representative.
10-51	Runway	The area on the airport prepared for the landing and takeoff of aircraft.
10-52	Runway Safety Area (RSA)	A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to aircraft. See the construction safety and phasing plan (CSPP) for limits of the RSA.
10-53	Safety Plan Compliance Document (SPCD)	Details how the Contractor will comply with the CSPP.

Paragraph Number	Term	Definition
10-54	Specifications	A part of the contract containing the written directions and requirements for completing the contract work. Standards for specifying materials or testing which are cited in the contract specifications by reference shall have the same force and effect as if included in the contract physically.
10-55	Sponsor	A Sponsor is defined in 49 USC § 47102(24) as a public agency that submits to the FAA for an AIP grant; or a private Owner of a public-use airport that submits to the FAA an application for an AIP grant for the airport.
10-56	Structures	Airport facilities such as bridges; culverts; catch basins, inlets, retaining walls, cribbing; storm and sanitary sewer lines; water lines; underdrains; electrical ducts, manholes, handholes, lighting fixtures and bases; transformers; navigational aids; buildings; vaults; and, other manmade features of the airport that may be encountered in the work and not otherwise classified herein.
10-57	Subgrade	The soil that forms the pavement foundation.
10-58	Superintendent	The Contractor's executive representative who is present on the work during progress, authorized to receive and fulfill instructions from the RPR, and who shall supervise and direct the construction.
10-59	Supplemental Agreement	A written agreement between the Contractor and the Owner that establishes the basis of payment and contract time adjustment, if any, for the work affected by the supplemental agreement. A supplemental agreement is required if: (1) in scope work would increase or decrease the total amount of the awarded contract by more than 25%; (2) in scope work would increase or decrease the total of any major contract item by more than 25%; (3) work that is not within the scope of the originally awarded contract; or (4) adding or deleting of a major contract item.
10-60	Surety	The corporation, partnership, or individual, other than the Contractor, executing payment or performance bonds that are furnished to the Owner by the Contractor.
10-61	Taxilane	A taxiway designed for low speed movement of aircraft between aircraft parking areas and terminal areas.
10-62	Taxiway	The portion of the air operations area of an airport that has been designated by competent airport authority for movement of aircraft to and from the airport's runways, aircraft parking areas, and terminal areas.
10-63	Taxiway/Taxilane Safety Area (TSA)	A defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an aircraft. See the construction safety and phasing plan (CSPP) for limits of the TSA.
10-64	Work	The furnishing of all labor, materials, tools, equipment, and incidentals necessary or convenient to the Contractor's performance of all duties and obligations imposed by the contract, plans, and specifications.
10-65	Working day	A working day shall be any day other than a legal holiday, Saturday, or Sunday on which the normal working forces of the Contractor may proceed with regular work for at least six (6) hours toward completion of the contract. When work is suspended for causes beyond the Contractor's control, it will not be counted as a working day. Saturdays, Sundays and holidays on which the Contractor's forces engage in regular work will be considered as working days.

Paragraph Number	Term	Definition
10-66	Advisory Circular	A document issued by the FAA containing informational material and guidance. When referred to in the plans and specifications, advisory circulars shall have the same force as supplemental specifications.

END OF SECTION 10

SECTION 20 – PROPOSAL REQUIREMENTS AND CONDITIONS

20-01 Advertisement (Notice to Bidders).

THIS SECTION NOT USED. REFER TO INSTRUCTIONS TO BIDDERS FOR BID REQUIREMENTS AND CONDITIONS.

END OF SECTION 20

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SECTION 30 - AWARD AND EXECUTION OF CONTRACT

THIS SECTION NOT USED. REFER TO INSTRUCTIONS TO BIDDERS FOR AWARD AND
EXECUTION OF CONTRACT

END OF SECTION 30

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SECTION 40 – SCOPE OF WORK

40-01 Intent of contract. The intent of the contract is to provide for construction and completion, in every detail, of the work described within the plans, specifications and terms of the contract. It is further intended that the Contractor shall furnish all labor, materials, equipment, tools, transportation, and supplies required to complete the work in accordance with the plans, specifications, and terms of the contract.

40-02 Alteration of work and quantities. The Owner reserves the right to make such changes in quantities and work as may be necessary or desirable to complete, in a satisfactory manner, the original intended work. Unless otherwise specified in the Contract, the Owner's Engineer or RPR shall be and is hereby authorized to make, in writing, such in-scope alterations in the work and variation of quantities as may be necessary to complete the work, provided such action does not represent a significant change in the character of the work.

For purpose of this section, a significant change in character of work means: any change that is outside the current contract scope of work; any change (increase or decrease) in the total contract cost by more than 1% (one percent); or any change in the total cost of a major contract item by more than 1% (one percent).

Work alterations and quantity variances that do not meet the definition of significant change in character of work shall not invalidate the contract nor release the surety. Contractor agrees to accept payment for such work alterations and quantity variances in accordance with Section 90, paragraph 90-03, *Compensation for Altered Quantities*.

Should the value of altered work or quantity variance meet the criteria for significant change in character of work, such altered work and quantity variance shall be covered by a supplemental agreement. Supplemental agreements shall also require consent of the Contractor's surety and separate performance and payment bonds. If the Owner and the Contractor are unable to agree on a unit adjustment for any contract item that requires a supplemental agreement, the Owner reserves the right to terminate the contract with respect to the item and make other arrangements for its completion.

40-03 Omitted items. The Owner, the Owner's Engineer or the RPR may provide written notice to the Contractor to omit from the work any contract item that does not meet the definition of major contract item. Major contract items may be omitted by a supplemental agreement. Such omission of contract items shall not invalidate any other contract provision or requirement.

Should a contract item be omitted or otherwise ordered to be non-performed, the Contractor shall be paid for all work performed toward completion of such item prior to the date of the order to omit such item. Payment for work performed shall be in accordance with Section 90, paragraph 90-04, *Payment for Omitted Items*.

40-04 Extra work. Should acceptable completion of the contract require the Contractor to perform an item of work not provided for in the awarded contract as previously modified by change order or supplemental agreement, Owner may issue a Change Order to cover the necessary extra work. Change orders for extra work shall contain agreed unit prices for performing the change order work in accordance with the requirements specified in the order, and shall contain any adjustment to the contract time that, in the RPR's opinion, is necessary for completion of the extra work. When determined by the RPR to be in the Owner's best interest, the RPR may order the Contractor to proceed with extra work as provided in Section 90, paragraph 90-05, *Payment for Extra Work*. Extra work that is necessary for acceptable completion of the project, but is not within the general scope of the work covered by the original contract shall be covered by a supplemental agreement as defined in Section 10, paragraph 10-59, *Supplemental Agreement*. If extra work is essential to maintaining the project critical path, RPR may order the Contractor to commence the extra work under a Time and Material contract method. Once sufficient detail is available to establish the level of effort necessary for the extra work, the Owner shall initiate a change order or supplemental agreement to cover the extra work.

Any claim for payment of extra work that is not covered by written agreement (change order or supplemental agreement) shall be rejected by the Owner.

40-05 Maintenance of traffic. It is the explicit intention of the contract that the safety of aircraft, as well as the Contractor's equipment and personnel, is the most important consideration. The Contractor shall maintain traffic in the manner detailed in the Construction Safety and Phasing Plan (CSPP).

a. It is understood and agreed that the Contractor shall provide for the free and unobstructed movement of aircraft in the air operations areas (AOAs) of the airport with respect to their own operations and the operations of

all subcontractors as specified in Section 80, paragraph 80-04, *Limitation of Operations*. It is further understood and agreed that the Contractor shall provide for the uninterrupted operation of visual and electronic signals (including power supplies thereto) used in the guidance of aircraft while operating to, from, and upon the airport as specified in Section 70, paragraph 70-15, *Contractor's Responsibility for Utility Service and Facilities of Others*.

b. With respect to their own operations and the operations of all subcontractors, the Contractor shall provide marking, lighting, and other acceptable means of identifying personnel, equipment, vehicles, storage areas, and any work area or condition that may be hazardous to the operation of aircraft, fire-rescue equipment, or maintenance vehicles at the airport in accordance with the construction safety and phasing plan (CSPP) and the safety plan compliance document (SPCD).

c. When the contract requires the maintenance of an existing road, street, or highway during the Contractor's performance of work that is otherwise provided for in the contract, plans, and specifications, the Contractor shall keep the road, street, or highway open to all traffic and shall provide maintenance as may be required to accommodate traffic. The Contractor, at their expense, shall be responsible for the repair to equal or better than preconstruction conditions of any damage caused by the Contractor's equipment and personnel. The Contractor shall furnish, erect, and maintain barricades, warning signs, flag person, and other traffic control devices in reasonable conformity with the Manual on Uniform Traffic Control Devices (MUTCD) (<http://mutcd.fhwa.dot.gov/>), unless otherwise specified. The Contractor shall also construct and maintain in a safe condition any temporary connections necessary for ingress to and egress from abutting property or intersecting roads, streets or highways.

40-06 Removal of existing structures. All existing structures encountered within the established lines, grades, or grading sections shall be removed by the Contractor, unless such existing structures are otherwise specified to be relocated, adjusted up or down, salvaged, abandoned in place, reused in the work or to remain in place. The cost of removing such existing structures shall not be measured or paid for directly, but shall be included in the various contract items.

Should the Contractor encounter an existing structure (above or below ground) in the work for which the disposition is not indicated on the plans, the Resident Project Representative (RPR) shall be notified prior to disturbing such structure. The disposition of existing structures so encountered shall be immediately determined by the RPR in accordance with the provisions of the contract.

Except as provided in Section 40, paragraph 40-07, *Rights in and Use of Materials Found in the Work*, it is intended that all existing materials or structures that may be encountered (within the lines, grades, or grading sections established for completion of the work) shall be used in the work as otherwise provided for in the contract and shall remain the property of the Owner when so used in the work.

40-07 Rights in and use of materials found in the work. Should the Contractor encounter any material such as (but not restricted to) sand, stone, gravel, slag, or concrete slabs within the established lines, grades, or grading sections, the use of which is intended by the terms of the contract to be embankment, the Contractor may at their own option either:

a. Use such material in another contract item, providing such use is approved by the RPR and is in conformance with the contract specifications applicable to such use; or,

b. Remove such material from the site, upon written approval of the RPR; or

c. Use such material for the Contractor's own temporary construction on site; or,

d. Use such material as intended by the terms of the contract.

Should the Contractor wish to exercise option a., b., or c., the Contractor shall request the RPR's approval in advance of such use.

Should the RPR approve the Contractor's request to exercise option a., b., or c., the Contractor shall be paid for the excavation or removal of such material at the applicable contract price. The Contractor shall replace, at their expense, such removed or excavated material with an agreed equal volume of material that is acceptable for use in constructing embankment, backfills, or otherwise to the extent that such replacement material is needed to complete the contract work. The Contractor shall not be charged for use of such material used in the work or removed from the site.

Should the RPR approve the Contractor's exercise of option a., the Contractor shall be paid, at the applicable contract price, for furnishing and installing such material in accordance with requirements of the contract item in which the material is used.

It is understood and agreed that the Contractor shall make no claim for delays by reason of their own exercise of option a., b., or c.

The Contractor shall not excavate, remove, or otherwise disturb any material, structure, or part of a structure which is located outside the lines, grades, or grading sections established for the work, except where such excavation or removal is provided for in the contract, plans, or specifications.

40-08 Final cleanup. Upon completion of the work and before acceptance and final payment will be made, the Contractor shall remove from the site all machinery, equipment, surplus and discarded materials, rubbish, temporary structures, and stumps or portions of trees. The Contractor shall cut all brush and woods within the limits indicated and shall leave the site in a neat and presentable condition. Material cleared from the site and deposited on adjacent property will not be considered as having been disposed of satisfactorily, unless the Contractor has obtained the written permission of the property Owner.

40-09 Access to the Work. Access to the work will be via the access routes shown on the plans or as directed by the Engineer. The Contractor shall identify access routes with suitable signs, barricades and similar equipment.

The entire access route and construction site shall be kept free and clean of all debris at all times and maintained in good repair by the Contractor. All damage to the access route caused by the actions of the Contractor or his agents shall be immediately repaired to the satisfaction of the Owner.

No additional payment will be made to the Contractor for complying with the requirements of this subsection. No other access to the work sites will be permitted without written approval by the Engineer. Contractor's vehicles and equipment, including vehicles and equipment of subcontractors and others coming under the Contractor's control, will not be permitted to traverse other airfield areas or pavements without written approval of the Engineer.

Contractor's vehicles, equipment, and materials may be stored in the area designated on the Plans, or by the Engineer. Upon completion of the work, the storage area shall be cleaned up and returned to its original condition to the satisfaction of the Engineer. No special payment will be made for clean-up and restoration of the storage area.

Space will be allotted by the Engineer for the use of employees of the Contractor and his subcontractor(s) for the daily parking of their automobiles during the construction period. Personal vehicles of employees and vehicles operated by vendors of goods or services will not be permitted beyond the Contractor's parking area. Drivers of vehicles being operated beyond this area shall be subject to loss of permission to enter the construction site.

END OF SECTION 40

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SECTION 50 – CONTROL OF WORK

50-01 Authority of the Resident Project Representative (RPR). The RPR has final authority regarding the interpretation of project specification requirements. The RPR shall determine acceptability of the quality of materials furnished, method of performance of work performed, and the manner and rate of performance of the work. The RPR does not have the authority to accept work that does not conform to specification requirements.

50-02 Conformity with plans and specifications. All work and all materials furnished shall be in reasonably close conformity with the lines, grades, grading sections, cross-sections, dimensions, material requirements, and testing requirements that are specified (including specified tolerances) in the contract, plans, or specifications.

If the RPR finds the materials furnished, work performed, or the finished product not within reasonably close conformity with the plans and specifications, but that the portion of the work affected will, in their opinion, result in a finished product having a level of safety, economy, durability, and workmanship acceptable to the Owner, the RPR will advise the Owner of their determination that the affected work be accepted and remain in place. The RPR will document the determination and recommend to the Owner a basis of acceptance that will provide for an adjustment in the contract price for the affected portion of the work. Changes in the contract price must be covered by contract change order or supplemental agreement as applicable.

If the RPR finds the materials furnished, work performed, or the finished product are not in reasonably close conformity with the plans and specifications and have resulted in an unacceptable finished product, the affected work or materials shall be removed and replaced or otherwise corrected by and at the expense of the Contractor in accordance with the RPR's written orders.

The term "reasonably close conformity" shall not be construed as waiving the Contractor's responsibility to complete the work in accordance with the contract, plans, and specifications. The term shall not be construed as waiving the RPR's responsibility to insist on strict compliance with the requirements of the contract, plans, and specifications during the Contractor's execution of the work, when, in the RPR's opinion, such compliance is essential to provide an acceptable finished portion of the work.

The term "reasonably close conformity" is also intended to provide the RPR with the authority, after consultation with the Sponsor and FAA, to use sound engineering judgment in their determinations to accept work that is not in strict conformity, but will provide a finished product equal to or better than that required by the requirements of the contract, plans and specifications.

The RPR will not be responsible for the Contractor's means, methods, techniques, sequences, or procedures of construction or the safety precautions incident thereto.

50-03 Coordination of contract, plans, and specifications. The contract, plans, specifications, and all referenced standards cited are essential parts of the contract requirements. If electronic files are provided and used on the project and there is a conflict between the electronic files and hard copy plans, the hard copy plans shall govern. A requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete work. In case of discrepancy, calculated dimensions will govern over scaled dimensions; contract technical specifications shall govern over contract general provisions, plans, cited standards for materials or testing, and cited advisory circulars (ACs); contract general provisions shall govern over plans, cited standards for materials or testing, and cited ACs; plans shall govern over cited standards for materials or testing and cited ACs. If any paragraphs contained in the Special Provisions conflict with General Provisions or Technical Specifications, the Special Provisions shall govern.

From time to time, discrepancies within cited testing standards occur due to the timing of the change, edits, and/or replacement of the standards. If the Contractor discovers any apparent discrepancy within standard test methods, the Contractor shall immediately ask the RPR for an interpretation and decision, and such decision shall be final.

The Contractor shall not take advantage of any apparent error or omission on the plans or specifications. In the event the Contractor discovers any apparent error or discrepancy, Contractor shall immediately notify the Owner or the designated representative in writing requesting their written interpretation and decision.

50-04 List of Special Provisions. Not Used

50-05 Cooperation of Contractor. The Contractor shall be supplied with an electronic PDF of the plans and specifications. The Contractor shall have available on the construction site at all times one hardcopy each of the

plans and specifications. Additional hard copies of plans and specifications may be obtained by the Contractor for the cost of reproduction.

The Contractor shall give constant attention to the work to facilitate the progress thereof, and shall cooperate with the RPR and their inspectors and with other Contractors in every way possible. The Contractor shall have a competent superintendent on the work at all times who is fully authorized as their agent on the work. The superintendent shall be capable of reading and thoroughly understanding the plans and specifications and shall receive and fulfill instructions from the RPR or their authorized representative.

50-06 Cooperation between Contractors. The Owner reserves the right to contract for and perform other or additional work on or near the work covered by this contract.

When separate contracts are let within the limits of any one project, each Contractor shall conduct the work not to interfere with or hinder the progress of completion of the work being performed by other Contractors. Contractors working on the same project shall cooperate with each other as directed.

Each Contractor involved shall assume all liability, financial or otherwise, in connection with their own contract and shall protect and hold harmless the Owner from any and all damages or claims that may arise because of inconvenience, delays, or loss experienced because of the presence and operations of other Contractors working within the limits of the same project.

The Contractor shall arrange their work and shall place and dispose of the materials being used to not interfere with the operations of the other Contractors within the limits of the same project. The Contractor shall join their work with that of the others in an acceptable manner and shall perform it in proper sequence to that of the others.

50-07 Construction layout and stakes. The Engineer/RPR shall establish necessary horizontal and vertical control. The establishment of Survey Control and/or reestablishment of survey control shall be by a State Licensed Land Surveyor. Contractor is responsible for preserving integrity of horizontal and vertical controls established by Engineer/RPR. In case of negligence on the part of the Contractor or their employees, resulting in the destruction of any horizontal and vertical control, the resulting costs will be deducted as a liquidated damage against the Contractor.

Prior to the start of construction, the Contractor will check all control points for horizontal and vertical accuracy and certify in writing to the RPR that the Contractor concurs with survey control established for the project. All lines, grades and measurements from control points necessary for the proper execution and control of the work on this project will be provided to the RPR. The Contractor is responsible to establish all layout required for the construction of the project.

Copies of survey notes will be provided to the RPR for each area of construction and for each placement of material as specified to allow the RPR to make periodic checks for conformance with plan grades, alignments and grade tolerances required by the applicable material specifications. Surveys will be provided to the RPR prior to commencing work items that cover or disturb the survey staking. Survey(s) and notes shall be provided in the following format(s): Electronic files of the survey shall be available in AutoCAD 3D format by Autodesk Inc. with a signed and sealed hard copy.

Laser, GPS, String line, or other automatic control shall be checked with temporary control as necessary. In the case of error, on the part of the Contractor, their surveyor, employees or subcontractors, resulting in established grades, alignment or grade tolerances that do not concur with those specified or shown on the plans, the Contractor is solely responsible for correction, removal, replacement and all associated costs at no additional cost to the Owner. No direct payment will be made, unless otherwise specified in contract documents, for this labor, materials, or other expenses. The cost shall be included in the price of the bid for the various items of the Contract.

50-08 Authority and duties of Quality Assurance (QA) inspectors. QA inspectors shall be authorized to inspect all work done and all material furnished. Such QA inspection may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. QA inspectors are not authorized to revoke, alter, or waive any provision of the contract. QA inspectors are not authorized to issue instructions contrary to the plans and specifications or to act as foreman for the Contractor.

QA Inspectors are authorized to notify the Contractor or their representatives of any failure of the work or materials to conform to the requirements of the contract, plans, or specifications and to reject such nonconforming materials in question until such issues can be referred to the RPR for a decision.

50-09 Inspection of the work. All materials and each part or detail of the work shall be subject to inspection. The RPR shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection.

If the RPR requests it, the Contractor, at any time before acceptance of the work, shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the specifications. Should the work thus exposed or examined prove acceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be paid for as extra work; but should the work so exposed or examined prove unacceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be at the Contractor's expense.

Provide advance written notice to the RPR of work the Contractor plans to perform each week and each day. Any work done or materials used without written notice and allowing opportunity for inspection by the RPR may be ordered removed and replaced at the Contractor's expense.

Should the contract work include relocation, adjustment, or any other modification to existing facilities, not the property of the (contract) Owner, authorized representatives of the Owners of such facilities shall have the right to inspect such work. Such inspection shall in no sense make any facility owner a party to the contract, and shall in no way interfere with the rights of the parties to this contract.

50-10 Removal of unacceptable and unauthorized work. All work that does not conform to the requirements of the contract, plans, and specifications will be considered unacceptable, unless otherwise determined acceptable by the RPR as provided in paragraph 50-02, *Conformity with Plans and Specifications*.

Unacceptable work, whether the result of poor workmanship, use of defective materials, damage through carelessness, or any other cause found to exist prior to the final acceptance of the work, shall be removed immediately and replaced in an acceptable manner in accordance with the provisions of Section 70, paragraph 70-14, *Contractor's Responsibility for Work*.

No removal work made under provision of this paragraph shall be done without lines and grades having been established by the RPR. Work done contrary to the instructions of the RPR, work done beyond the lines shown on the plans or as established by the RPR, except as herein specified, or any extra work done without authority, will be considered as unauthorized and will not be paid for under the provisions of the contract. Work so done may be ordered removed or replaced at the Contractor's expense.

Upon failure on the part of the Contractor to comply with any order of the RPR made under the provisions of this subsection, the RPR will have authority to cause unacceptable work to be remedied or removed and replaced; and unauthorized work to be removed and recover the resulting costs as a liquidated damage against the Contractor.

50-11 Load restrictions. The Contractor shall comply with all legal load restrictions in the hauling of materials on public roads beyond the limits of the work. A special permit will not relieve the Contractor of liability for damage that may result from the moving of material or equipment.

The operation of equipment of such weight or so loaded as to cause damage to structures or to any other type of construction will not be permitted. Hauling of materials over the base course or surface course under construction shall be limited as directed. No loads will be permitted on a concrete pavement, base, or structure before the expiration of the curing period. The Contractor, at their own expense, shall be responsible for the repair to equal or better than preconstruction conditions of any damage caused by the Contractor's equipment and personnel.

50-12 Maintenance during construction. The Contractor shall maintain the work during construction and until the work is accepted. Maintenance shall constitute continuous and effective work executed day by day, with adequate equipment and forces so that the work is maintained in satisfactory condition at all times.

In the case of a contract for the placing of a course upon a course or subgrade previously constructed, the Contractor shall maintain the previous course or subgrade during all construction operations.

All costs of maintenance work during construction and before the project is accepted shall be included in the unit prices bid on the various contract items, and the Contractor will not be paid an additional amount for such work.

50-13 Failure to maintain the work. Should the Contractor at any time fail to maintain the work as provided in paragraph 50-12, *Maintenance during Construction*, the RPR shall immediately notify the Contractor of such noncompliance. Such notification shall specify a reasonable time within which the Contractor shall be required to remedy such unsatisfactory maintenance condition. The time specified will give due consideration to the exigency that exists.

Should the Contractor fail to respond to the RPR's notification, the Owner may suspend any work necessary for the Owner to correct such unsatisfactory maintenance condition, depending on the exigency that exists. Any maintenance cost incurred by the Owner, shall be recovered as a liquidated damage against the Contractor.

50-14 Partial acceptance. If at any time during the execution of the project the Contractor substantially completes a usable unit or portion of the work, the occupancy of which will benefit the Owner, the Contractor may request the RPR to make final inspection of that unit. If the RPR finds upon inspection that the unit has been satisfactorily completed in compliance with the contract, the RPR may accept it as being complete, and the Contractor may be relieved of further responsibility for that unit. Such partial acceptance and beneficial occupancy by the Owner shall not void or alter any provision of the contract.

50-15 Final acceptance. Upon due notice from the Contractor of presumptive completion of the entire project, the RPR and Owner will make an inspection. If all construction provided for and contemplated by the contract is found to be complete in accordance with the contract, plans, and specifications, such inspection shall constitute the final inspection. The RPR shall notify the Contractor in writing of final acceptance as of the date of the final inspection. If, however, the inspection discloses any work, in whole or in part, as being unsatisfactory, the RPR will notify the Contractor and the Contractor shall correct the unsatisfactory work. Upon correction of the work, another inspection will be made which shall constitute the final inspection, provided the work has been satisfactorily completed. In such event, the RPR will make the final acceptance and notify the Contractor in writing of this acceptance as of the date of final inspection.

50-16 Claims for adjustment and disputes. If for any reason the Contractor deems that additional compensation is due for work or materials not clearly provided for in the contract, plans, or specifications or previously authorized as extra work, the Contractor shall notify the RPR in writing of their intention to claim such additional compensation before the Contractor begins the work on which the Contractor bases the claim. If such notification is not given or the RPR is not afforded proper opportunity by the Contractor for keeping strict account of actual cost as required, then the Contractor hereby agrees to waive any claim for such additional compensation. Such notice by the Contractor and the fact that the RPR has kept account of the cost of the work shall not in any way be construed as proving or substantiating the validity of the claim. When the work on which the claim for additional compensation is based has been completed, the Contractor shall, within 10 calendar days, submit a written claim to the RPR who will present it to the Owner for consideration in accordance with local laws or ordinances. Nothing in this subsection shall be construed as a waiver of the Contractor's right to dispute final payment based on differences in measurements or computations.

END OF SECTION 50

SECTION 60 – CONTROL OF MATERIALS

60-01 Source of supply and quality requirements. The materials used in the work shall conform to the requirements of the contract, plans, and specifications. Unless otherwise specified, such materials that are manufactured or processed shall be new (as compared to used or reprocessed).

In order to expedite the inspection and testing of materials, the Contractor shall furnish documentation to the RPR as to the origin, composition, and manufacture of all materials to be used in the work. Documentation shall be furnished promptly after execution of the contract but, in all cases, prior to delivery of such materials.

At the RPR's option, materials may be approved at the source of supply before delivery. If it is found after trial that sources of supply for previously approved materials do not produce specified products, the Contractor shall furnish materials from other sources.

The Contractor shall furnish airport lighting equipment that meets the requirements of the specifications; and is listed in AC 150/5345-53, *Airport Lighting Equipment Certification Program* and *Addendum*, that is in effect on the date of advertisement.

60-02 Samples, tests, and cited specifications. All materials used in the work shall be inspected, tested, and approved by the RPR before incorporation in the work unless otherwise designated. Any work in which untested materials are used without approval or written permission of the RPR shall be performed at the Contractor's risk. Materials found to be unacceptable and unauthorized will not be paid for and, if directed by the RPR, shall be removed at the Contractor's expense.

Unless otherwise designated, quality assurance tests will be made by and at the expense of the Owner in accordance with the cited standard methods of ASTM, American Association of State Highway and Transportation Officials (AASHTO), federal specifications, Commercial Item Descriptions, and all other cited methods, which are current on the date of advertisement for bids.

The testing organizations performing on-site quality assurance field tests shall have copies of all referenced standards on the construction site for use by all technicians and other personnel. Unless otherwise designated, samples for quality assurance will be taken by a qualified representative of the RPR. All materials being used are subject to inspection, test, or rejection at any time prior to or during incorporation into the work. Copies of all tests will be furnished to the Contractor's representative at their request after review and approval of the RPR.

A copy of all Contractor QC test data shall be provided to the RPR daily, along with printed reports, in an approved format, on a weekly basis. After completion of the project, and prior to final payment, the Contractor shall submit a final report to the RPR showing all test data reports, plus an analysis of all results showing ranges, averages, and corrective action taken on all failing tests.

60-03 Certification of compliance/analysis (COC/COA). The RPR may permit the use, prior to sampling and testing, of certain materials or assemblies when accompanied by manufacturer's COC stating that such materials or assemblies fully comply with the requirements of the contract. The certificate shall be signed by the manufacturer. Each lot of such materials or assemblies delivered to the work must be accompanied by a certificate of compliance in which the lot is clearly identified. The COA is the manufacturer's COC and includes all applicable test results. Materials or assemblies used on the basis of certificates of compliance may be sampled and tested at any time and if found not to be in conformity with contract requirements will be subject to rejection whether in place or not. The form and distribution of certificates of compliance shall be as approved by the RPR. When a material or assembly is specified by "brand name or equal" and the Contractor elects to furnish the specified "or equal," the Contractor shall be required to furnish the manufacturer's certificate of compliance for each lot of such material or assembly delivered to the work. Such certificate of compliance shall clearly identify each lot delivered and shall certify as to:

- a. Conformance to the specified performance, testing, quality or dimensional requirements; and,
- b. Suitability of the material or assembly for the use intended in the contract work.

The RPR shall be the sole judge as to whether the proposed "or equal" is suitable for use in the work.

The RPR reserves the right to refuse permission for use of materials or assemblies on the basis of certificates of compliance.

60-04 Plant inspection. The RPR or their authorized representative may inspect, at its source, any specified material or assembly to be used in the work. Manufacturing plants may be inspected from time to time for the purpose of determining compliance with specified manufacturing methods or materials to be used in the work and to obtain samples required for acceptance of the material or assembly.

Should the RPR conduct plant inspections, the following conditions shall exist:

a. The RPR shall have the cooperation and assistance of the Contractor and the producer with whom the Contractor has contracted for materials.

b. The RPR shall have full entry at all reasonable times to such parts of the plant that concern the manufacture or production of the materials being furnished.

c. If required by the RPR, the Contractor shall arrange for adequate office or working space that may be reasonably needed for conducting plant inspections. Place office or working space in a convenient location with respect to the plant.

It is understood and agreed that the Owner shall have the right to retest any material that has been tested and approved at the source of supply after it has been delivered to the site. The RPR shall have the right to reject only material which, when retested, does not meet the requirements of the contract, plans, or specifications.

60-05 Engineer/ Resident Project Representative (RPR) field office. ~~[The Contractor shall provide dedicated space for the use of the engineer, RPR, and inspectors, as a field office for the duration of the project. This space shall be located conveniently near the construction and shall be separate from any space used by the Contractor. The Contractor shall furnish water, sanitary facilities, heat, air conditioning, and electricity.]~~ [An Engineer/RPR field office is not required.]

60-06 Storage of materials. Materials shall be stored to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, may again be inspected prior to their use in the work. Stored materials shall be located to facilitate their prompt inspection. The Contractor shall coordinate the storage of all materials with the RPR. Materials to be stored on airport property shall not create an obstruction to air navigation nor shall they interfere with the free and unobstructed movement of aircraft. Unless otherwise shown on the plans and/or CSPP, the storage of materials and the location of the Contractor's plant and parked equipment or vehicles shall be as directed by the RPR. Private property shall not be used for storage purposes without written permission of the Owner or lessee of such property. The Contractor shall make all arrangements and bear all expenses for the storage of materials on private property. Upon request, the Contractor shall furnish the RPR a copy of the property Owner's permission.

All storage sites on private or airport property shall be restored to their original condition by the Contractor at their expense, except as otherwise agreed to (in writing) by the Owner or lessee of the property.

60-07 Unacceptable materials. Any material or assembly that does not conform to the requirements of the contract, plans, or specifications shall be considered unacceptable and shall be rejected. The Contractor shall remove any rejected material or assembly from the site of the work, unless otherwise instructed by the RPR.

Rejected material or assembly, the defects of which have been corrected by the Contractor, shall not be returned to the site of the work until such time as the RPR has approved its use in the work.

60-08 Owner furnished materials. The Contractor shall furnish all materials required to complete the work, except those specified, if any, to be furnished by the Owner. Owner-furnished materials shall be made available to the Contractor at the location specified.

All costs of handling, transportation from the specified location to the site of work, storage, and installing Owner-furnished materials shall be included in the unit price bid for the contract item in which such Owner-furnished material is used.

After any Owner-furnished material has been delivered to the location specified, the Contractor shall be responsible for any demurrage, damage, loss, or other deficiencies that may occur during the Contractor's handling, storage, or

use of such Owner-furnished material. The Owner will deduct from any monies due or to become due the Contractor any cost incurred by the Owner in making good such loss due to the Contractor's handling, storage, or use of Owner-furnished materials.

END OF SECTION 60

SECTION 70 – LEGAL REGULATIONS AND RESPONSIBILITY TO PUBLIC

70-01 Laws to be observed. The Contractor shall keep fully informed of all federal and state laws, all local laws, ordinances, and regulations and all orders and decrees of bodies or tribunals having any jurisdiction or authority, which in any manner affect those engaged or employed on the work, or which in any way affect the conduct of the work. The Contractor shall at all times observe and comply with all such laws, ordinances, regulations, orders, and decrees; and shall protect and indemnify the Owner and all their officers, agents, or servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by the Contractor or the Contractor's employees.

If the Contractor observes that the drawings and specifications are at variance with any laws, codes, ordinances, and regulations, he shall promptly notify the Engineer in writing, and any necessary changes shall be adjusted as provided in the contract for changes in the work. If the Contractor performs any work contrary to such laws, codes, ordinances, and regulations, and without such notice to the Engineer, he shall bear all costs arising therefrom.

70-02 Permits, licenses, and taxes. The Contractor shall procure all permits and licenses, pay all charges, fees, and taxes, and give all notices necessary and incidental to the due and lawful execution of the work.

70-03 Patented devices, materials, and processes. If the Contractor is required or desires to use any design, device, material, or process covered by letters of patent or copyright, the Contractor shall provide for such use by suitable legal agreement with the Patentee or Owner. The Contractor and the surety shall indemnify and hold harmless the Owner, any third party, or political subdivision from any and all claims for infringement by reason of the use of any such patented design, device, material or process, or any trademark or copyright, and shall indemnify the Owner for any costs, expenses, and damages which it may be obliged to pay by reason of an infringement, at any time during the execution or after the completion of the work.

70-04 Restoration of surfaces disturbed by others. The Owner reserves the right to authorize the construction, reconstruction, or maintenance of any public or private utility service, FAA or National Oceanic and Atmospheric Administration (NOAA) facility, or a utility service of another government agency at any time during the progress of the work. To the extent that such construction, reconstruction, or maintenance has been coordinated with the Owner, such authorized work (by others) must be shown on the plans and is indicated as follows: N/A.

Except as listed above, the Contractor shall not permit any individual, firm, or corporation to excavate or otherwise disturb such utility services or facilities located within the limits of the work without the written permission of the RPR.

Should the Owner of public or private utility service, FAA, or NOAA facility, or a utility service of another government agency be authorized to construct, reconstruct, or maintain such utility service or facility during the progress of the work, the Contractor shall cooperate with such Owners by arranging and performing the work in this contract to facilitate such construction, reconstruction or maintenance by others whether or not such work by others is listed above. When ordered as extra work by the RPR, the Contractor shall make all necessary repairs to the work which are due to such authorized work by others, unless otherwise provided for in the contract, plans, or specifications. It is understood and agreed that the Contractor shall not be entitled to make any claim for damages due to such authorized work by others or for any delay to the work resulting from such authorized work.

70-05 Federal Participation. The United States Government has agreed to reimburse the Owner for some portion of the contract costs. The contract work is subject to the inspection and approval of duly authorized representatives of the FAA Administrator. No requirement of this contract shall be construed as making the United States a party to the contract nor will any such requirement interfere, in any way, with the rights of either party to the contract. The attention of the Contractor is also invited to the fact that the State in which this project is located may pay a portion of the cost of this improvement. In accordance with said State's rules and regulations, work will be subject to such inspection of the State, or its representative, as deemed necessary to protect the interests of the people of the State. The Contractor shall furnish the inspecting party with every reasonable assistance to ascertain whether or not the requirements and intent of the contract are being met. Such inspections will in no way infer that the State is party to the contract, except for those contracts wherein the State is a signatory.

70-06 Sanitary, health, and safety provisions. The Contractor's worksite and facilities shall comply with applicable federal, state, and local requirements for health, safety and sanitary provisions.

70-07 Public convenience and safety. The Contractor shall control their operations and those of their subcontractors and all suppliers, to assure the least inconvenience to the traveling public. Under all circumstances, safety shall be the most important consideration.

The Contractor shall maintain the free and unobstructed movement of aircraft and vehicular traffic with respect to their own operations and those of their own subcontractors and all suppliers in accordance with Section 40, paragraph 40-05, *Maintenance of Traffic*, and shall limit such operations for the convenience and safety of the traveling public as specified in Section 80, paragraph 80-04, *Limitation of Operations*.

The Contractor shall remove or control debris and rubbish resulting from its work operations at frequent intervals, and upon the order of the RPR. If the RPR determines the existence of Contractor debris in the work site represents a hazard to airport operations and the Contractor is unable to respond in a prompt and reasonable manner, the RPR reserves the right to assign the task of debris removal to a third party and recover the resulting costs as a liquidated damage against the Contractor.

The Contractor shall provide initial and continuing instructions to all supervisors, employees, subcontractors, and suppliers to enable them to conduct their work in a manner that will provide the maximum safety with the least hindrance to air and ground traffic, the general public, airport employees, and to the workmen employed on the site. All safety provisions specified by the plans and documents or received from the Engineer, and those required by laws, codes and ordinances, shall be thoroughly disseminated and rigidly enforced.

70-08 Construction Safety and Phasing Plan (CSPP). The Contractor shall complete the work in accordance with the approved Construction Safety and Phasing Plan (CSPP) developed in accordance with AC 150/5370-2, Operational Safety on Airports During Construction.

70-09 Use of explosives. The use of explosives is not permitted on this project.

70-10 Protection and restoration of property and landscape. The Contractor shall be responsible for the preservation of all public and private property, and shall protect carefully from disturbance or damage all land monuments and property markers until the Engineer/RPR has witnessed or otherwise referenced their location and shall not move them until directed.

The Contractor shall be responsible for all damage or injury to property of any character, during the execution of the work, resulting from any act, omission, neglect, or misconduct in manner or method of executing the work, or at any time due to defective work or materials, and said responsibility shall not be released until the project has been completed and accepted.

When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work, or in consequence of the non-execution thereof by the Contractor, the Contractor shall restore, at their expense, such property to a condition similar or equal to that existing before such damage or injury was done, by repairing, or otherwise restoring as may be directed, or the Contractor shall make good such damage or injury in an acceptable manner.

70-11 Responsibility for damage claims. The Contractor shall indemnify and hold harmless the Engineer/RPR and the Owner and their officers, agents, and employees from all suits, actions, or claims, of any character, brought because of any injuries or damage received or sustained by any person, persons, or property on account of the operations of the Contractor; or on account of or in consequence of any neglect in safeguarding the work; or through use of unacceptable materials in constructing the work; or because of any act or omission, neglect, or misconduct of said Contractor; or because of any claims or amounts recovered from any infringements of patent, trademark, or copyright; or from any claims or amounts arising or recovered under the "Workmen's Compensation Act," or any other law, ordinance, order, or decree. Money due the Contractor under and by virtue of their own contract considered necessary by the Owner for such purpose may be retained for the use of the Owner or, in case no money is due, their own surety may be held until such suits, actions, or claims for injuries or damages shall have been settled and suitable evidence to that effect furnished to the Owner, except that money due the Contractor will not be withheld when the Contractor produces satisfactory evidence that he or she is adequately protected by public liability and property damage insurance.

70-12 Third party beneficiary clause. It is specifically agreed between the parties executing the contract that it is not intended by any of the provisions of any part of the contract to create for the public or any member thereof, a third-party beneficiary or to authorize anyone not a party to the contract to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of the contract.

70-13 Opening sections of the work to traffic. If it is necessary for the Contractor to complete portions of the contract work for the beneficial occupancy of the Owner prior to completion of the entire contract, such “phasing” of the work must be specified below and indicated on the approved Construction Safety and Phasing Plan (CSPP) and the project plans. When so specified, the Contractor shall complete such portions of the work on or before the date specified or as otherwise specified. Upon completion of any portion of work listed above, such portion shall be accepted by the Owner in accordance with Section 50, paragraph 50-14, *Partial Acceptance*.

No portion of the work may be opened by the Contractor until directed by the Owner in writing. Should it become necessary to open a portion of the work to traffic on a temporary or intermittent basis, such openings shall be made when, in the opinion of the RPR, such portion of the work is in an acceptable condition to support the intended traffic. Temporary or intermittent openings are considered to be inherent in the work and shall not constitute either acceptance of the portion of the work so opened or a waiver of any provision of the contract. Any damage to the portion of the work so opened that is not attributable to traffic which is permitted by the Owner shall be repaired by the Contractor at their expense.

The Contractor shall make their own estimate of the inherent difficulties involved in completing the work under the conditions herein described and shall not claim any added compensation by reason of delay or increased cost due to opening a portion of the contract work.

The Contractor must conform to safety standards contained AC 150/5370-2 and the approved CSPP.

Contractor shall refer to the plans, specifications, and the approved CSPP to identify barricade requirements, temporary and/or permanent markings, airfield lighting, guidance signs and other safety requirements prior to opening up sections of work to traffic.

70-14 Contractor’s responsibility for work. Until the RPR’s final written acceptance of the entire completed work, excepting only those portions of the work accepted in accordance with Section 50, paragraph 50-14, *Partial Acceptance*, the Contractor shall have the charge and care thereof and shall take every precaution against injury or damage to any part due to the action of the elements or from any other cause, whether arising from the execution or from the non-execution of the work. The Contractor shall rebuild, repair, restore, and make good all injuries or damages to any portion of the work occasioned by any of the above causes before final acceptance and shall bear the expense thereof except damage to the work due to unforeseeable causes beyond the control of and without the fault or negligence of the Contractor, including but not restricted to acts of God such as earthquake, tidal wave, tornado, hurricane or other cataclysmic phenomenon of nature, or acts of the public enemy or of government authorities. If the work is suspended for any cause whatever, the Contractor shall be responsible for the work and shall take such precautions necessary to prevent damage to the work. The Contractor shall provide for normal drainage and shall erect necessary temporary structures, signs, or other facilities at their own expense. During such period of suspension of work, the Contractor shall properly and continuously maintain in an acceptable growing condition all living material in newly established planting, seeding, and sodding furnished under the contract, and shall take adequate precautions to protect new tree growth and other important vegetative growth against injury.

70-15 Contractor’s responsibility for utility service and facilities of others. As provided in paragraph 70-04, *Restoration of Surfaces Disturbed by Others*, the Contractor shall cooperate with the owner of any public or private utility service, FAA or NOAA, or a utility service of another government agency that may be authorized by the Owner to construct, reconstruct or maintain such utility services or facilities during the progress of the work. In addition, the Contractor shall control their operations to prevent the unscheduled interruption of such utility services and facilities.

To the extent that such public or private utility services, FAA, or NOAA facilities, or utility services of another governmental agency are known to exist within the limits of the contract work, the approximate locations have been indicated on the plans and/or in the contract documents.

See Plans.

It is understood and agreed that the Owner does not guarantee the accuracy or the completeness of the location information relating to existing utility services, facilities, or structures that may be shown on the plans or

encountered in the work. Any inaccuracy or omission in such information shall not relieve the Contractor of the responsibility to protect such existing features from damage or unscheduled interruption of service. It is further understood and agreed that the Contractor shall, upon execution of the contract, notify the Owners of all utility services or other facilities of their plan of operations. Such notification shall be in writing addressed to "The Person to Contact" as provided in this paragraph and paragraph 70-04, *Restoration of Surfaces Disturbed By Others*. A copy of each notification shall be given to the RPR.

In addition to the general written notification provided, it shall be the responsibility of the Contractor to keep such individual Owners advised of changes in their plan of operations that would affect such Owners. Prior to beginning the work in the general vicinity of an existing utility service or facility, the Contractor shall again notify each such Owner of their plan of operation. If, in the Contractor's opinion, the Owner's assistance is needed to locate the utility service or facility or the presence of a representative of the Owner is desirable to observe the work, such advice should be included in the notification. Such notification shall be given by the most expeditious means to reach the utility owner's "Person to Contact" no later than two normal business days prior to the Contractor's commencement of operations in such general vicinity. The Contractor shall furnish a written summary of the notification to the RPR.

The Contractor's failure to give the two days' notice shall be cause for the Owner to suspend the Contractor's operations in the general vicinity of a utility service or facility.

Where the outside limits of an underground utility service have been located and staked on the ground, the Contractor shall be required to use hand excavation methods within 3 feet (1 m) of such outside limits at such points as may be required to ensure protection from damage due to the Contractor's operations.

Should the Contractor damage or interrupt the operation of a utility service or facility by accident or otherwise, the Contractor shall immediately notify the proper authority and the RPR and shall take all reasonable measures to prevent further damage or interruption of service. The Contractor, in such events, shall cooperate with the utility service or facility owner and the RPR continuously until such damage has been repaired and service restored to the satisfaction of the utility or facility owner.

The Contractor shall bear all costs of damage and restoration of service to any utility service or facility due to their operations whether due to negligence or accident. The Owner reserves the right to deduct such costs from any monies due or which may become due the Contractor, or their own surety.

70-15.1 FAA facilities and cable runs. Not Applicable

70-16 Furnishing rights-of-way. The Owner will be responsible for furnishing all rights-of-way upon which the work is to be constructed in advance of the Contractor's operations.

70-17 Personal liability of public officials. In carrying out any of the contract provisions or in exercising any power or authority granted by this contract, there shall be no liability upon the Engineer, RPR, their authorized representatives, or any officials of the Owner either personally or as an official of the Owner. It is understood that in such matters they act solely as agents and representatives of the Owner.

70-18 No waiver of legal rights. Upon completion of the work, the Owner will expeditiously make final inspection and notify the Contractor of final acceptance. Such final acceptance, however, shall not preclude or stop the Owner from correcting any measurement, estimate, or certificate made before or after completion of the work, nor shall the Owner be precluded or stopped from recovering from the Contractor or their surety, or both, such overpayment as may be sustained, or by failure on the part of the Contractor to fulfill their obligations under the contract. A waiver on the part of the Owner of any breach of any part of the contract shall not be held to be a waiver of any other or subsequent breach.

The Contractor, without prejudice to the terms of the contract, shall be liable to the Owner for latent defects, fraud, or such gross mistakes as may amount to fraud, or as regards the Owner's rights under any warranty or guaranty.

70-19 Environmental protection. The Contractor shall comply with all federal, state, and local laws and regulations controlling pollution of the environment. The Contractor shall take necessary precautions to prevent pollution of streams, lakes, ponds, and reservoirs with fuels, oils, asphalts, chemicals, or other harmful materials and to prevent pollution of the atmosphere from particulate and gaseous matter.

70-20 Archaeological and historical findings. Unless otherwise specified in this subsection, the Contractor is advised that the site of the work is not within any property, district, or site, and does not contain any building, structure, or object listed in the current National Register of Historic Places published by the United States Department of Interior.

Should the Contractor encounter, during their operations, any building, part of a building, structure, or object that is incongruous with its surroundings, the Contractor shall immediately cease operations in that location and notify the RPR. The RPR will immediately investigate the Contractor's finding and the Owner will direct the Contractor to either resume operations or to suspend operations as directed.

Should the Owner order suspension of the Contractor's operations in order to protect an archaeological or historical finding, or order the Contractor to perform extra work, such shall be covered by an appropriate contract change order or supplemental agreement as provided in Section 40, paragraph 40-04, *Extra Work*, and Section 90, paragraph 90-05, *Payment for Extra Work*. If appropriate, the contract change order or supplemental agreement shall include an extension of contract time in accordance with Section 80, paragraph 80-07, *Determination and Extension of Contract Time*.

70-21 Insurance Requirements. Insurance requirements are in the Okaloosa County Standard Clauses contained in the Front End Documents section of the Project Manual.

END OF SECTION 70

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SECTION 80 – EXECUTION AND PROGRESS

80-01 Subletting of contract. The Owner will not recognize any subcontractor on the work. The Contractor shall at all times when work is in progress be represented either in person, by a qualified superintendent, or by other designated, qualified representative who is duly authorized to receive and execute orders of the Resident Project Representative (RPR).

The Contractor shall perform, with his organization, an amount of work equal to at least **40** percent of the total contract cost.

Should the Contractor elect to assign their contract, said assignment shall be concurred in by the surety, shall be presented for the consideration and approval of the Owner, and shall be consummated only on the written approval of the Owner.

The Contractor shall provide copies of all subcontracts to the RPR [14] days prior to being utilized on the project. As a minimum, the information shall include the following:

- Subcontractor's legal company name.
- Subcontractor's legal company address, including County name.
- Principal contact person's name, telephone and fax number.
- Complete narrative description, and dollar value of the work to be performed by the subcontractor.
- Copies of required insurance certificates in accordance with the specifications.
- Minority/ non-minority status.

80-02 Notice to proceed (NTP). The Owners notice to proceed will state the date on which contract time commences. The Contractor is expected to commence project operations within **10 days** of the NTP date. The Contractor shall notify the RPR at least **24 hours** in advance of the time contract operations begins. The Contractor shall not commence any actual operations prior to the date on which the notice to proceed is issued by the Owner.

80-03 Execution and progress. Unless otherwise specified, the Contractor shall submit their coordinated construction schedule showing all work activities for the RPR's review and acceptance at least **10 days** prior to the start of work. The Contractor's progress schedule, once accepted by the RPR, will represent the Contractor's baseline plan to accomplish the project in accordance with the terms and conditions of the Contract. The RPR will compare actual Contractor progress against the baseline schedule to determine that status of the Contractor's performance. The Contractor shall provide sufficient materials, equipment, and labor to guarantee the completion of the project in accordance with the plans and specifications within the time set forth in the proposal.

If the Contractor falls significantly behind the submitted schedule, the Contractor shall, upon the RPR's request, submit a revised schedule for completion of the work within the contract time and modify their operations to provide such additional materials, equipment, and labor necessary to meet the revised schedule. Should the execution of the work be discontinued for any reason, the Contractor shall notify the RPR at least **24 hours** in advance of resuming operations.

The Contractor shall not commence any actual construction prior to the date on which the NTP is issued by the Owner.

The project schedule shall be prepared as a network diagram in Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), or other format, or as otherwise specified. It shall include information on the sequence of work activities, milestone dates, and activity duration. The schedule shall show all work items identified in the project proposal for each work area and shall include the project start date and end date.

The Contractor shall maintain the work schedule and provide an update and analysis of the progress schedule on a **twice** monthly basis, or as otherwise specified in the contract. Submission of the work schedule shall not relieve the Contractor of overall responsibility for scheduling, sequencing, and coordinating all work to comply with the requirements of the contract.

80-04 Limitation of operations. The Contractor shall control their operations and the operations of their subcontractors and all suppliers to provide for the free and unobstructed movement of aircraft in the air operations areas (AOA) of the airport.

When the work requires the Contractor to conduct their operations within an AOA of the airport, the work shall be coordinated with airport operations (through the RPR) at least **48 hours** prior to commencement of such work. The Contractor shall not close an AOA until so authorized by the RPR and until the necessary temporary marking, signage and associated lighting is in place as provided in Section 70, paragraph 70-08, *Construction Safety and Phasing Plan (CSPP)*.

When the contract work requires the Contractor to work within an AOA of the airport on an intermittent basis (intermittent opening and closing of the AOA), the Contractor shall maintain constant communications as specified; immediately obey all instructions to vacate the AOA; and immediately obey all instructions to resume work in such AOA. Failure to maintain the specified communications or to obey instructions shall be cause for suspension of the Contractor's operations in the AOA until satisfactory conditions are provided. The areas of the AOA identified in the Construction Safety Phasing Plan (CSPP) and as listed below, cannot be closed to operating aircraft to permit the Contractor's operations on a continuous basis and will therefore be closed to aircraft operations intermittently as follows:

See Plans.

The construction limits are not expected to inhibit aircraft operations but baggage cart and other AOA operations will be affected.

The Contractor shall be required to conform to safety standards contained in AC 150/5370-2, Operational Safety on Airports During Construction and the approved CSPP.

80-04.1 Operational safety on airport during construction. All Contractors' operations shall be conducted in accordance with the approved project Construction Safety and Phasing Plan (CSPP) and the Safety Plan Compliance Document (SPCD) and the provisions set forth within the current version of AC 150/5370-2, Operational Safety on Airports During Construction. The CSPP included within the contract documents conveys minimum requirements for operational safety on the airport during construction activities. The Contractor shall prepare and submit a SPCD that details how it proposes to comply with the requirements presented within the CSPP.

The Contractor shall implement all necessary safety plan measures prior to commencement of any work activity.

The Contractor shall conduct routine checks to assure compliance with the safety plan measures.

The Contractor is responsible to the Owner for the conduct of all subcontractors it employs on the project. The Contractor shall assure that all subcontractors are made aware of the requirements of the CSPP and SPCD and that they implement and maintain all necessary measures.

No deviation or modifications may be made to the approved CSPP and SPCD unless approved in writing by the Owner. The necessary coordination actions to review Contractor proposed modifications to an approved CSPP or approved SPCD can require a significant amount of time.

80-05 Character of workers, methods, and equipment. The Contractor shall, at all times, employ sufficient labor and equipment for prosecuting the work to full completion in the manner and time required by the contract, plans, and specifications.

All workers shall have sufficient skill and experience to perform properly the work assigned to them. Workers engaged in special work or skilled work shall have sufficient experience in such work and in the operation of the equipment required to perform the work satisfactorily.

Any person employed by the Contractor or by any subcontractor who violates any operational regulations or operational safety requirements and, in the opinion of the RPR, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the RPR, be removed immediately by the Contractor or subcontractor employing such person, and shall not be employed again in any portion of the work without approval of the RPR.

Should the Contractor fail to remove such person or persons, or fail to furnish suitable and sufficient personnel for the proper execution of the work, the RPR may suspend the work by written notice until compliance with such orders.

All equipment that is proposed to be used on the work shall be of sufficient size and in such mechanical condition as to meet requirements of the work and to produce a satisfactory quality of work. Equipment used on any portion of the work shall not cause injury to previously completed work, adjacent property, or existing airport facilities due to its use.

When the methods and equipment to be used by the Contractor in accomplishing the work are not prescribed in the contract, the Contractor is free to use any methods or equipment that will accomplish the work in conformity with the requirements of the contract, plans, and specifications.

When the contract specifies the use of certain methods and equipment, such methods and equipment shall be used unless otherwise authorized by the RPR. If the Contractor desires to use a method or type of equipment other than specified in the contract, the Contractor may request authority from the RPR to do so. The request shall be in writing and shall include a full description of the methods and equipment proposed and of the reasons for desiring to make the change. If approval is given, it will be on the condition that the Contractor will be fully responsible for producing work in conformity with contract requirements. If, after trial use of the substituted methods or equipment, the RPR determines that the work produced does not meet contract requirements, the Contractor shall discontinue the use of the substitute method or equipment and shall complete the remaining work with the specified methods and equipment. The Contractor shall remove any deficient work and replace it with work of specified quality, or take such other corrective action as the RPR may direct. No change will be made in basis of payment for the contract items involved nor in contract time as a result of authorizing a change in methods or equipment under this paragraph.

Any person employed by the Contractor or by a subcontractor who, in the opinion of the Engineer, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the Engineer, be removed forthwith by the Contractor or subcontractor employing such person, and shall not be employed again in any portion of the work without the approval of the Engineer.

Should the Contractor fail to remove such person or persons or fail to furnish suitable and sufficient personnel for the proper prosecution of the work, the Engineer may suspend the work by written notice until compliance with such orders.

The failure to provide adequate labor and equipment may be considered cause for terminating the contract.

80-06 Temporary suspension of the work. The Owner shall have the authority to suspend the work wholly, or in part, for such period or periods the Owner may deem necessary, due to unsuitable weather, or other conditions considered unfavorable for the execution of the work, or for such time necessary due to the failure on the part of the Contractor to carry out orders given or perform any or all provisions of the contract.

In the event that the Contractor is ordered by the Owner, in writing, to suspend work for some unforeseen cause not otherwise provided for in the contract and over which the Contractor has no control, the Contractor may be reimbursed for actual money expended on the work during the period of shutdown. No allowance will be made for anticipated profits. The period of shutdown shall be computed from the effective date of the written order to suspend work to the effective date of the written order to resume the work. Claims for such compensation shall be filed with the RPR within the time period stated in the RPR's order to resume work. The Contractor shall submit with their own claim information substantiating the amount shown on the claim. The RPR will forward the Contractor's claim to the Owner for consideration in accordance with local laws or ordinances. No provision of this article shall be construed as entitling the Contractor to compensation for delays due to inclement weather or for any other delay provided for in the contract, plans, or specifications.

If it becomes necessary to suspend work for an indefinite period, the Contractor shall store all materials in such manner that they will not become an obstruction nor become damaged in any way. The Contractor shall take every precaution to prevent damage or deterioration of the work performed and provide for normal drainage of the work. The Contractor shall erect temporary structures where necessary to provide for traffic on, to, or from the airport.

If the Contractor requests a suspension of the work in whole or part for such period or periods as he may need, due to unsuitable weather or such other conditions as Contractor considers unfavorable for the prosecution of the work, or if ordered by Owner or Engineer due to inclement weather or the failure on the part of the Contractor to carry out orders given, or to perform any or all provisions of the Contractor shall perform the following without additional compensations:

1. Suitably store all materials.
2. Implement measures to protect existing work from damage or deterioration.

3. Erect such temporary structures and barricades as Engineer may require to provide for traffic on, to, or from the airport and air operations area.
4. Periodically inspect and maintain the work and temporary measures during the suspension period. Repair any damage to the work during the suspension period.
5. Pay all cost of Owner associated with the suspension including but not limited to cost of Engineer, inspection and Owner's testing laboratory to perform their contractual requirements with respect to the project during the work suspension.
6. Maintain all insurance and bond coverages.
7. Perform such other work as required by the Contract Documents with respect to the Project.

80-07 Determination and extension of contract time. The number of calendar days or completion date shall be stated in the proposal and contract and shall be known as the Contract Time.

If the contract time requires extension for reasons beyond the Contractor's control, it shall be adjusted as follows:

80-07.1 Contract time based on calendar days. Contract Time based on calendar days shall consist of the number of calendar days stated in the contract counting from the effective date of the Notice to Proceed and including all Saturdays, Sundays, holidays, and non-work days. All calendar days elapsing between the effective dates of the Owner's orders to suspend and resume all work, due to causes not the fault of the Contractor, shall be excluded.

At the time of final payment, the contract time shall be increased in the same proportion as the cost of the actually completed quantities bears to the cost of the originally estimated quantities in the proposal. Such increase in the contract time shall not consider either cost of work or the extension of contract time that has been covered by a change order or supplemental agreement. Charges against the contract time will cease as of the date of final acceptance.

In all cases where the Contractor is delayed, obstructed, or hindered in the execution of the work, or any part thereof, for any reason whatsoever, the Contractor shall not be entitled to claim or recover any damages or additional payment from the Owner or Engineer. However, it is the intent of this Contract that in all cases where the Contractor is substantially delayed, obstructed, or hindered in the execution of the work through no fault of the Contractor and because of conditions beyond the Contractor's control, the Engineer may recommend an extension on the contract time under Subsection 80-07 by such amount as conditions, in the judgment of the Engineer, justify, and such extension of the contract time shall be the exclusive remedy of the Contractor for delay, hindrance or obstruction occurring through no fault of the Contractor and because of conditions beyond the Contractor's control.

80-08 Failure to complete on time. For each calendar day or working day, as specified in the contract, that any work remains uncompleted after the contract time (including all extensions and adjustments as provided in paragraph 80-07, *Determination and Extension of Contract Time*) the sum specified in the contract and proposal as liquidated damages (LD) will be deducted from any money due or to become due the Contractor or their own surety. Such deducted sums shall not be deducted as a penalty but shall be considered as liquidation of a reasonable portion of damages including but not limited to additional engineering services that will be incurred by the Owner should the Contractor fail to complete the work in the time provided in their contract.

See Section 01010 – Summary of Work for construction time and liquidated damages.

80-09 Default and termination of contract. The Contractor shall be considered in default of their contract and such default will be considered as cause for the Owner to terminate the contract for any of the following reasons (non-inclusive), if the Contractor:

- a. Fails to begin the work under the contract within the time specified in the Notice to Proceed, or
- b. Fails to perform the work or fails to provide sufficient workers, equipment and/or materials to assure completion of work in accordance with the terms of the contract, or
- c. Performs the work unsuitably or neglects or refuses to remove materials or to perform anew such work as may be rejected as unacceptable and unsuitable, or
- d. Discontinues the execution of the work, or
- e. Fails to resume work which has been discontinued within a reasonable time after notice to do so, or

- f. Becomes insolvent or is declared bankrupt, or commits any act of bankruptcy or insolvency, or
- g. Allows any final judgment to stand against the Contractor unsatisfied for a period of 10 days, or
- h. Makes an assignment for the benefit of creditors, or
- i. For any other cause whatsoever, fails to carry on the work in an acceptable manner.

Should the Owner consider the Contractor in default of the contract for any reason above (non-inclusive), the Owner shall immediately give written notice to the Contractor and the Contractor's surety as to the reasons for considering the Contractor in default and the Owner's intentions to terminate the contract.

If the Contractor or surety, within a period of 10 days after such notice, does not proceed in accordance therewith, then the Owner will, upon written notification from the RPR of the facts of such delay, neglect, or default and the Contractor's failure to comply with such notice, have full power and authority without violating the contract, to take the execution of the work out of the hands of the Contractor. The Owner may appropriate or use any or all materials and equipment that have been mobilized for use in the work and are acceptable and may enter into an agreement for the completion of said contract according to the terms and provisions thereof, or use such other methods as in the opinion of the RPR will be required for the completion of said contract in an acceptable manner.

All costs and charges incurred by the Owner, together with the cost of completing the work under contract, will be deducted from any monies due or which may become due the Contractor. If such expense exceeds the sum which would have been payable under the contract, then the Contractor and the surety shall be liable and shall pay to the Owner the amount of such excess.

80-10 Termination for national emergencies. The Owner shall terminate the contract or portion thereof by written notice when the Contractor is prevented from proceeding with the construction contract as a direct result of an Executive Order of the President with respect to the execution of war or in the interest of national defense.

When the contract, or any portion thereof, is terminated before completion of all items of work in the contract, payment will be made for the actual number of units or items of work completed at the contract price or as mutually agreed for items of work partially completed or not started. No claims or loss of anticipated profits shall be considered.

Reimbursement for organization of the work, and other overhead expenses, (when not otherwise included in the contract) and moving equipment and materials to and from the job will be considered, the intent being that an equitable settlement will be made with the Contractor.

Acceptable materials, obtained or ordered by the Contractor for the work and that are not incorporated in the work shall, at the option of the Contractor, be purchased from the Contractor at actual cost as shown by receipted bills and actual cost records at such points of delivery as may be designated by the RPR.

Termination of the contract or a portion thereof shall neither relieve the Contractor of their responsibilities for the completed work nor shall it relieve their surety of its obligation for and concerning any just claim arising out of the work performed.

The Engineer and the Owner shall be given full access to all books, cost records, correspondence and papers of the Contractor relating to the contract in order to determine amounts to be paid the Contractor due to any termination of the contract.

80-11 Work area, storage area and sequence of operations. The Contractor shall obtain approval from the RPR prior to beginning any work in all areas of the airport. No operating runway, taxiway, or air operations area (AOA) shall be crossed, entered, or obstructed while it is operational. The Contractor shall plan and coordinate work in accordance with the approved CSPP and SPCD.

END OF SECTION 80

SECTION 90 – MEASUREMENT AND PAYMENT

90-01 Measurement of quantities. All work completed under the contract will be measured by the RPR, or their authorized representatives, using United States Customary Units of Measurement.

The method of measurement and computations to be used in determination of quantities of material furnished and of work performed under the contract will be those methods generally recognized as conforming to good engineering practice.

Unless otherwise specified, longitudinal measurements for area computations will be made horizontally, and no deductions will be made for individual fixtures (or leave-outs) having an area of 9 square feet (0.8 square meters) or less. Unless otherwise specified, transverse measurements for area computations will be the neat dimensions shown on the plans or ordered in writing by the RPR.

Unless otherwise specified, all contract items which are measured by the linear foot such as electrical ducts, conduits, pipe culverts, underdrains, and similar items shall be measured parallel to the base or foundation upon which such items are placed.

The term “lump sum” when used as an item of payment will mean complete payment for the work described in the contract. When a complete structure or structural unit (in effect, “lump sum” work) is specified as the unit of measurement, the unit will be construed to include all necessary fittings and accessories.

When requested by the Contractor and approved by the RPR in writing, material specified to be measured by the cubic yard (cubic meter) may be weighed, and such weights will be converted to cubic yards (cubic meters) for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the RPR and shall be agreed to by the Contractor before such method of measurement of pay quantities is used.

Measurement and Payment Terms

Term	Description
Excavation and Embankment Volume	In computing volumes of excavation, the average end area method will be used unless otherwise specified.
Measurement and Proportion by Weight	The term “ton” will mean the short ton consisting of 2,000 pounds (907 kg) avoirdupois. All materials that are measured or proportioned by weights shall be weighed on accurate, independently certified scales by competent, qualified personnel at locations designated by the RPR. If material is shipped by rail, the car weight may be accepted provided that only the actual weight of material is paid for. However, car weights will not be acceptable for material to be passed through mixing plants. Trucks used to haul material being paid for by weight shall be weighed empty daily at such times as the RPR directs, and each truck shall bear a plainly legible identification mark.
Measurement by Volume	Materials to be measured by volume in the hauling vehicle shall be hauled in approved vehicles and measured therein at the point of delivery. Vehicles for this purpose may be of any size or type acceptable for the materials hauled, provided that the body is of such shape that the actual contents may be readily and accurately determined. All vehicles shall be loaded to at least their water level capacity, and all loads shall be leveled when the vehicles arrive at the point of delivery.
Asphalt Material	Asphalt materials will be measured by the gallon (liter) or ton (kg). When measured by volume, such volumes will be measured at 60°F (16°C) or will be corrected to the volume at 60°F (16°C) using ASTM D1250 for asphalts. Net certified scale weights or weights based on certified volumes in the case of rail shipments will be used as a basis of measurement, subject to correction when asphalt material has been lost from the car or the distributor, wasted, or otherwise not incorporated in the work. When asphalt materials are shipped by truck or transport, net certified weights by volume, subject to correction for loss or foaming, will be used for computing quantities.
Cement	Cement will be measured by the ton (kg) or hundredweight (km).
Structure	Structures will be measured according to neat lines shown on the plans or as altered to fit field conditions.

Term	Description
Timber	Timber will be measured by the thousand feet board measure (MFBM) actually incorporated in the structure. Measurement will be based on nominal widths and thicknesses and the extreme length of each piece.
Plates and Sheets	The thickness of plates and galvanized sheet used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing will be specified and measured in decimal fraction of inch.
Miscellaneous Items	When standard manufactured items are specified such as fence, wire, plates, rolled shapes, pipe conduit, etc., and these items are identified by gauge, unit weight, section dimensions, etc., such identification will be considered to be nominal weights or dimensions. Unless more stringently controlled by tolerances in cited specifications, manufacturing tolerances established by the industries involved will be accepted.
Scales	<p>Scales must be tested for accuracy and serviced before use. Scales for weighing materials which are required to be proportioned or measured and paid for by weight shall be furnished, erected, and maintained by the Contractor, or be certified permanently installed commercial scales. Platform scales shall be installed and maintained with the platform level and rigid bulkheads at each end.</p> <p>Scales shall be accurate within 0.5% of the correct weight throughout the range of use. The Contractor shall have the scales checked under the observation of the RPR before beginning work and at such other times as requested. The intervals shall be uniform in spacing throughout the graduated or marked length of the beam or dial and shall not exceed 0.1% of the nominal rated capacity of the scale, but not less than one pound (454 grams). The use of spring balances will not be permitted.</p> <p>In the event inspection reveals the scales have been “overweighing” (indicating more than correct weight) they will be immediately adjusted. All materials received subsequent to the last previous correct weighting-accuracy test will be reduced by the percentage of error in excess of 0.5%.</p> <p>In the event inspection reveals the scales have been under-weighing (indicating less than correct weight), they shall be immediately adjusted. No additional payment to the Contractor will be allowed for materials previously weighed and recorded.</p> <p>Beams, dials, platforms, and other scale equipment shall be so arranged that the operator and the RPR can safely and conveniently view them.</p> <p>Scale installations shall have available ten standard 50-pound (2.3 km) weights for testing the weighing equipment or suitable weights and devices for other approved equipment.</p> <p>All costs in connection with furnishing, installing, certifying, testing, and maintaining scales; for furnishing check weights and scale house; and for all other items specified in this subsection, for the weighing of materials for proportioning or payment, shall be included in the unit contract prices for the various items of the project.</p>
Rental Equipment	Rental of equipment will be measured by time in hours of actual working time and necessary traveling time of the equipment within the limits of the work. Special equipment ordered in connection with extra work will be measured as agreed in the change order or supplemental agreement authorizing such work as provided in paragraph 90-05 <i>Payment for Extra Work</i> .
Pay Quantities	When the estimated quantities for a specific portion of the work are designated as the pay quantities in the contract, they shall be the final quantities for which payment for such specific portion of the work will be made, unless the dimensions of said portions of the work shown on the plans are revised by the RPR. If revised dimensions result in an increase or decrease in the quantities of such work, the final quantities for payment will be revised in the amount represented by the authorized changes in the dimensions.

90-02 Scope of payment. The Contractor shall receive and accept compensation provided for in the contract as full payment for furnishing all materials, for performing all work under the contract in a complete and acceptable

manner, and for all risk, loss, damage, or expense of whatever character arising out of the nature of the work or the execution thereof, subject to the provisions of Section 70, paragraph 70-18, *No Waiver of Legal Rights*. When the "basis of payment" subsection of a technical specification requires that the contract price (price bid) include compensation for certain work or material essential to the item, this same work or material will not also be measured for payment under any other contract item which may appear elsewhere in the contract, plans, or specifications.

90-03 Compensation for altered quantities. When the accepted quantities of work vary from the quantities in the proposal, the Contractor shall accept as payment in full, so far as contract items are concerned, payment at the original contract price for the accepted quantities of work actually completed and accepted. No allowance, except as provided for in Section 40, paragraph 40-02, *Alteration of Work and Quantities*, will be made for any increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor which results directly from such alterations or indirectly from their own unbalanced allocation of overhead and profit among the contract items, or from any other cause.

90-04 Payment for omitted items. As specified in Section 40, paragraph 40-03, *Omitted Items*, the RPR shall have the right to omit from the work (order nonperformance) any contract item, except major contract items, in the best interest of the Owner.

Should the RPR omit or order nonperformance of a contract item or portion of such item from the work, the Contractor shall accept payment in full at the contract prices for any work actually completed and acceptable prior to the RPR's order to omit or non-perform such contract item.

Acceptable materials ordered by the Contractor or delivered on the work prior to the date of the RPR's order will be paid for at the actual cost to the Contractor and shall thereupon become the property of the Owner.

In addition to the reimbursement hereinbefore provided, the Contractor shall be reimbursed for all actual costs incurred for the purpose of performing the omitted contract item prior to the date of the RPR's order. Such additional costs incurred by the Contractor must be directly related to the deleted contract item and shall be supported by certified statements by the Contractor as to the nature the amount of such costs.

90-05 Payment for extra work. Extra work, performed in accordance with Section 40, paragraph 40-04, *Extra Work*, will be paid for at the contract prices or agreed prices specified in the change order or supplemental agreement authorizing the extra work.

90-06 Partial payments. Partial payments will be made to the Contractor at least once each month as the work progresses. Said payments will be based upon estimates, prepared by the RPR, of the value of the work performed and materials complete and in place, in accordance with the contract, plans, and specifications. Such partial payments may also include the delivered actual cost of those materials stockpiled and stored in accordance with paragraph 90-07, *Payment for Materials on Hand*. No partial payment will be made when the amount due to the Contractor since the last estimate amounts to less than five hundred dollars.

a. From the total of the amount determined to be payable on a partial payment, **10 percent** of such total amount will be deducted and retained by the Owner for protection of the Owner's interests. Unless otherwise instructed by the Owner, the amount retained by the Owner will be in effect until the final payment is made except as follows:

(1) Contractor may request release of retainage on work that has been partially accepted by the Owner in accordance with Section 50-03. Contractor must provide a certified invoice to the RPR that supports the value of retainage held by the Owner for partially accepted work.

(2) In lieu of retainage, the Contractor may exercise at its option the establishment of an escrow account per paragraph 90-08.

b. The Contractor is required to pay all subcontractors for satisfactory performance of their contracts no later than 30 days after the Contractor has received a partial payment. Contractor must provide the Owner evidence of prompt and full payment of retainage held by the prime Contractor to the subcontractor within 30 days after the subcontractor's work is satisfactorily completed. A subcontractor's work is satisfactorily completed when all the tasks called for in the subcontract have been accomplished and documented as required by the Owner. When the Owner has made an incremental acceptance of a portion of a prime contract, the work of a subcontractor covered by that acceptance is deemed to be satisfactorily completed.

c. When at least 95% of the work has been completed to the satisfaction of the RPR, the RPR shall, at the Owner's discretion and with the consent of the surety, prepare estimates of both the contract value and the cost of the remaining work to be done. The Owner may retain an amount not less than twice the contract value or estimated cost, whichever is greater, of the work remaining to be done. The remainder, less all previous payments and deductions, will then be certified for payment to the Contractor.

It is understood and agreed that the Contractor shall not be entitled to demand or receive partial payment based on quantities of work in excess of those provided in the proposal or covered by approved change orders or supplemental agreements, except when such excess quantities have been determined by the RPR to be a part of the final quantity for the item of work in question.

No partial payment shall bind the Owner to the acceptance of any materials or work in place as to quality or quantity. All partial payments are subject to correction at the time of final payment as provided in paragraph 90-09, *Acceptance and Final Payment*.

The Contractor shall deliver to the Owner a complete release of all claims for labor and material arising out of this contract before the final payment is made. If any subcontractor or supplier fails to furnish such a release in full, the Contractor may furnish a bond or other collateral satisfactory to the Owner to indemnify the Owner against any potential lien or other such claim. The bond or collateral shall include all costs, expenses, and attorney fees the Owner may be compelled to pay in discharging any such lien or claim.

90-07 Payment for materials on hand. Partial payments may be made to the extent of the delivered cost of materials to be incorporated in the work, provided that such materials meet the requirements of the contract, plans, and specifications and are delivered to acceptable sites on the airport property or at other sites in the vicinity that are acceptable to the Owner. Such delivered costs of stored or stockpiled materials may be included in the next partial payment after the following conditions are met:

- a. The material has been stored or stockpiled in a manner acceptable to the RPR at or on an approved site.
- b. The Contractor has furnished the RPR with acceptable evidence of the quantity and quality of such stored or stockpiled materials.
- c. The Contractor has furnished the RPR with satisfactory evidence that the material and transportation costs have been paid.
- d. The Contractor has furnished the Owner legal title (free of liens or encumbrances of any kind) to the material stored or stockpiled.
- e. The Contractor has furnished the Owner evidence that the material stored or stockpiled is insured against loss by damage to or disappearance of such materials at any time prior to use in the work.

It is understood and agreed that the transfer of title and the Owner's payment for such stored or stockpiled materials shall in no way relieve the Contractor of their responsibility for furnishing and placing such materials in accordance with the requirements of the contract, plans, and specifications.

In no case will the amount of partial payments for materials on hand exceed the contract price for such materials or the contract price for the contract item in which the material is intended to be used.

No partial payment will be made for stored or stockpiled living or perishable plant materials.

The Contractor shall bear all costs associated with the partial payment of stored or stockpiled materials in accordance with the provisions of this paragraph.

90-08 Payment of withheld funds. At the Contractor's option, if an Owner withholds retainage in accordance with the methods described in paragraph 90-06 *Partial Payments*, the Contractor may request that the Owner deposit the retainage into an escrow account. The Owner's deposit of retainage into an escrow account is subject to the following conditions:

- a. The Contractor shall bear all expenses of establishing and maintaining an escrow account and escrow agreement acceptable to the Owner.

b. The Contractor shall deposit to and maintain in such escrow only those securities or bank certificates of deposit as are acceptable to the Owner and having a value not less than the retainage that would otherwise be withheld from partial payment.

c. The Contractor shall enter into an escrow agreement satisfactory to the Owner.

d. The Contractor shall obtain the written consent of the surety to such agreement.

90-09 Acceptance and final payment. When the contract work has been accepted in accordance with the requirements of Section 50, paragraph 50-15, *Final Acceptance*, the RPR will prepare the final estimate of the items of work actually performed. The Contractor shall approve the RPR's final estimate or advise the RPR of the Contractor's objections to the final estimate which are based on disputes in measurements or computations of the final quantities to be paid under the contract as amended by change order or supplemental agreement. The Contractor and the RPR shall resolve all disputes (if any) in the measurement and computation of final quantities to be paid within 30 calendar days of the Contractor's receipt of the RPR's final estimate. If, after such 30-day period, a dispute still exists, the Contractor may approve the RPR's estimate under protest of the quantities in dispute, and such disputed quantities shall be considered by the Owner as a claim in accordance with Section 50, paragraph 50-16, *Claims for Adjustment and Disputes*.

After the Contractor has approved, or approved under protest, the RPR's final estimate, and after the RPR's receipt of the project closeout documentation required in paragraph 90-11, *Contractor Final Project Documentation*, final payment will be processed based on the entire sum, or the undisputed sum in case of approval under protest, determined to be due the Contractor less all previous payments and all amounts to be deducted under the provisions of the contract. All prior partial estimates and payments shall be subject to correction in the final estimate and payment.

If the Contractor has filed a claim for additional compensation under the provisions of Section 50, paragraph 50-16, *Claims for Adjustments and Disputes*, or under the provisions of this paragraph, such claims will be considered by the Owner in accordance with local laws or ordinances. Upon final adjudication of such claims, any additional payment determined to be due the Contractor will be paid pursuant to a supplemental final estimate.

90-10 Construction warranty.

a. In addition to any other warranties in this contract, the Contractor warrants that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, workmanship, or design furnished, or performed by the Contractor or any subcontractor or supplier at any tier.

b. This warranty shall continue for a period of one year from the date of final acceptance of the work, except as noted. If the Owner takes possession of any part of the work before final acceptance, this warranty shall continue for a period of one year from the date the Owner takes possession. However, this will not relieve the Contractor from corrective items required by the final acceptance of the project work. Light Emitting Diode emitting diode (LED) light fixtures with the exception of obstruction lighting, must be warranted by the manufacturer for a minimum of four (4) years after date of installation inclusive of all electronics.

c. The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Owner real or personal property, when that damage is the result of the Contractor's failure to conform to contract requirements; or any defect of equipment, material, workmanship, or design furnished by the Contractor.

d. The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for one year from the date of repair or replacement.

e. The Owner will notify the Contractor, in writing, within seven (7) days after the discovery of any failure, defect, or damage.

f. If the Contractor fails to remedy any failure, defect, or damage within 14 days after receipt of notice, the Owner shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

g. With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall: (1) Obtain all warranties that would be given in normal commercial practice; (2) Require all warranties to be executed, in writing, for the benefit of the Owner, as directed by the Owner, and (3) Enforce all warranties for the benefit of the Owner.

h. This warranty shall not limit the Owner's rights with respect to latent defects, gross mistakes, or fraud.

90-11 Contractor Final Project Documentation. Approval of final payment to the Contractor is contingent upon completion and submittal of the items listed below. The final payment will not be approved until the RPR approves the Contractor's final submittal. The Contractor shall:

- a. Provide two (2) copies of all manufacturers warranties specified for materials, equipment, and installations.
- b. Provide weekly payroll records (not previously received) from the general Contractor and all subcontractors.
- c. Complete final cleanup in accordance with Section 40, paragraph 40-08, *Final Cleanup*.
- d. Complete all punch list items identified during the Final Inspection.
- e. Provide complete release of all claims for labor and material arising out of the Contract.
- f. Provide a certified statement signed by the subcontractors, indicating actual amounts paid to the Disadvantaged Business Enterprise (DBE) subcontractors and/or suppliers associated with the project.
- g. When applicable per state requirements, return copies of sales tax completion forms.
- h. Manufacturer's certifications for all items incorporated in the work.
- i. All required record drawings, as-built drawings or as-constructed drawings.
- j. Project Operation and Maintenance (O&M) Manual(s).
- k. Security for Construction Warranty.
- l. Equipment commissioning documentation submitted, if required.

90-12 Liens. Neither the final payment nor any part of the retained percentage shall become due until the Contractor delivers to the Owner: (a) an affidavit stating, if that be in fact, that all subcontractors and suppliers have been paid in full, or if the fact be otherwise, showing the name of each subcontractor and supplier who has not been paid in full and the amount due or to become due each for labor, service or material furnished; (b) consent of surety, if any, to final payment; and (c) if required by Owner, other data establishing payment for satisfaction of all obligations, such as receipt, releases, and waivers of lien arising out of the Contract to the extent and in such form as designated by the Owner

END OF SECTION 90

Section 100



**FAA
Airports**

Required Contract Provisions for Airport Improvement Program and for Obligated Sponsors

Issued on January 29, 2016

Airports (ARP)

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RECORD OF CHANGES

No.	Date	Item	Change
1	1/29/2016	Entire Document	Re-structured document to enhance user understanding of use and applicability; added suggested provisions for "Termination for Cause", "Recovered Materials", "Seismic Safety".
2	6/10/2016	Table 1	Item 10, Distracted Driving: Updated "Dollar Threshold" to \$3,500 to reflect current micro-purchase threshold.
2	6/10/2016	A2, Affirmative Action	Update the reference to the Department of Labor online document to be "Participation Goals for Minority and Females"
2	6/10/2016	A12, Disadvantaged Business Enterprise	<p>A12.3: Changed Title to "Required Provisions"</p> <p>A12.3.1: Corrected starting timeframe for submitting written confirmation from "Owner Notice of Award" to "bid opening"</p> <p>A12.3.1: Provided two sets of last paragraphs to reflect change (7 days to 5 days) that occurs on December 31, 2016.</p> <p>A12.3.2: Moved Race/Gender Neutral language up and renamed heading to reflect text is solicitation language.</p> <p>A12.3.3: Moved and renamed contract clause information and clarified it is for prime contract covered by a DBE program.</p>

REQUIREMENTS

1. Required Contract Provisions

Federal laws and regulations require that recipients of federal assistance (Sponsors) include specific contract provisions in certain contracts, requests for proposals, or invitations to bid.

Certain provisions must be included in all sponsor contracts, regardless of **whether or not** the contracts are federally-funded. This requirement was established when a sponsor accepted the Airport Improvement Program (AIP) grant assurances.

To maintain eligibility of their procurement actions, a sponsor must incorporate applicable contract provisions in all federally-assisted procurement and contract documents, including all subcontracts. For purposes of determining requirements for contract provisions, the term **contract** includes subcontracts.

2. Sponsor Requirements

In general, the sponsor must:

- 1) Incorporate applicable contract provisions in each contract funded under AIP;
 - a. Except as noted herein, a sponsor must physically incorporate the text of the provision within the procurement documents.
 - b. Where specifically noted, sponsors may incorporate select provisions by reference provided the sponsor indicates that the reference has the same force and effect as if given in full text.
- 2) Require the contractor (including all subcontractors) to insert these contract provisions in each lower tier contracts (e.g. subcontract or sub-agreement);
- 3) Require the contractor (or subcontractor) to incorporate the applicable requirements of these contract provisions by reference for work done under any purchase orders, rental agreements and other agreements for supplies or services;
- 4) Require that the prime contractor be responsible for compliance with these contract provisions by any subcontractor, lower-tier subcontractor or service provider;
- 5) Verify that any required local or State provision does not conflict with, or alter a Federal law or regulation.

3. Incorporation of Provisions

The statutes and regulations that establish the requirements for contract provisions do not always specify language the sponsor must use to address the requirement. Appendix A of this guide provides information on when a provision or clause has mandatory language that a sponsor must apply. Refer to the subheading *Applicability* for each provision.

Whenever a clause or provision has mandatory text, the sponsor must incorporate the text of the provision without change. The only exception to this restriction is for those instances within the provision text that require the sponsor to insert appropriate information such as name or value. To align with the sponsor's standard contract language, the word "Owner" may also be replaced with "Airport

Authority” or their standard method of referring to the sponsor in contracts. Any modification beyond what is specifically permitted is not permitted and may invalidate the clause.

For those provisions that do not have required language, this guidance provides model language acceptable to the FAA in meeting the intent and purpose of the law or regulation. Some sponsors may already have standard procurement language that is equivalent to those Federal provisions that do not have explicit mandatory language. In these cases, sponsors may use their existing standard procurement provision language provided the text meets the intent and purpose of the Federal law or regulation.

Contract clause language must be made available to bidders. The Sponsor does this by including the required language in Requests for Bids, Notices to Bidders, or in the contract.

4. Requests for Bids (Advertisement) and Notice to Bidders

The sponsor may incorporate certain provisions *by reference* in the Request for Bids (the Advertisement) rather than including the entire text of the provision in the Request or Notice to Bidders. The sponsor must incorporate the full text of these provisions within any contract that originates from the procurement action. The provisions that can be incorporated by reference in the Request or Notice are:

- 1) Buy American Preference
- 2) Foreign Trade Restriction
- 3) Davis Bacon
- 4) Affirmative Action
- 5) Government-wide Debarment and Suspension
- 6) Government-wide Requirements for Drug-free Workplace

5. Requirements For All Contracts Entered into by Obligated Sponsors.

A sponsor’s acceptance of previous grant assurances obligates them to include certain notifications in all contracts and procurement actions they undertake regardless of funding source. Contracts and agreements fully funded by the sponsor must incorporate those select provisions.

6. Failure to Comply with Provisions

Sponsor failure to incorporate required provisions will jeopardize AIP eligibility of the sponsor’s project. Contractor failure to comply with the terms of these contract provisions may be sufficient grounds to:

- 1) Withhold progress payments or final payment;
- 2) Terminate the contract for cause;
- 3) Seek suspension/debarment; or
- 4) Take other action determined to be appropriate by the sponsor or the FAA.

7. Applicability Matrix for Contract Provisions

[Table 1](#) summarizes the applicability of contract provisions based upon the type of contract or agreement. The dollar threshold represents the value at which, when equal to or exceeded, the sponsor must incorporate the provision in their contract or agreement. Supplemental information addressing applicability and use for each provision is located in Appendix A.

Meaning of cell values

- REQD - a provision the sponsor must incorporate in their procurement action.
- Limited –a provision with limited applicability depending on circumstances of the procurement.
- n/a – a provision that is not applicable for that procurement type.

Table 1 – Applicability of Provisions

Provision	Dollar Threshold	Professional Services	Construction	Equipment	Property (Land)	Non-AIP Contracts
a. Access to Records and Reports	\$ 0	REQD	REQD	REQD	REQD	n/a
b. Buy American Preferences	\$ 0	Limited	REQD	REQD	Limited	n/a
(1) Buy American Statement	\$ 0	Limited	REQD	REQD	Limited	n/a
(3) Buy American – Manufactured Product	\$ 0	Limited	REQD	REQD	Limited	n/a
c. Civil Rights – General	\$ 0	REQD	REQD	REQD	REQD	REQD
d. Civil Rights - Title VI Assurances	\$ 0	REQD	REQD	REQD	REQD	REQD
(1) Notice - Solicitation	\$ 0	REQD	REQD	REQD	REQD	REQD
(2) Clause - Contracts	\$ 0	REQD	REQD	REQD	REQD	REQD
(3) List – Pertinent Authorities	\$0	REQD	REQD	REQD	REQD	REQD
e. Disadvantaged Business Enterprise	\$ 0	REQD	REQD	REQD	REQD	n/a
f. Energy Conservation Requirements	\$ 0	REQD	REQD	REQD	REQD	n/a
g. Federal Fair Labor Standards Act	\$ 0	REQD	REQD	REQD	REQD	REQD
h. Occupational Safety and Health Act	\$ 0	REQD	REQD	REQD	REQD	REQD
i. Trade Restriction Certification	\$ 0	REQD	REQD	REQD	REQD	n/a
j. Veteran’s Preference	\$ 0	REQD	REQD	REQD	REQD	n/a
k.						
l. Copeland Anti-Kickback	\$ 2,000	Limited	REQD	Limited	Limited	n/a
m. Davis Bacon Requirements	\$ 2,000	Limited	REQD	Limited	Limited	n/a
m. Distracted Driving	\$3,500	REQD	REQD	REQD	REQD	n/a
o. Affirmative Action Requirement	\$10,000	Limited	REQD	Limited	Limited	n/a
p. Equal Employment Opportunity	\$10,000	Limited	REQD	Limited	Limited	n/a
(1) EEO Contract Clause	\$10,000	Limited	REQD	Limited	Limited	n/a
(2) EEO Specification	\$10,000	Limited	REQD	Limited	Limited	n/a
q. Prohibition of Segregated Facilities	\$10,000	Limited	REQD	Limited	Limited	n/a
r. Recovered Materials	\$10,000	Limited	REQD	REQD	Limited	n/a
s. Termination of Contract	\$10,000	REQD	REQD	REQD	REQD	n/a
t. Debarment and Suspension	\$25,000	REQD	REQD	REQD	Limited	n/a
u. Contract Work Hours and Safety Standards	\$100,000	Limited	REQD	Limited	Limited	n/a
v. Lobbying Federal Employees	\$ 100,000	REQD	REQD	REQD	REQD	n/a
w. Breach of Contract	\$150,000	REQD	REQD	REQD	REQD	n/a
x. Clean Air/Water Pollution Control	\$150,000	REQD	REQD	REQD	REQD	n/a

APPENDIX A – CONTRACT PROVISIONS

A1 ACCESS TO RECORDS AND REPORTS

A1.1 SOURCE

2 CFR § 200.333

2 CFR § 200.336

FAA Order 5100.38

A1.2 APPLICABILITY

2 CFR § 200.333 requires a sponsor to retain records pertinent to a Federal award for a period of three years from submission of final closure documents. 2 CFR § 200.336 establishes that sponsors must provide Federal entities the right to access records pertinent to the Federal award. FAA policy extends these requirements to the sponsor's contracts and subcontracts of AIP funded projects.

Contract Types – The sponsor must include this provision in all contracts and subcontracts of AIP funded projects.

Use of Provision – The regulation does not prescribe mandatory language, the following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor's language must fully satisfy the requirements of part 200.

A1.3 CONTRACT CLAUSE

ACCESS TO RECORDS AND REPORTS

The Contractor must maintain an acceptable cost accounting system. The Contractor agrees to provide the sponsor, the Federal Aviation Administration, and the Comptroller General of the United States or any of their duly authorized representatives, access to any books, documents, papers, and records of the contractor which are directly pertinent to the specific contract for the purpose of making audit, examination, excerpts and transcriptions. The Contractor agrees to maintain all books, records and reports required under this contract for a period of not less than three years after final payment is made and all pending matters are closed.

A2 AFFIRMATIVE ACTION REQUIREMENT

A2.1 SOURCE

41 CFR part 60-4

Executive Order 11246

A2.2 APPLICABILITY

Minority Participation. Sponsors are required to set goals for minority participation in AIP funded projects. The goals for minority participation depend on Economic Area (EA) and Standard Metropolitan Statistical Area (SMSA) as established in Volume 45 of the Federal Register dated 10/3/80. Page 65984 contains a table of all EAs and SMSAs and the associated minority participation goals.

To find the goals for minority participation, a sponsor must either refer to the Federal Register Notice or to the Department of Labor online document, "[Participation Goals for Minorities and Females](#)". EA's and SMSA's cross state boundaries so a sponsor may have to refer to entries for adjacent states to find their project location.

A sponsor must insert the applicable percentage minority goal. Sponsor must not simply insert a reference to the Federal Register Notice.

Female Participation. Executive Order 11246 has set a goal of 6.9% nationally for female participation for all construction contractors. This value does not change per county or state.

Contract Types –

Construction: The sponsor must incorporate this notice in all solicitations for bids or requests for proposals for AIP funded construction work contracts and subcontracts that exceed \$10,000. Construction work means construction, rehabilitation, alteration, conversion, extension, demolition or repair of buildings, highways, or other changes or improvements to real property, including facilities providing utility services. The term also includes the supervision, inspection, and other onsite functions incidental to the actual construction.

Equipment: The sponsor must incorporate this notice in any equipment project exceeding \$10,000 that involves installation of equipment onsite (e.g. electrical vault equipment). This provision does not apply to equipment acquisition projects where the manufacture of the equipment takes place offsite at the vendor plant (e.g. firefighting and snow removal vehicles)

Professional Services: The sponsor must incorporate this notice in any professional service agreement if the professional service agreement includes construction work (as defined above) that exceed \$10,000. Examples include installation of noise monitoring systems.

Property/Land: The sponsor must incorporate this notice in any agreement associated with land acquisition if the agreement includes construction work (defined above) that exceeds \$10,000. Examples include demolition of structures or installation of boundary fencing.

Use of Provision – The sponsor must incorporate the text of this provision without modification. The sponsor must incorporate the established minority participation goal and the covered area by geographic name within the provision text.

A2.3 CONTRACT CLAUSE

NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION to ENSURE EQUAL EMPLOYMENT OPPORTUNITY

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.
2. The goals and timetables for minority and female participation, expressed in percentage terms for the contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Timetables

Goals for minority participation for each trade: **15.4%**

Goals for female participation in each trade: 6.9%

These goals are applicable to all of the contractor's construction work (whether or not it is Federal or federally-assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and non-federally involved construction.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs (OFCCP) within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

4. As used in this notice and in the contract resulting from this solicitation, the "covered area" is **Okaloosa County, Florida.**

A3 BREACH OF CONTRACT TERMS

A3.1 SOURCE

2 CFR § 200 Appendix II(A)

A3.2 APPLICABILITY

This provision requires sponsors to incorporate administrative, contractual or legal remedies if contractors violate or breach contract terms. The sponsor must also include appropriate sanctions and penalties.

Contract Types – This provision is required for all contracts that exceed the simplified acquisition threshold as stated in 2 CFR Part 200, Appendix II (A). This threshold is occasionally adjusted for inflation, and is now equal to \$150,000.

Use of Provision – The regulation does not prescribe mandatory language. The following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor’s language must fully satisfy the requirements of part 200. Select either “contractor” or “consultant” as applicable.

A3.3 CONTRACT CLAUSE

BREACH OF CONTRACT TERMS

Any violation or breach of terms of this contract on the part of the contractor or its subcontractors may result in the suspension or termination of this contract or such other action that may be necessary to enforce the rights of the parties of this agreement.

Owner will provide *Contractor* written notice that describes the nature of the breach and corrective actions the *Contractor* must undertake in order to avoid termination of the contract. Owner reserves the right to withhold payments to Contractor until such time the Contractor corrects the breach or the Owner elects to terminate the contract. The Owner’s notice will identify a specific date by which the *Contractor* must correct the breach. Owner may proceed with termination of the contract if the *Contractor* fails to correct the breach by deadline indicated in the Owner’s notice.

The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder are in addition to, and not a limitation of, any duties, obligations, rights and remedies otherwise imposed or available by law.

A4 BUY AMERICAN PREFERENCE

A4.1 SOURCE

Title 49 USC § 50101

A4.2 APPLICABILITY

The Buy-American Preference requirement in 49 USC § 50101 requires that all steel and manufactured goods used on AIP projects be produced in the United States. The statute gives the FAA the ability to issue a waiver to a sponsor to use non-domestic material on the AIP funded project. The sponsor may request that the FAA issue a waiver from the Buy American Preference requirements if the FAA finds that:

- 1) Applying the provision is not in the public interest;
- 2) The steel or manufactured goods are not available in sufficient quantity or quality in the United States;
- 3) The cost of components and subcomponents produced in the United States is more than 60 percent of the total components of a facility or equipment, and final assembly has taken place in the United States. Items that have an FAA standard specification item number (such as specific airport lighting equipment) are considered the equipment.
- 4) Applying this provision would increase the cost of the overall project by more than 25 percent.

Timing of Waiver Requests. The sponsor must submit Type 1 or Type 2 waiver requests *before* issuing a solicitation for bids or a request for proposal for a project.

The sponsor must submit Type 3 or Type 4 waiver requests *prior* to executing the contract. The FAA will generally not consider waiver requests after execution of the contract except where extraordinary only if extenuating circumstances exist. The FAA cannot review incomplete waiver requests or requests that the Sponsor has not reviewed for adequacy. Sponsor must assess the adequacy of the waiver request before forwarding the request to the FAA.

Buy American Conformance List. The FAA Office of Airports maintains a listing of equipment that has received National waivers from the Buy American Preference requirements or that fully meet the Buy American requirements. This Buy American Conformance List is available online at www.faa.gov/airports/aip/buy_american/. Products listed on the Buy American Conformance list do not require a project specific Buy American Preference requirement waiver from the FAA.

Facility Waiver Requests. For construction of a facility, the sponsor may submit the waiver request after bid opening, but prior to contract execution. Examples of facility construction include terminal buildings, terminal renovation, and snow removal equipment buildings.

Contract Types –

Construction and Equipment - The sponsor must meet the Buy American Preference requirements of 49 USC § 50101 for all AIP funded projects that require steel or manufactured goods. The Buy America requirements flow down from the sponsor to first tier contractors, who

are responsible for ensuring that lower tier contractors and subcontractors are also in compliance.

Note: the Buy American Preference does not apply to equipment a contractor uses as a tool of their trade and does not remain as part of the project.

Professional Services – Professional service agreements (PSA) do not normally result in a deliverable that meets the definition of a manufactured product. However, the emergence of different project delivery methods has created situations where task deliverables may include a manufactured product. If a PSA includes providing a manufactured good as part of the contract, the sponsor must include the Buy American Preference provision in the agreement.

Property – Most land transactions do not involve acquiring a manufactured product. However, under certain circumstances, a property acquisition project could result in the installation of a manufactured product. For example, the installation of property fencing, gates, doors and locks, etc. represent manufactured products acquired under the AIP funded project that must meet the Buy American Preference.

Use of Provision – The regulation does not prescribe mandatory language, the following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor’s revised language must fully comply with 49 USC § 50101.

There are two types of Buy American certifications. The sponsor must incorporate the appropriate “Certificate of Buy America Compliance” in the solicitation:

- Projects for a facility (Buildings such as Terminal, SRE, ARFF, etc.) – Insert the Certificate of Compliance Based on Total Facility
- Projects for non-facility development (non-building construction projects such as runway or roadway construction; or equipment acquisition projects) – Insert the Certificate of Compliance Based on Equipment and Materials Used on the Project.

A4.3 CONTRACT CLAUSE

A4.3.1 Buy American Preference Statement

BUY AMERICAN PREFERENCE

The contractor agrees to comply with 49 USC § 50101, which provides that Federal funds may not be obligated unless all steel and manufactured goods used in AIP funded projects are produced in the United States, unless the FAA has issued a waiver for the product; the product is listed as an Excepted Article, Material Or Supply in Federal Acquisition Regulation subpart 25.108; or is included in the FAA Nationwide Buy American Waivers Issued list.

A bidder or offeror must complete and submit the Buy America certification included herein with their bid or offer. The Owner will reject as nonresponsive any bid or offer that does not include a completed Certificate of Buy American Compliance.

A4.3.2

A4.3.3 Certificate of Buy American Compliance – Manufactured Product

Certificate of Buy American Compliance for Manufactured Products

As a matter of bid responsiveness, the bidder or offeror must complete, sign, date, and submit this certification statement with their proposal. The bidder or offeror must indicate how they intend to comply with 49 USC § 50101 by selecting one on the following certification statements. These statements are mutually exclusive. Bidder must select one or the other (not both) by inserting a checkmark (✓) or the letter “X”.

- Bidder or offeror hereby certifies that it will comply with 49 USC § 50101 by:
- a) Only installing steel and manufactured products produced in the United States, or;
 - b) Installing manufactured products for which the FAA has issued a waiver as indicated by inclusion on the current FAA Nationwide Buy American Waivers Issued listing, or;
 - c) Installing products listed as an Excepted Article, Material or Supply in Federal Acquisition Regulation Subpart 25.108.

By selecting this certification statement, the bidder or offeror agrees:

1. To provide to the Owner evidence that documents the source and origin of the steel and manufactured product.
2. To faithfully comply with providing US domestic product
3. To furnish US domestic product for any waiver request that the FAA rejects
4. To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

- The bidder or offeror hereby certifies it cannot comply with the 100% Buy American Preferences of 49 USC § 50101(a) but may qualify for either a Type 3 or Type 4 waiver under 49 USC § 50101(b). By selecting this certification statement, the apparent bidder or offeror with the apparent low bid agrees:

1. To the submit to the Owner within 15 calendar days of the bid opening, a formal waiver request and required documentation that support the type of waiver being requested.
2. That failure to submit the required documentation within the specified timeframe is cause for a non-responsive determination may result in rejection of the proposal.
3. To faithfully comply with providing US domestic products at or above the approved US domestic content percentage as approved by the FAA.
4. To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

Required Documentation

Type 3 Waiver - The cost of the item components and subcomponents produced in the United States is more that 60% of the cost of all components and subcomponents of the “item”. The required documentation for a type 3 waiver is:

- a) Listing of all product components and subcomponents that are not comprised of 100% US domestic content (Excludes products listed on the FAA Nationwide Buy American

Waivers Issued listing and products excluded by Federal Acquisition Regulation Subpart 25.108; products of unknown origin must be considered as non-domestic products in their entirety).

- b) Cost of non-domestic components and subcomponents, excluding labor costs associated with final assembly at place of manufacture.
- c) Percentage of non-domestic component and subcomponent cost as compared to total “item” component and subcomponent costs, excluding labor costs associated with final assembly at place of manufacture.

Type 4 Waiver – Total cost of project using US domestic source product exceeds the total project cost using non-domestic product by 25%. The required documentation for a type 4 of waiver is:

- a) Detailed cost information for total project using US domestic product
- b) Detailed cost information for total project using non-domestic product

False Statements: Per 49 USC § 47126, this certification concerns a matter within the jurisdiction of the Federal Aviation Administration and the making of a false, fictitious or fraudulent certification may render the maker subject to prosecution under Title 18, United States Code.

USE FORM PROVIDED IN BID FORMS SECTION

A5 CIVIL RIGHTS - GENERAL

A5.1 SOURCE

49 USC § 47123

A5.2 APPLICABILITY

Note: This provision is in addition to the Civil Rights – Title VI provisions.

Contract Types – The General Civil Rights Provisions found in 49 USC § 47123, derived from the Airport and Airway Improvement Act of 1982, Section 520, apply to all sponsor contracts regardless of funding source.

Use of Provision – There are two versions of this provision. One applies to sponsor contracts and the other applies to sponsor lease agreements and transfer agreements. The sponsor must incorporate the text of the appropriate provision without modification.

A5.3 CONTRACT CLAUSE

A5.3.1 Sponsor Contracts

GENERAL CIVIL RIGHTS PROVISIONS

The contractor agrees to comply with pertinent statutes, Executive Orders and such rules as are promulgated to ensure that no person shall, on the grounds of race, creed, color, national origin, sex,

age, or disability be excluded from participating in any activity conducted with or benefiting from Federal assistance.

This provision binds the contractor and subtier contractors from the bid solicitation period through the completion of the contract. This provision is in addition to that required of Title VI of the Civil Rights Act of 1964.

A5.3.2 Sponsor Lease Agreements and Transfer Agreements

GENERAL CIVIL RIGHTS PROVISIONS

The tenant/concessionaire/lessee and its transferee agree to comply with pertinent statutes, Executive Orders and such rules as are promulgated to ensure that no person shall, on the grounds of race, creed, color, national origin, sex, age, or disability be excluded from participating in any activity conducted with or benefiting from Federal assistance.

This provision obligates the tenant/concessionaire/lessee or its transferee for the period during which Federal assistance is extended to the airport through the Airport Improvement Program.

In cases where Federal assistance provides, or is in the form of personal property; real property or interest therein; structures or improvements thereon, this provision obligates the party or any transferee for the longer of the following periods:

- (a) The period during which the property is used by the airport sponsor or any transferee for a purpose for which Federal assistance is extended, or for another purpose involving the provision of similar services or benefits; or
- (b) The period during which the airport sponsor or any transferee retains ownership or possession of the property.

A6 CIVIL RIGHTS – TITLE VI ASSURANCE

A6.1 SOURCE

49 USC § 47123

FAA Order 1400.11

A6.2 APPLICABILITY

Title VI of the Civil Rights Act of 1964, as amended, (Title VI) prohibits discrimination on the grounds of race, color, or national origin under any program or activity receiving Federal financial assistance. Sponsors must include appropriate clauses from the Standard DOT Title VI Assurances in all contracts and solicitations.

The clauses are as follows:

A6.2.1 Applicability of Title VI Solicitation Notice

Contract Clause	The Sponsor must include the contract clause in:	Clause Text is Included in Paragraph
Title VI Solicitation Notice	<ol style="list-style-type: none">1) All solicitations for bids, requests for proposals work, or material subject to the nondiscrimination acts and regulations made in connection with Airport Improvement Program grants; and2) All proposals for negotiated agreements regardless of funding source.	A6.3.1
Title VI Clauses for Compliance with Nondiscrimination Requirements	Every contract or agreement, unless the sponsor has determined and the FAA concurs, that the contract or agreement is not subject to the Nondiscrimination Acts and Authorities	A6.3.2
Title VI Required Clause for Property Interests Transferred from the United States	As a covenant running with the land, in any deed from the United States effecting or recording a transfer of real property, structures, use, or improvements thereon or interest therein to a sponsor.	A6.3.3

Contract Clause	The Sponsor must include the contract clause in:	Clause Text is Included in Paragraph
Title VI Required Clause for Transfer of Real Property Acquired or Improved Under the Activity, Facility or Program	As a covenant running with the land, in any future deeds, leases, licenses, permits, or similar instruments entered into by the sponsor with other parties for all transfers of real property acquired or improved under the activity, facility, or program	A6.3.4
Clauses for Construction/Use/Access to Real Property Acquired Under the Activity, Facility or Program	As a covenant running with the land, in any future deeds, leases, licenses, permits, or similar instruments entered into by the sponsor with other parties for the construction or use of, or access to, space on, over, or under real property acquired or improved under the applicable activity, project, or program	A6.3.5
Title VI List Of Pertinent Nondiscrimination Acts And Authorities	Insert this list in every contract or agreement, unless the sponsor has determined and the FAA concurs, that the contract or agreement is not subject to the Nondiscrimination Acts and Authorities	A6.3.6

A6.3 CONTRACT CLAUSE

A6.3.1 Title VI Solicitation Notice

Title VI Solicitation Notice:

The **(Name of Sponsor)**, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. §§ 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

A6.3.2 Title VI Clauses for Compliance with Nondiscrimination Requirements

Compliance with Nondiscrimination Requirements

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the “contractor”) agrees as follows:

1. **Compliance with Regulations:** The contractor (hereinafter includes consultants) will comply with the Title VI List of Pertinent Nondiscrimination Acts And Authorities, as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.
2. **Non-discrimination:** The contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor will not participate directly or indirectly in the discrimination prohibited by the Nondiscrimination Acts and Authorities, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR part 21.
3. **Solicitations for Subcontracts, Including Procurements of Materials and Equipment:** In all solicitations, either by competitive bidding, or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the contractor of the contractor’s obligations under this contract and the Nondiscrimination Acts And Authorities on the grounds of race, color, or national origin.
4. **Information and Reports:** The contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the sponsor or the Federal Aviation Administration to be pertinent to ascertain compliance with such Nondiscrimination Acts And Authorities and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the contractor will so certify to the sponsor or the Federal Aviation Administration, as appropriate, and will set forth what efforts it has made to obtain the information.
5. **Sanctions for Noncompliance:** In the event of a contractor’s noncompliance with the Non-discrimination provisions of this contract, the sponsor will impose such contract sanctions as it or the Federal Aviation Administration may determine to be appropriate, including, but not limited to:
 - a. Withholding payments to the contractor under the contract until the contractor complies; and/or
 - b. Cancelling, terminating, or suspending a contract, in whole or in part.

6. **Incorporation of Provisions:** The contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations and directives issued pursuant thereto. The contractor will take action with respect to any subcontract or procurement as the sponsor or the Federal Aviation Administration may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the contractor may request the sponsor to enter into any litigation to protect the interests of the sponsor. In addition, the contractor may request the United States to enter into the litigation to protect the interests of the United States.

A6.3.3 Title VI Clauses for Deeds Transferring United States Property (OMITTED)

**A6.3.4 Title VI Clauses for Transfer of Real Property
Acquired or Improved Under the Activity, Facility, or
Program (OMITTED)**

A6.3.5 Title VI Clauses for Construction/Use/Access to Real Property Acquired Under the Activity, Facility or Program (OMITTED)

A6.3.6 Title VI List of Pertinent Nondiscrimination Acts and Authorities

Title VI List of Pertinent Nondiscrimination Acts and Authorities

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the “contractor”) agrees to comply with the following non-discrimination statutes and authorities; including but not limited to:

- Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d *et seq.*, 78 stat. 252), (prohibits discrimination on the basis of race, color, national origin);
- 49 CFR part 21 (Non-discrimination In Federally-Assisted Programs of The Department of Transportation—Effectuation of Title VI of The Civil Rights Act of 1964);
- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 U.S.C. § 4601), (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);
- Section 504 of the Rehabilitation Act of 1973, (29 U.S.C. § 794 *et seq.*), as amended, (prohibits discrimination on the basis of disability); and 49 CFR part 27;
- The Age Discrimination Act of 1975, as amended, (42 U.S.C. § 6101 *et seq.*), (prohibits discrimination on the basis of age);
- Airport and Airway Improvement Act of 1982, (49 USC § 471, Section 47123), as amended, (prohibits discrimination based on race, creed, color, national origin, or sex);
- The Civil Rights Restoration Act of 1987, (PL 100-209), (Broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, The Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms “programs or activities” to include all of the programs or activities of the Federal-aid recipients, sub-recipients and contractors, whether such programs or activities are Federally funded or not);
- Titles II and III of the Americans with Disabilities Act of 1990, which prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 U.S.C. §§ 12131 – 12189) as implemented by Department of Transportation regulations at 49 CFR parts 37 and 38;
- The Federal Aviation Administration’s Non-discrimination statute (49 U.S.C. § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex);
- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures non-discrimination against minority populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations;

- Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100);
- Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 U.S.C. 1681 et seq).

A7 CLEAN AIR AND WATER POLLUTION CONTROL

A7.1 SOURCE

2 CFR § 200, Appendix II(G)

A7.2 APPLICABILITY

Contract Types – This provision is required for all contracts and lower tier contracts that exceed \$150,000.

Use of Provision – The regulation does not prescribe mandatory language. The following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor's language must fully satisfy the requirements of Appendix II to 2 CFR §200.

A7.3 CONTRACT CLAUSE

CLEAN AIR AND WATER POLLUTION CONTROL

Contractor agrees to comply with all applicable standards, orders, and regulations issued pursuant to the Clean Air Act (42 U.S.C. § 740-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. § 1251-1387). The Contractor agrees to report any violation to the Owner immediately upon discovery. The Owner assumes responsibility for notifying the Environmental Protection Agency (EPA) and the Federal Aviation Administration.

Contractor must include this requirement in all subcontracts that exceeds \$150,000.

A8 CONTRACT WORKHOURS AND SAFETY STANDARDS ACT REQUIREMENTS

A8.1 SOURCE

2 CFR § 200, Appendix II(E)

A8.2 APPLICABILITY

Contract Workhours and Safety Standards Act Requirements, (CWHSSA) requires contractors and subcontractors on covered contracts to pay laborers and mechanics employed in the performance of the contracts one and one-half times their basic rate of pay for all hours worked over 40 in a workweek. CWHSSA prohibits unsanitary, hazardous, or dangerous working conditions on federally assisted projects. The Wage and Hour Division (WHD) within the U.S. Department of Labor (DOL) enforces the compensation requirements of this Act, while DOL's Occupational Safety and Health Administration (OSHA) enforces the safety and health requirements

Contract Types –

Construction - This provision applies to all contracts and lower tier contracts that exceed \$100,000, and employ laborers, mechanics, watchmen and guards.

Equipment - This provision applies to any equipment project exceeding \$100,000 that involves installation of equipment onsite (e.g. electrical vault equipment). This provision does not apply to equipment acquisition projects where the manufacture of the equipment takes place offsite at the vendor plant (e.g. ARFF and SRE vehicles)

Professional Services - This provision applies to professional service agreements that exceed \$100,000 and employs laborers, mechanics, watchmen and guards. This includes members of survey crews and exploratory drilling operations.

Property – While most land transactions do not involve employment of laborers, mechanics, watchmen and guards, under certain circumstances, a property acquisition project could require such employment. Examples include the installation of property fencing or testing for environmental contamination

Use of Provision – Sponsors must incorporate this text without modification.

A8.3 CONTRACT CLAUSE

CONTRACT WORKHOURS AND SAFETY STANDARDS ACT REQUIREMENTS

1. Overtime Requirements.

No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic, including watchmen and guards, in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a

rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

2. Violation; Liability for Unpaid Wages; Liquidated Damages.

In the event of any violation of the clause set forth in paragraph (1) of this clause, the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this clause, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1) of this clause.

3. Withholding for Unpaid Wages and Liquidated Damages.

The Federal Aviation Administration (FAA) or the Owner shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph 2 of this clause.

4. Subcontractors.

The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraphs (1) through (4) and also a clause requiring the subcontractor to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1) through (4) of this clause.

A9 COPELAND “ANTI-KICKBACK” ACT

A9.1 SOURCE

2 CFR § 200, Appendix II(D)

29 CFR Parts 3 & 5

A9.2 APPLICABILITY and PURPOSE

The Copeland (Anti-Kickback) Act (18 U.S.C. 874 and 40 U.S.C. 3145) makes it unlawful to induce by force, intimidation, threat of dismissal from employment, or by any other manner, any person employed in the construction or repair of public buildings or public works, financed in whole or in part by the United States, to give up any part of the compensation to which that person is entitled under a contract of employment. The Copeland Act also requires each contractor and subcontractor to furnish weekly a statement of compliance with respect to the wages paid each employee during the preceding week.

Contract Types –

Construction – This provision applies to all construction contracts and subcontracts financed under the AIP program that exceeds \$2,000.

Equipment – This provision applies to all equipment installation projects (e.g. electrical vault improvements) financed under the AIP program that exceeds \$ 2, 000. This provision does not apply to equipment acquisitions where the equipment is manufactured at the vendor’s plant (e.g. SRE and ARFF vehicles)

Professional Services - The emergence of different project delivery methods has created situations where Professional Service Agreements (PSA) includes tasks that meet the definition of construction, alteration or repair as defined in 29 CFR Part 5. If such tasks result in work that qualifies as construction, alteration or repair and it exceeds \$2,000, the PSA must incorporate the Copeland Anti-kickback provision.

Property - Ordinarily, land acquisition projects would not involve employment of laborers or mechanics and thus the Copeland Anti-Kickback provision would not apply. However, land projects that involve installation of boundary fencing and demolition of structures would involve laborers and mechanics. The sponsor must include this provision if the land acquisition project involves employment of laborers or mechanics for a contract exceeding \$2,000.

Use of Provision – 29 CFR Part 5 establishes specific language a sponsor must use in construction contracts. The sponsor may not make any modification to the standard language. A/E firms that employ laborers and mechanics on a task that meets the definition of construction, alteration or repair are acting as a contractor. The sponsor may not substitute the term “contractor” for “consultant” in such instances.

A9.3 CONTRACT CLAUSE

COPELAND “ANTI-KICKBACK” ACT

Contractor must comply with the requirements of the Copeland “Anti-Kickback” Act (18 U.S.C. 874 and 40 U.S.C. 3145), as supplemented by Department of Labor regulation 29 CFR part 3. Contractor and subcontractors are prohibited from inducing, by any means, any person employed on the project to give up any part of the compensation to which the employee is entitled. The Contractor and each Subcontractor must submit to the Owner, a weekly statement on the wages paid to each employee performing on covered work during the prior week. Owner must report any violations of the Act to the Federal Aviation Administration.

A10 DAVIS-BACON REQUIREMENTS

A10.1 SOURCE

2 CFR § 200, Appendix II(D)

29 CFR Part 5

A10.2 APPLICABILITY

The Davis-Bacon Act ensures that laborers and mechanics employed under the contract receive pay no less than the locally prevailing wages and fringe benefits as determined by the Department of Labor.

Contract Types –

Construction - Incorporate into all construction contracts and subcontracts that exceed \$2,000 and include funding from the AIP program.

Equipment – This provision applies to all equipment installation projects (e.g. electrical vault improvements) financed under the AIP program that exceeds \$ 2, 000. This provision does not apply to equipment acquisitions where the equipment is manufactured at the vendor’s plant (e.g. SRE and ARFF vehicles)

Professional Services - The emergence of different project delivery methods has created situations where Professional Service Agreements (PSA) includes tasks that meet the definition of construction, alteration or repair as defined in 29 CFR Part 5. If such tasks result in work that qualifies as construction, alteration or repair and it exceeds \$2,000, the PSA must incorporate this clause.

Property - Ordinarily, land acquisition projects would not involve employment of laborers or mechanics and thus the provision would not apply. However, land projects that involve installation of boundary fencing and demolition of structures would involve laborers and mechanics. The sponsor must include this provision if the land acquisition project involves employment of laborers or mechanics for a contract exceeding \$2,000.

Fencing Projects - Fencing projects that exceed \$2,000 must include this provision.

Use of Provision – 29 CFR Part 5 establishes specific language a sponsor must use. The sponsor may not make any modification to the standard language. A/E firms that employ laborers and mechanics on a task that meets the definition of construction, alteration or repair are acting as a contractor. The sponsor may not substitute the term “contractor” for “consultant” in such instances.

A10.3 CONTRACT CLAUSE

DAVIS-BACON REQUIREMENTS

1. Minimum Wages

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any

account (except such payroll deductions as are permitted by the Secretary of Labor under the Copeland Act (29 CFR Part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalent thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR Part 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided*, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under (1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can easily be seen by the workers.

(ii)(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

- (1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and
- (2) The classification is utilized in the area by the construction industry; and
- (3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, D.C. 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate

(including the amount designated for fringe benefits where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs (1)(ii) (B) or (C) of this paragraph, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided*, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

2 Withholding.

The Federal Aviation Administration or the sponsor shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of work, all or part of the wages required by the contract, the Federal Aviation Administration may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

3. Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the

contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual costs incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Federal Aviation Administration if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant, sponsor, or owner, as the case may be, for transmission to the Federal Aviation Administration. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (*e.g.*, the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the Federal Aviation Administration if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit them to the applicant, sponsor, or owner, as the case may be, for transmission to the Federal Aviation Administration, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, sponsor, or owner).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

- (1) That the payroll for the payroll period contains the information required to be provided under 29 CFR § 5.5(a)(3)(ii), the appropriate information is being maintained under 29 CFR § 5.5 (a)(3)(i) and that such information is correct and complete;
- (2) That each laborer and mechanic (including each helper, apprentice and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations 29 CFR Part 3;
- (3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (3)(i) of this section available for inspection, copying or transcription by authorized representatives of the sponsor, the Federal Aviation Administration or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to the contractor, sponsor, applicant or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and Trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an

apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate that is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal Employment Opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

5. Compliance with Copeland Act Requirements.

The contractor shall comply with the requirements of 29 CFR Part 3, which are incorporated by reference in this contract.

6. Subcontracts.

The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR Part 5.5(a)(1) through (10) and such other clauses as the Federal Aviation Administration may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR Part 5.5.

7. Contract Termination: Debarment.

A breach of the contract clauses in paragraph 1 through 10 of this section may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance With Davis-Bacon and Related Act Requirements.

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are herein incorporated by reference in this contract.

9. Disputes Concerning Labor Standards.

Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR Parts 5, 6 and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of Eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

A11 DEBARMENT AND SUSPENSION

A11.1 SOURCE

2 CFR part 180 (Subpart C)

2 CFR part 1200

DOT Order 4200.5

A11.2 APPLICABILITY

The sponsor must verify that the firm or individual that it is entering into a contract with are not presently suspended, excluded or debarred by any Federal department or agency from participating in federally-assisted projects. The sponsor accomplishes this by: (1) checking the System for Award Management (SAM.gov) to verify that the firm or individual is not listed in SAM.gov as being suspended, debarred or excluded, (2) collecting a certification from the firm or individual that they are not suspended, debarred or excluded, and (3) incorporating a clause in the contract that requires lower tier contracts to verify that no suspended, debarred or excluded firm or individual are included in the project.

Contract Types – This requirement applies to *covered transactions*, which are defined in 2 CFR part 180. AIP funded contracts are non-procurement transactions, as defined by §180.970. Covered transactions include any AIP-funded contract, regardless of tier, that is awarded by a contractor, subcontractor, supplier, consultant, or its agent or representative in any transaction, if the amount of the contract is expected to equal or exceed \$25,000. This includes contracts associated with land acquisition projects.

Use of Provision – The regulation does not prescribe mandatory language, the following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor’s language must fully satisfy the requirements of 2 CFR part 180. For professional service agreements, sponsor may substitute bidder/offeror with consultant.

A11.3 CONTRACT CLAUSE

A11.3.1 Bidder or Offeror Certification

CERTIFICATION OF OFFERER/BIDDER REGARDING DEBARMENT

By submitting a bid/proposal under this solicitation, the bidder or offeror certifies that neither it nor its principals are presently debarred or suspended by any Federal department or agency from participation in this transaction.

A11.3.2 Lower Tier Contract Certification

CERTIFICATION OF LOWER TIER CONTRACTORS REGARDING DEBARMENT

The successful bidder, by administering each lower tier subcontract that exceeds \$25,000 as a “covered transaction”, must verify each lower tier participant of a “covered transaction” under the project is not

presently debarred or otherwise disqualified from participation in this federally assisted project. The successful bidder will accomplish this by:

1. Checking the System for Award Management at website: <http://www.sam.gov>
2. Collecting a certification statement similar to the Certificate Regarding Debarment and Suspension (Bidder or Offeror), above.
3. Inserting a clause or condition in the covered transaction with the lower tier contract

If the FAA later determines that a lower tier participant failed to disclose to a higher tier participant that it was excluded or disqualified at the time it entered the covered transaction, the FAA may pursue any available remedies, including suspension and debarment of the non-compliant participant.

A12 DISADVANTAGED BUSINESS ENTERPRISE

A12.1 SOURCE

49 CFR part 26

A12.2 APPLICABILITY and PURPOSE

A sponsor that anticipates awarding \$250,000 or more in AIP funded prime contracts in a federal fiscal year must have an approved Disadvantaged Business Enterprise (DBE) program on file with the FAA Office of Civil Rights (§26.21). The approved DBE program will identify a 3-year overall program goal that the sponsor bases on the availability of ready, willing and able DBEs relative to all businesses ready, willing and able to participate on the project (§26.45).

Contract Types – Sponsors with a DBE program on file with the FAA must include the three following provisions, if applicable:

Clause in all solicitations for proposals for which a contract goal has been established.

Clause in each prime contract

Clause in solicitations that are obtaining DBE participation through race/gender neutral means.

Use of Provision –

1. Solicitations with a DBE Project Goal - 49 CFR §26.53 requires a sponsor's solicitation to address what a contractor must submit on proposed DBE participation. This language is not required for projects where DBE participation is by race-gender neutral means.

The regulation does not prescribe mandatory language, the following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor's revised language must fully these requirements.

The sponsor may require the contractor's submittal on proposed DBE participation either with the bid or within a specified timeframe after bidding.

2. Contracts Covered by DBE Program - Sponsors must incorporate this language if they have a DBE program on file with the FAA. This includes projects where DBE participation is obtained through race-gender neutral means (i.e. no project goal). Sections §26.13 and §26.29 establish mandatory language for contractor assurance and prompt payment. The sponsor must not modify the language.
3. The regulation does not prescribe mandatory language. The following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor's revised language must fully these requirements for a sponsor that is not applying a project specific contract goal but is covered by a DBE program on file with the FAA.

4. Sponsors that do not have a DBE program on file with the FAA are not required to include DBE provisions and clauses.

A12.3 REQUIRED PROVISIONS

A12.3.1 Solicitation Language (Solicitations that include a Project Goal)

The Owner's award of this contract is conditioned upon Bidder or Offeror satisfying the good faith effort requirements of 49 CFR §26.53.

As a condition of bid responsiveness, the Bidder or Offeror must submit the following information with their proposal on the forms provided herein:

- (1) The names and addresses of Disadvantaged Business Enterprise (DBE) firms that will participate in the contract;
- (2) A description of the work that each DBE firm will perform;
- (3) The dollar amount of the participation of each DBE firm listed under (1)
- (4) Written statement from Bidder or Offeror that attests their commitment to use the DBE firm(s) listed under (1) to meet the Owner's project goal;
- (5) If Bidder or Offeror cannot meet the advertised project DBE goal; evidence of good faith efforts undertaken by the Bidder or Offeror as described in appendix A to 49 CFR Part 26.

[Note: Contract bid dates on or prior to December 31, 2016, use the following language]

The successful Bidder or Offeror must provide written confirmation of participation from each of the DBE firms the Bidder or Offeror lists in their commitment. This Bidder or Offeror must submit the DBE's written confirmation of participation ["within 7 days after bid opening or "with the proposal documents as a condition of bid responsiveness"]

[Note: Contract bid dates after December 31, 2016, use the following language]

The successful Bidder or Offeror must provide written confirmation of participation from each of the DBE firms the Bidder or Offeror lists in their commitment. This Bidder or Offeror must submit the DBE's written confirmation of participation ["within 5 days after bid opening or "with the proposal documents as a condition of bid responsiveness"]

A12.3.2 Solicitation Language (Race/Gender Neutral Means)

The requirements of 49 CFR part 26 apply to this contract. It is the policy of **Okaloosa County, Florida** to practice nondiscrimination based on race, color, sex or national origin in the award or performance of this contract. The Owner encourages participation by all firms qualifying under this solicitation regardless of business size or ownership.

A12.3.3 Prime Contracts (Projects covered by DBE Program)

DISADVANTAGED BUSINESS ENTERPRISES

Contract Assurance (§ 26.13) - The contractor or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy, as the recipient deems appropriate.

Prompt Payment (§26.29) - The prime contractor agrees to pay each subcontractor under this prime contract for satisfactory performance of its contract no later than **10** days from the receipt of each payment the prime contractor receives from the **Owner**. The prime contractor agrees further to return retainage payments to each subcontractor within **10** days after the subcontractor's work is satisfactorily completed. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval of the **Subcontractor**. This clause applies to both DBE and non-DBE subcontractors.

A13 DISTRACTED DRIVING

A13.1 SOURCE

Executive Order 13513

DOT Order 3902.10

A13.2 APPLICABILITY

The FAA encourages recipients of Federal grant funds to adopt and enforce safety policies that decrease crashes by distracted drivers, including policies to ban text messaging while driving when performing work related to a grant or sub-grant.

Contract Types – Sponsors must insert this provision in all AIP funded contracts that exceed the micro-purchase threshold of 2 CFR §200.67 (currently set at \$3,500).

Use of Provision – The regulation does not prescribe mandatory language, the following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor’s revised language must fully these requirements. .

A13.3 CONTRACT CLAUSE

TEXTING WHEN DRIVING

In accordance with Executive Order 13513, "Federal Leadership on Reducing Text Messaging While Driving" (10/1/2009) and DOT Order 3902.10 "Text Messaging While Driving" (12/30/2009), the FAA encourages recipients of Federal grant funds to adopt and enforce safety policies that decrease crashes by distracted drivers, including policies to ban text messaging while driving when performing work related to a grant or sub-grant.

In support of this initiative, the Owner encourages the Contractor to promote policies and initiatives for its employees and other work personnel that decrease crashes by distracted drivers, including policies that ban text messaging while driving motor vehicles while performing work activities associated with the project. The Contractor must include the substance of this clause in all sub-tier contracts exceeding \$3,500 and involve driving a motor vehicle in performance of work activities associated with the project.

A14 ENERGY CONSERVATION REQUIREMENTS

A14.1 SOURCE

2 CFR § 200, Appendix II(H)

A14.2 APPLICABILITY

The Energy Conservation Requirements found in 2 CFR § 200 Appendix II(H) requires this provision on energy efficiency.

Contract Types – The sponsor must include this provision in all AIP funded contracts and lower-tier contracts.

Use of Provision – The regulation does not prescribe mandatory language, the following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor’s revised language must fully these requirements. Sponsor may substitute “contractor and subcontractor” with “consultant and sub-consultant” for professional service agreements.

A14.3 CONTRACT CLAUSE

ENERGY CONSERVATION REQUIREMENTS

Contractor and Subcontractor agree to comply with mandatory standards and policies relating to energy efficiency as contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (42 U.S.C. 6201*et seq*).

A15 EQUAL EMPLOYEMENT OPPORTUNITY (E.E.O.)

A15.1 SOURCE

2 CFR 200, Appendix II(C)

41 CFR § 60-1.4

41 CFR § 60-4.3

Executive Order 11246

A15.2 APPLICABILITY

The purpose of this provision is to provide equal opportunity for all persons, without regard to race, color, religion, sex, or national origin who are employed or seeking employment with contractors performing under a federally assisted construction contract. There are two provisions – a construction clause and a specification clause.

The equal opportunity contract clause must be included in any contract or subcontract when the amount exceeds \$10,000. Once the equal opportunity clause is determined to be applicable, the contract or subcontract must include the clause for the remainder of the year, regardless of the amount or the contract.

Contract Types –

Construction – The sponsor must incorporate contract and specification language in all construction contracts and subcontracts as required above.

Equipment - The sponsor must incorporate contract and specification language into all equipment contracts as required above that involves installation of equipment onsite (e.g. electrical vault equipment). This provision does not apply to equipment acquisition projects where the manufacture of the equipment takes place offsite at the vendor plant (e.g. ARFF and SRE vehicles)

Professional Services - The sponsor must include contract and specification language into all professional service agreements as required above. *Property* – The sponsor must include contract and specification language into all land acquisition projects that include work that qualifies as construction work as defined by 41 CFR part 60 as required above. An example is installation of boundary fencing.

Use of Provision – 41 CFR § 60-1.4 provides the mandatory contract language. 41 CFR § 60-4.3 provides the mandatory specification language. The sponsor must incorporate these clauses without modification.

A15.3 MANDATORY CONTRACT CLAUSE

A15.3.1 E.E.O. Contract Clause

EQUAL OPPORTUNITY CLAUSE

During the performance of this contract, the contractor agrees as follows:

(1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identify or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

(2) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive considerations for employment without regard to race, color, religion, sex, or national origin.

(3) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the

administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: *Provided, however*, That in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency the contractor may request the United States to enter into such litigation to protect the interests of the United States.

A15.3.2 EEO Specification

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONSTRUCTION CONTRACT SPECIFICATIONS

1. As used in these specifications:

- a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;
- b. "Director" means Director, Office of Federal Contract Compliance Programs (OFCCP), U.S. Department of Labor, or any person to whom the Director delegates authority;
- c. "Employer identification number" means the Federal social security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941;
- d. "Minority" includes:
 - (1) Black (all) persons having origins in any of the Black African racial groups not of Hispanic origin);
 - (2) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin regardless of race);
 - (3) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
 - (4) American Indian or Alaskan native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the contractor, or any subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors shall be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each contractor or subcontractor participating in an approved plan is individually required to comply with its obligations under the EEO clause and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other

contractors or subcontractors toward a goal in an approved Plan does not excuse any covered contractor's or subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

4. The contractor shall implement the specific affirmative action standards provided in paragraphs 7a through 7p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered construction contractors performing construction work in a geographical area where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement nor the failure by a union with whom the contractor has a collective bargaining agreement to refer either minorities or women shall excuse the contractor's obligations under these specifications, Executive Order 11246 or the regulations promulgated pursuant thereto.

6. In order for the non-working training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees shall be employed by the contractor during the training period and the contractor shall have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees shall be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The contractor shall document these efforts fully and shall implement affirmative action steps at least as extensive as the following:

a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the contractor's employees are assigned to work. The contractor, where possible, will assign two or more women to each construction project. The contractor shall specifically ensure that all foremen, superintendents, and other onsite supervisory personnel are aware of and carry out the contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

c. Maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source, or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the contractor

by the union or, if referred, not employed by the contractor, this shall be documented in the file with the reason therefore along with whatever additional actions the contractor may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the contractor has a collective bargaining agreement has not referred to the contractor a minority person or female sent by the contractor, or when the contractor has other information that the union referral process has impeded the contractor's efforts to meet its obligations.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the contractor's employment needs, especially those programs funded or approved by the Department of Labor. The contractor shall provide notice of these programs to the sources compiled under 7b above.

f. Disseminate the contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination, or other employment decisions including specific review of these items with onsite supervisory personnel such as superintendents, general foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the contractor's EEO policy with other contractors and subcontractors with whom the contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female, and community organizations, to schools with minority and female students; and to minority and female recruitment and training organizations serving the contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the contractor shall send written notification to organizations, such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer, and vacation employment to minority and female youth both on the site and in other areas of a contractor's workforce.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel, for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are non-segregated except that separate or single user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisor's adherence to and performance under the contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations, which assist in fulfilling one or more of their affirmative action obligations (7a through 7p). The efforts of a contractor association, joint contractor union, contractor community, or other similar groups of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through 7p of these specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the contractor. The obligation to comply, however, is the contractor's and failure of such a group to fulfill an obligation shall not be a defense for the contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, if the particular group is employed in a substantially disparate manner (for example, even though the contractor has achieved its goals for women generally,) the contractor may be in violation of the Executive Order if a specific minority group of women is underutilized.

10. The contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

11. The contractor shall not enter into any subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination, and cancellation of existing

subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13. The contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

14. The contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government, and to keep records. Records shall at least include for each employee, the name, address, telephone number, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

A16 FEDERAL FAIR LABOR STANDARDS ACT (FEDERAL MINIMUM WAGE)

A16.1 SOURCE

29 U.S.C. § 201, et seq

A16.2 APPLICABILITY

The United States Department of Labor (DOL) Wage and Hour Division administers the Fair Labor Standards Act (FLSA). This act prescribes federal standards for basic minimum wage, overtime pay, record keeping and child labor standards.

Contract Types – Per the Department of Labor, all employees of certain enterprises having workers engaged in interstate commerce, producing goods for interstate commerce, or handling, selling, or otherwise working on goods or materials that have been moved in or produced for such commerce by any person, are covered by the FLSA.

All consultants, sub-consultants, contractors and subcontractors employed under this federally assisted project must comply with the FLSA.

Professional Services – 29 CFR § 213 exempts employees in a bona fide executive, administrative or professional capacity. Because professional firms employ individuals that are not covered by this exemption, the sponsor’s agreement with a professional services firm must include the FLSA provision.

Use of Provision – The regulation does not prescribe mandatory language, the following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor’s language must fully satisfy the requirements of 29 U.S.C. § 201. The sponsor must select *contractor* or *consultant*, as appropriate for the contract.

A16.3 CONTRACT CLAUSE

All contracts and subcontracts that result from this solicitation incorporate by reference the provisions of 29 CFR part 201, the Federal Fair Labor Standards Act (FLSA), with the same force and effect as if given in full text. The FLSA sets minimum wage, overtime pay, recordkeeping, and child labor standards for full and part time workers.

The *contractor* has full responsibility to monitor compliance to the referenced statute or regulation. The *contractor* must address any claims or disputes that arise from this requirement directly with the U.S. Department of Labor – Wage and Hour Division

A17 LOBBYING AND INFLUENCING FEDERAL EMPLOYEES

A17.1 SOURCE

31 U.S.C. § 1352 – Byrd Anti-Lobbying Amendment

2 CFR part 200, Appendix II(J)

49 CFR part 20, Appendix A

A17.2 APPLICABILITY

Consultants and contractors that apply or bid for an award of \$100,000 or more must certify that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or another award covered by 31 U.S.C. 1352. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award.

Contract Types – The sponsor must incorporate this provision into all contracts exceeding \$100,000.

Use of Provision – Appendix A to 49 CFR Part 20 prescribes language the sponsor must use. The sponsor must incorporate this provision without modification.

A17.3 CONTRACT CLAUSE

CERTIFICATION REGARDING LOBBYING

The bidder or offeror certifies by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the Bidder or Offeror, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, “Disclosure Form to Report Lobbying,” in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including subcontracts, sub-grants, and contracts under

grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

A18 PROHIBITION of SEGREGATED FACILITIES

A18.1 SOURCE

41 CFR § 60

A18.2 APPLICABILITY

The contractor must comply with the requirements of the E.E.O. clause by ensuring that facilities they provide for employees are free of segregation on the basis of race, color, religion, sex, sexual orientation, gender identity, or national origin. This clause must be included in all contracts that include the equal opportunity clause, regardless of the amount of the contract.

Contract Types – AIP sponsors must incorporate the Prohibition of Segregated Facilities clause in any contract containing the Equal Employment Opportunity clause of 41 CFR §60.1. This obligation flows down to subcontract and sub-tier purchase orders containing the Equal Employment Opportunity clause.

Construction - Construction work means construction, rehabilitation, alteration, conversion, extension, demolition or repair of buildings, highways, or other changes or improvements to real property, including facilities providing utility services. The term also includes the supervision, inspection, and other onsite functions incidental to the actual construction.

Equipment – On site installation of equipment such as airfield lighting control equipment meets the definition of construction and thus this provision would apply. This provision does not apply to equipment projects involving manufacture of the item at a vendor’s manufacturing plant. An example would be the manufacture of a SRE or ARFF vehicle.

Professional Services - Professional services that include tasks that qualify as construction work as defined by 41 CFR part 60. Examples include the installation of noise monitoring equipment.

Property/Land - Land acquisition contracts that include tasks that qualify as construction work as defined by 41 CFR part 60. Examples include demolition of structures or installation of boundary fencing.

Use of Provision – The regulation does not prescribe mandatory language, the following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor’s language must fully satisfy the requirements of 41 CFR § 60.

A18.3 CONTRACT CLAUSE

PROHIBITION of SEGREGATED FACILITIES

(a) The Contractor agrees that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor agrees that a breach of this clause is a violation of the Equal Opportunity clause in this contract.

(b) “Segregated facilities,” as used in this clause, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing

areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees, that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, sex, or national origin because of written or oral policies or employee custom. The term does not include separate or single-user rest rooms or necessary dressing or sleeping areas provided to assure privacy between the sexes.

(c) The Contractor shall include this clause in every subcontract and purchase order that is subject to the Equal Opportunity clause of this contract.

A19 OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970

A19.1 SOURCE

20 CFR part 1910

A19.2 APPLICABILITY

Contract Types – All contracts and subcontracts must comply with the Occupational Safety and Health Act of 1970 (OSH). The United States Department of Labor Occupational Safety & Health Administration (OSHA) oversees the workplace health and safety standards wage provisions from OSH.

Use of Provision – The regulation does not prescribe mandatory language. The following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor's language must fully satisfy the requirements of 20 CFR part 1910.

A19.3 CONTRACT CLAUSE

All contracts and subcontracts that result from this solicitation incorporate by reference the requirements of 29 CFR Part 1910 with the same force and effect as if given in full text. Contractor must provide a work environment that is free from recognized hazards that may cause death or serious physical harm to the employee. The Contractor retains full responsibility to monitor its compliance and their subcontractor's compliance with the applicable requirements of the Occupational Safety and Health Act of 1970 (20 CFR Part 1910). Contractor must address any claims or disputes that pertain to a referenced requirement directly with the U.S. Department of Labor – Occupational Safety and Health Administration.

A20 PROCUREMENT OF RECOVERED MATERIALS

A20.1 SOURCE

2 CFR § 200.322

40 CFR part 247

A20.2 APPLICABILITY

Sponsors of AIP funded development and equipment projects must comply with Section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act. Section 6002 emphasizes maximizing energy and resource recovery through use of affirmative procurement actions for recovered materials identified in the EPA guidelines.

The requirements of § 6002 include procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition.

Contract Types – This provision applies to any contracts that include procurement of products where the purchase price of the item exceeds \$10,000 or the value of the quantity acquired by the preceding fiscal year exceeded \$10,000.

Construction and Equipment – Include this provision in all construction and equipment projects

Professional Services and Property – Include this provision if the agreement includes procurement of a product that exceeds \$10,000

Use of Provision – The regulation does not prescribe mandatory language. The following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor's language must fully satisfy the requirements of 2 CFR § 200.

A20.3 CONTRACT CLAUSE

Procurement of Recovered Materials

Contractor and subcontractor agree to comply with Section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act, and the regulatory provisions of 40 CFR Part 247. In the performance of this contract and to the extent practicable, the Contractor and subcontractors are to use of products containing the highest percentage of recovered materials for items designated by the Environmental Protection Agency (EPA) under 40 CFR Part 247 whenever:

- a) The contract requires procurement of \$10,000 or more of a designated item during the fiscal year; or,
- b) The contractor has procured \$10,000 or more of a designated item using Federal funding during the previous fiscal year.

The list of EPA-designated items is available at www.epa.gov/epawaste/consERVE/tools/cpg/products/.

Section 6002(c) establishes exceptions to the preference for recovery of EPA-designated products if the contractor can demonstrate the item is:

- a) Not reasonably available within a timeframe providing for compliance with the contract performance schedule;
- b) Fails to meet reasonable contract performance requirements; or
- c) Is only available at an unreasonable price.

A21 RIGHT TO INVENTIONS (OMITTED)

A22 SEISMIC SAFETY (OMITTED)

A23 TERMINATION OF CONTRACT

A23.1 SOURCE

2 CFR § 200 Appendix II(B)

FAA Advisory Circular 150/5370-10, Section 80-09

A23.2 APPLICABILITY

Contract Types – All contracts and subcontracts in excess of \$10,000 must address *termination for cause* and *termination for convenience* by the sponsor. The provision must address the manner (i.e. notice, opportunity to cure, and effective date) by which the sponsor’s contract will be affected and the basis for settlement (i.e. incurred expenses, completed work, profit, etc.).

Use of Provision –

Termination for Default - Section 80-09 of FAA Advisory Circular 150/5370-10 establishes standard language for Termination for Default under a construction contract. The sponsor must not make any changes to this standard language.

Termination for Convenience – The sponsor must include a clause for termination for convenience. The following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor’s language must fully satisfy the requirements of Appendix II to 2 CFR part 200.

Equipment, Professional Services and Property – The sponsor may use their established clause language provided that it adequately addresses the intent of Appendix II(B) to Part 200, which addresses termination for fault and for convenience.

A23.3 CONTRACT CLAUSE

A23.3.1 Termination for Convenience

Termination for Convenience (Construction & Equipment Contracts)

The Owner may terminate this contract in whole or in part at any time by providing written notice to the Contractor. Such action may be without cause and without prejudice to any other right or remedy of Owner. Upon receipt of a written notice of termination, except as explicitly directed by the Owner, the Contractor shall immediately proceed with the following obligations regardless of any delay in determining or adjusting amounts due under this clause:

1. Contractor must immediately discontinue work as specified in the written notice.
2. Terminate all subcontracts to the extent they relate to the work terminated under the notice.
3. Discontinue orders for materials and services except as directed by the written notice.

4. Deliver to the owner all fabricated and partially fabricated parts, completed and partially completed work, supplies, equipment and materials acquired prior to termination of the work and as directed in the written notice.
5. Complete performance of the work not terminated by the notice.
6. Take action as directed by the owner to protect and preserve property and work related to this contract that Owner will take possession.

Owner agrees to pay Contractor for:

- a) completed and acceptable work executed in accordance with the contract documents prior to the effective date of termination;
- b) documented expenses sustained prior to the effective date of termination in performing work and furnishing labor, materials, or equipment as required by the contract documents in connection with uncompleted work;
- c) reasonable and substantiated claims, costs and damages incurred in settlement of terminated contracts with Subcontractors and Suppliers; and
- d) reasonable and substantiated expenses to the contractor directly attributable to Owner's termination action

Owner will not pay Contractor for loss of anticipated profits or revenue or other economic loss arising out of or resulting from the Owner's termination action.

The rights and remedies this clause provides are in addition to any other rights and remedies provided by law or under this contract.

Termination for Convenience (Professional Services)

The Owner may, by written notice to the Consultant, terminate this Agreement for its convenience and without cause or default on the part of Consultant. Upon receipt of the notice of termination, except as explicitly directed by the Owner, the Contractor must immediately discontinue all services affected.

Upon termination of the Agreement, the Consultant must deliver to the Owner all data, surveys, models, drawings, specifications, reports, maps, photographs, estimates, summaries, and other documents and materials prepared by the Engineer under this contract, whether complete or partially complete.

Owner agrees to make just and equitable compensation to the Consultant for satisfactory work completed up through the date the Consultant receives the termination notice. Compensation will not include anticipated profit on non-performed services.

Owner further agrees to hold Consultant harmless for errors or omissions in documents that are incomplete as a result of the termination action under this clause.

A23.4 Termination for Default

Termination for Default (Construction)

Section 80-09 of FAA Advisory Circular 150/5370-10 establishes conditions, rights and remedies associated with Owner termination of this contract due default of the Contractor.

Termination for Default (Equipment)

The Owner may, by written notice of default to the Contractor, terminate all or part of this Contract if the Contractor:

1. Fails to commence the Work under the Contract within the time specified in the Notice- to- Proceed;
2. Fails to make adequate progress as to endanger performance of this Contract in accordance with its terms;
3. Fails to make delivery of the equipment within the time specified in the Contract, including any Owner approved extensions;
4. Fails to comply with material provisions of the Contract;
5. Submits certifications made under the Contract and as part of their proposal that include false or fraudulent statements;
6. Becomes insolvent or declares bankruptcy;

If one or more of the stated events occur, the Owner will give notice in writing to the Contractor and Surety of its intent to terminate the contract for cause. At the Owner's discretion, the notice may allow the Contractor and Surety an opportunity to cure the breach or default.

If within [10] days of the receipt of notice, the Contractor or Surety fails to remedy the breach or default to the satisfaction of the Owner, the Owner has authority to acquire equipment by other procurement action. The Contractor will be liable to the Owner for any excess costs the Owner incurs for acquiring such similar equipment.

Payment for completed equipment delivered to and accepted by the Owner shall be at the Contract price. The Owner may withhold from amounts otherwise due the Contractor for such completed equipment, such sum as the Owner determines to be necessary to protect the Owner against loss because of Contractor default.

Owner will not terminate the Contractor's right to proceed with the Work under this clause if the delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such acceptable causes include: acts of God, acts of the Owner, acts of another Contractor in the performance of a contract with the Owner, and severe weather events that substantially exceed normal conditions for the location.

If, after termination of the Contractor's right to proceed, the Owner determines that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the Owner issued the termination for the convenience the Owner.

The rights and remedies of the Owner in this clause are in addition to any other rights and remedies provided by law or under this contract.

Termination for Default (Professional Services)

Either party may terminate this Agreement for cause if the other party fails to fulfill its obligations that are essential to the completion of the work per the terms and conditions of the Agreement. The party initiating the termination action must allow the breaching party an opportunity to dispute or cure the breach.

The terminating party must provide the breaching party [7] days advance written notice of its intent to terminate the Agreement. The notice must specify the nature and extent of the breach, the conditions

necessary to cure the breach, and the effective date of the termination action. The rights and remedies in this clause are in addition to any other rights and remedies provided by law or under this agreement.

- a) **Termination by Owner:** The Owner may terminate this Agreement in whole or in part, for the failure of the Consultant to:
1. Perform the services within the time specified in this contract or by Owner approved extension;
 2. Make adequate progress so as to endanger satisfactory performance of the Project;
 3. Fulfill the obligations of the Agreement that are essential to the completion of the Project.

Upon receipt of the notice of termination, the Consultant must immediately discontinue all services affected unless the notice directs otherwise. Upon termination of the Agreement, the Consultant must deliver to the Owner all data, surveys, models, drawings, specifications, reports, maps, photographs, estimates, summaries, and other documents and materials prepared by the Engineer under this contract, whether complete or partially complete.

Owner agrees to make just and equitable compensation to the Consultant for satisfactory work completed up through the date the Consultant receives the termination notice. Compensation will not include anticipated profit on non-performed services.

Owner further agrees to hold Consultant harmless for errors or omissions in documents that are incomplete as a result of the termination action under this clause.

If, after finalization of the termination action, the Owner determines the Consultant was not in default of the Agreement, the rights and obligations of the parties shall be the same as if the Owner issued the termination for the convenience of the Owner.

- b) **Termination by Consultant:** The Consultant may terminate this Agreement in whole or in part, if the Owner:
1. Defaults on its obligations under this Agreement;
 2. Fails to make payment to the Consultant in accordance with the terms of this Agreement;
 3. Suspends the Project for more than [180] days due to reasons beyond the control of the Consultant.

Upon receipt of a notice of termination from the Consultant, Owner agrees to cooperate with Consultant for the purpose of terminating the agreement or portion thereof, by mutual consent. If Owner and Consultant cannot reach mutual agreement on the termination settlement, the Consultant may, without prejudice to any rights and remedies it may have, proceed with terminating all or parts of this Agreement based upon the Owner's breach of the contract.

In the event of termination due to Owner breach, the Engineer is entitled to invoice Owner and to receive full payment for all services performed or furnished in accordance with this Agreement and all justified reimbursable expenses incurred by the Consultant through the effective date of termination action. Owner agrees to hold Consultant harmless for errors or omissions in documents that are incomplete as a result of the termination action under this clause.

A24 TRADE RESTRICTION CERTIFICATION

A24.1 SOURCE

49 USC § 50104

49 CFR part 30

A24.2 APPLICABILITY

Unless waived by the Secretary of Transportation, sponsors may not use AIP funds on a product or service from a foreign country included in the current list of countries that discriminate against U.S. firms as published by the Office of the United States Trade Representative (U.S.T.R)

Contract Types – The trade restriction certification and clause applies to all AIP funded projects.

Use of Provision – 49 CFR part 30 prescribes the language for this model clause. The sponsor must include this certification language in all contracts and subcontracts without modification.

A24.3 CONTRACT CLAUSE

TRADE RESTRICTION CERTIFICATION

By submission of an offer, the Offeror certifies that with respect to this solicitation and any resultant contract, the Offeror -

- a. is not owned or controlled by one or more citizens of a foreign country included in the list of countries that discriminate against U.S. firms as published by the Office of the United States Trade Representative (U.S.T.R.);
- b. has not knowingly entered into any contract or subcontract for this project with a person that is a citizen or national of a foreign country included on the list of countries that discriminate against U.S. firms as published by the U.S.T.R; and
- c. has not entered into any subcontract for any product to be used on the Federal on the project that is produced in a foreign country included on the list of countries that discriminate against U.S. firms published by the U.S.T.R.

This certification concerns a matter within the jurisdiction of an agency of the United States of America and the making of a false, fictitious, or fraudulent certification may render the maker subject to prosecution under Title 18, United States Code, Section 1001.

The Offeror/Contractor must provide immediate written notice to the Owner if the Offeror/Contractor learns that its certification or that of a subcontractor was erroneous when submitted or has become erroneous by reason of changed circumstances. The Contractor must require subcontractors provide immediate written notice to the Contractor if at any time it learns that its certification was erroneous by reason of changed circumstances.

Unless the restrictions of this clause are waived by the Secretary of Transportation in accordance with 49 CFR 30.17, no contract shall be awarded to an Offeror or subcontractor:

- (1) who is owned or controlled by one or more citizens or nationals of a foreign country included on the list of countries that discriminate against U.S. firms published by the U.S.T.R. or
- (2) whose subcontractors are owned or controlled by one or more citizens or nationals of a foreign country on such U.S.T.R. list or
- (3) who incorporates in the public works project any product of a foreign country on such U.S.T.R. list;

Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by this provision. The knowledge and information of a contractor is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

The Offeror agrees that, if awarded a contract resulting from this solicitation, it will incorporate this provision for certification without modification in all lower tier subcontracts. The contractor may rely on the certification of a prospective subcontractor that it is not a firm from a foreign country included on the list of countries that discriminate against U.S. firms as published by U.S.T.R., unless the Offeror has knowledge that the certification is erroneous.

This certification is a material representation of fact upon which reliance was placed when making an award. If it is later determined that the Contractor or subcontractor knowingly rendered an erroneous certification, the Federal Aviation Administration may direct through the Owner cancellation of the contract or subcontract for default at no cost to the Owner or the FAA.

A25 VETERAN'S PREFERENCE

A25.1 SOURCE

49 USC § 47112(c)

A25.2 APPLICABILITY

Contract Types – This provision applies to all AIP funded projects that involve labor to carry out the project. This preference, which excludes executive, administrative and supervisory positions, applies to covered veterans (as defined under §47112(c)) only when they are readily available and qualified to accomplish the work required by the project.

Use of Provision – The regulation does not prescribe mandatory language, the following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor's language must fully satisfy the requirements of 49 U.S.C. § 47112.

A25.3 CONTRACT CLAUSE

VETERAN'S PREFERENCE

In the employment of labor (excluding executive, administrative, and supervisory positions), the contractor and all sub-tier contractors must give preference to covered veterans as defined within Title 49 United States Code Section 47112. Covered veterans include Vietnam-era veterans, Persian Gulf veterans, Afghanistan-Iraq war veterans, disabled veterans, and small business concerns (as defined by 15 U.S.C. 632) owned and controlled by disabled veterans. This preference only applies when there are covered veterans readily available and qualified to perform the work to which the employment relates.

A26 DAVIS-BACON WAGE DECISION

General Decision Number: FL190179 01/04/2019

FL17

9 Superseded General Decision Number: FL20180222 State:

Florida

Construction Type: Highway

County: Okaloosa County in Florida.

HIGHWAY CONSTRUCTION PROJECTS

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.60 for calendar year 2019 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015.

If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.60 per hour (or the applicable

wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2019. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate,

if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number Publication
 Date 0 01/04/2019

* SUFL2013-040 08/19/2013

	Rates	Fringes
CARPENTER.....	\$ 13.71	0.00
CEMENT MASON/CONCRETE FINISHER, Includes Form Work.....	\$ 11.71	0.00
ELECTRICIAN.....	\$ 22.11	0.00
HIGHWAY/PARKING LOT STRIPING: Operator (Striping Machine).....	\$ 13.81	0.00
 HIGHWAY/PARKING LOT STRIPING:		
Painter.....	\$ 12.13	0.00
IRONWORKER, ORNAMENTAL.....	\$ 13.48	0.00
IRONWORKER, REINFORCING.....	\$ 16.24	0.00
IRONWORKER, STRUCTURAL.....	\$ 16.42	0.00
LABORER (Traffic Control Specialist).....	\$ 11.51	0.00
LABORER: Asphalt, Includes Raker, Shoveler, Spreader and Distributor.....	\$ 10.91	0.00
LABORER: Common or General.....	\$ 9.71	0.00
LABORER: Flagger.....	\$ 10.25	0.00
LABORER: Grade Checker.....	\$ 10.83	0.00
LABORER: Mason Tender - Cement/Concrete.....	\$ 12.81	0.00
LABORER: Pipelayer.....	\$ 11.70	0.00
OPERATOR: Backhoe/Excavator/Trackhoe.....	\$ 14.83	0.00
OPERATOR: Bobcat/Skid Steer/Skid Loader.....	\$ 14.07	0.00

OPERATOR: Broom/Sweeper.....	\$ 11.10	1.89
OPERATOR: Bulldozer.....	\$ 14.29	0.00
OPERATOR: Concrete Finishing Machine.....	\$ 15.44	0.00
OPERATOR: Crane.....	\$ 21.23	0.00
OPERATOR: Curb Machine.....	\$ 19.21	0.00
OPERATOR: Drill.....	\$ 14.78	0.00
OPERATOR: Forklift.....	\$ 12.29	0.00
OPERATOR: Gradall.....	\$ 14.71	0.00
OPERATOR: Grader/Blade.....	\$ 16.50	0.00
OPERATOR: Loader.....	\$ 11.66	0.00
OPERATOR: Mechanic.....	\$ 15.84	0.00
OPERATOR: Milling Machine.....	\$ 13.29	1.92
OPERATOR: Oiler.....	\$ 16.32	0.00
OPERATOR: Paver(Asphalt, Aggregate, and Concrete).....	\$ 12.87	0.00
OPERATOR: Piledriver.....	\$ 17.23	0.00
OPERATOR: Post Driver (Guardrail/Fences).....	\$ 17.02	0.00
OPERATOR: Roller.....	\$ 11.06	0.00
OPERATOR: Scraper.....	\$ 12.01	0.00
OPERATOR: Screed.....	\$ 13.68	0.00
OPERATOR: Trencher.....	\$ 16.04	0.00
PAINTER: Spray.....	\$ 19.57	0.00
TRUCK DRIVER: Dump Truck.....	\$ 10.86	0.00
TRUCK DRIVER: Flatbed Truck.....	\$ 14.28	0.00
TRUCK DRIVER: Lowboy Truck.....	\$ 13.35	0.00
TRUCK DRIVER: Slurry Truck.....	\$ 11.96	0.00
TRUCK DRIVER: Water Truck.....	\$ 12.90	0.00

WELDERS - Receive rate prescribed for craft performing
operation to which welding is incidental.
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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year.

Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local

0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7).

Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

END OF SECTION 100

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SECTION 011100 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Conditions/Provisions of Contract, including Contractual Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 PROJECT DESCRIPTION

- A. Project/Work Identification:

- 1. The General overall description of the Work of the Contract for the:

DESTIN-FORT WALTON BEACH AIRPORT
ITB AP 59-20 CONSTRUCT BAGGAGE HANDLING SYSTEM AND WEST
TERMINAL EXPANSION
Eglin AFB, Florida 32542-1498

can be summarized for purposes of administration and payment in the manner of project segments as follows:

- 2. The Project consists of a one-story baggage handling expansion with a checked baggage inspection system room, a checked baggage resolution area room, and support spaces. The project also includes a one-story terminal expansion with airline ticketing areas and restrooms. The project also includes miscellaneous site work associated with the construction of the building and utilities, sidewalks, tug drives, and parking lot modifications as outlined in the drawings and specifications.

1.3 CONTRACTOR USE OF PREMISES

- A. Limit use of the premises to construction activities within areas indicated; allow for any Owner and tenant occupancy, and use by the public.

- 1. Minimize any disruption to all operating areas, including parking areas.
 - a. Existing public services and utility systems shall remain in operation during the construction period, excluding times required for installation of new work unless specifically allowed by the Contract.
 - b. Schedule and coordinate outages and interruptions of public service with the VPS. See the specific forms for processes and time constraints. Utilize the following forms:

- 1) Form #XXX System Interruption/Utility Outage Notification.
 - 2) Form #XXX System Interruption/Utility Outage Notification Procedures.
 - 3) Form #XXX Security System Interruption/Outage Request
2. Provide all temporary directional signage, safety, and barricading required for passenger services.
 - a. Submit a plan indicating signage, safety, and barricading for access routes, storage areas and work sites, at the pre-construction meeting.
 - b. Directional signing at the access gate and or along the delivery route to the storage area or work site shall be as directed by the VPS.
 3. Confine operations to areas within Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
 4. Access to site shall be shown on the plans or as directed by the VPS. Do not permit any unauthorized construction personnel or traffic on the site. Provide for traffic control to and from the various construction areas. Immediately clean-up any debris deposited along the access road as a result of construction traffic.
 - a. Keep driveways and entrances serving the premises clear and available to the Owner, Tenant, their employees at all times, and the public. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.
 5. All material orders for delivery to the site will use as a delivery address the access point at the Contractor's storage site.
 - a. Coordinate with the VPS and allow for the least possible disruption of the facilities normal operations for delivery of materials and removal of demolished and discarded materials.
 - b. Delivery of materials and removal of demolished and discarded materials shall be scheduled as follows:
 - 1) Schedule and coordinate all deliveries and removal of debris between the hours of 7:00 A.M. and 6:00 PM each day of the work week.
 6. The limits of construction material storage areas, equipment storage areas, and parking areas shall be as indicated in the documents or as directed by the VPS. Erect and maintain secured fencing in compliance with FAA, TSA and VPS requirements, marking and warning devices suitable for both day/night use to

delineate the perimeter of all such areas. Provide secure gates for equipment. Gates shall be manned by TSA and VPS approved personnel. 24 hours a day 7 days a week for the project duration.

- B. Use of the Existing Site Improvements: Maintain the improvement in a weathertight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the site its occupants and public during the construction period.

1.4 OWNER OCCUPANCY

- A. Full Owner Occupancy: The Owner, its tenants, and the public will occupy the site and adjacent facilities (outside the limits of the construction area unless specified) during the entire construction period. Cooperate with the Owner during construction operations to minimize conflicts, facilitate occupancy usage, and protect persons and property in the project area during the entire construction period. Perform the Work so as not to interfere with the Owner's operations.

- 1. Unless otherwise directed by the Owner, work shall be scheduled between the hours of 7:00 AM until 6:00 PM each day.

1.5 LAWS, PERMITS, AND REGULATIONS

- A. Comply with all applicable laws, ordinances, regulations, codes, ADA requirements.
- B. Obtain and pay for all license and permits, all fees and charges for connection to outside services and parking for Contractor's vehicles.
- C. Abide by FAA, TSA and Owner's safety and security regulations and procedures relative to access to, and work in, Airport Operations Areas and secured facilities.
- D. Comply with Owner's insurance requirements.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 011100

SECTION 012500 SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Conditions/Provisions of Contract, including Contractual Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after the Project is advertised.
- B. Procedural requirements governing the Contractor's selection of products and product options are included under Section "Materials and Equipment."

1.3 DEFINITIONS

- A. Definitions used in this Section are not intended to change or modify the meaning of other terms used in the Contract Documents.
- B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after the Project is advertised are considered requests for "substitutions."

- 1. The following are not considered substitutions:

- a. Revisions to Contract Documents requested by the Owner or A/E.
- b. Specified options of products and construction methods included in Contract Documents.
- c. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

- 2. Substitutions requested by Bidders during the bidding period, and accepted prior to the bid date of Contract are subject to requirements specified in this Section for substitutions, and will be incorporated into the Contract Documents by addendum.

1.4 SUBMITTALS

- A. Substitution Request Submittal: Requests for substitution may be considered per the General Conditions of the Contract. Requests received may be rejected at the discretion of the A/E and County. The A/E will render a decision on a Request for Substitution received after award of Contract within thirty (30) days after the complete Request for

Substitution has been received by the A/E. Each Request for Substitution must be submitted as follows:

1. Submit four (4) copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals in the General Conditions/Provisions.
2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
 - a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
 - b. Samples, where applicable or requested.
 - c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, code compliance, maintenance requirements, energy usage, and environmental considerations, performance, key components and visual effect.
 - d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.
 - e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
 - f. Cost information, including a proposal of the net change in the Contract Sum.
 - g. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.
 - h. A paragraph by paragraph comparison and analysis of the related specification section indicating compliance or variation from specification standard. If specified with a "Basis of Design", provide a comparison and analysis of each component of the manufacturers' detailed specification for the "Basis of Design". Each variation shall be substantiated with necessary submission to validate products compliance with specifications.

- i. Failure to include the above requirements in the submittal may be cause for rejection of the submittal in its entirety.
3. State the amount of credit, for cost and time, if any, the Owner will receive as the result of the substitution, if applicable.
4. A/E's Action: Additional information or documentation necessary for evaluation of the request may be requested. Notification of approved substitutions will be made by Addendum prior to bid and by a Change Notice after bid.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Conditions: The substitution request will be received and considered by the A/E when one or more of the following conditions are satisfied, as determined by the A/E; otherwise requests will be returned without action except to record noncompliance with these requirements.
 1. Extensive revisions to Contract Documents are not required.
 2. Proposed changes are in keeping with the general intent of Contract Documents.
 3. The request is timely, fully documented and properly submitted.
 4. The request is directly related to an "or approved substitution" clause or similar language in the Contract Documents.
 5. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
 6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
 7. A substantial advantage is offered the County, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the County may be required to bear. Additional responsibilities for the County shall include additional compensation to the A/E for redesign and evaluation services, increased cost of other construction by the Contractor or separate Contractors, and similar considerations.

8. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where certification is provided that the substitution will overcome the incompatibility.
 9. The specified product or method of construction cannot be coordinated with other materials, and where certification is provided that the proposed substitution can be coordinated.
 10. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where certification is provided that the proposed substitution provides the required warranty.
 11. Where a proposed substitution involves more than the Contractor, each subcontractor shall cooperate with the Contractor to coordinate the Work, provide uniformity and consistency, and to assure compatibility of products.
- B. The submittal and the A/E's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.
- C. If the use of a substitute product requires additional work or modifications to new or existing facilities, all such additional work, including utility modifications shall be borne by the Contractor.

2.2 PROCEDURES

- A. Selection Procedures: Options in product selection is governed by the Contract Documents and governing regulations, not by previous industry tradition or project experience. Procedures governing product selection include, but are not limited to the following:
1. Proprietary Specification Requirements: Where a single product or manufacturer is named, provide the product indicated. Other products will not be considered by the A/E.
 - a. Advise the A/E before proceeding when it is discovered that the named product is not a feasible solution.
 2. Semi-proprietary Specification Requirements: Where two or more products and manufacturers are named, provide one of the products indicated. No substitutions will be permitted unless the specification indicates consideration of other products.
 - a. When products are specified by one manufacturer's model numbers or performance criteria with reference to other acceptable manufacturers, products manufactured by the acceptable manufacturers listed must meet minimum performance criteria specified or meet quality of models specified.

- b. Advise the A/E before proceeding when it is discovered that the named product is not a feasible solution.
3. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with the requirements and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.
4. Compliance with Standards, Codes, and Regulations: Where the Specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes or regulations specified.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 012500

SUBSTITUTION REQUEST FORM

TO:	PROJECT:
GRAEF 2300 Maitland Center Parkway, Ste 210 Maitland, FL 32751	Package Name: _____

A/E Project No.:	Date: _____
Submitted for consideration is the following product instead of the specified item for the above- noted Project.	
Specification Section and Paragraph:	_____
Drawings and Details affected:	_____
Specified Item/Mfr/Model No.:	_____

Proposed Substitution Description:

<p>It is the General Contractor's responsibility to provide all information to determine proposed substitution is equal to or better than the specified item. Complete product description, technical information, drawings, photographs, test data and performance information necessary for evaluation of requested substitution will be attached and marked for comparison purposes. Fill in ALL BLANKS below.</p> <p>WHY IS SUBSTITUTION BEING SUBMITTED? (Select 1 of the following):</p> <p><input type="checkbox"/> Pre-Bid Substitution (Prior Approval): Include detailed analysis comparing proposed substitution against specified product, including redlined Specification Sections showing differences.</p> <p><input type="checkbox"/> Specified product is not available. Explain in detail using attached letter.</p> <p><input type="checkbox"/> Cost Savings to Owner. Indicate comparative cost analysis as attachment. Other (Explain):</p>
--

EFFECTS OF PROPOSED SUBSTITUTION

(Attach complete explanations and technical data, including laboratory test, If applicable)

Include complete information changes to Drawings and/or Specification that proposed substitution would require for its proper Installation. Fill in blanks below:

A.	<input type="checkbox"/>	<input type="checkbox"/>
B.		
C. Does the substitution affect dimensions, locations, or configurations shown on Drawings? If "Yes", Explain:	<input type="checkbox"/> No	<input type="checkbox"/> Yes
D. Will changes be required to the building/project or other construction in order to properly install or accommodate the requested substitution? If "Yes", Explain:	<input type="checkbox"/> No	<input type="checkbox"/> Yes
E. What affect does substitution have on other trades? Explain:		
F. Will the General Contractor pay for any changes to the building design, including re-design, engineering and detailing cost caused by acceptance of the substitution request? If "No", explain:	<input type="checkbox"/> No	<input type="checkbox"/> Yes
G. Does the requested substitution meet all applicable Codes, Ordinances and applicable standards? If "No", explain:	<input type="checkbox"/> No	<input type="checkbox"/> Yes

H. Will the requested substitution affect the construction progress schedule and affect the "Contract Time"? If "Yes", explain:	<input type="checkbox"/> No <input type="checkbox"/> Yes
I. Has the requested substitution been used in similar applications? Identify:	<input type="checkbox"/> No <input type="checkbox"/> Yes
J. Does the manufacturer's warranty on the requested substitution differ from the specified item? If "Yes", explain:	<input type="checkbox"/> No <input type="checkbox"/> Yes
K. State monetary credit (itemized breakdown including overhead and profit) and reduction of Contract Time Owner will realize if this Substitution Request is accepted	

The Architect and Owner will not be required to prove any product is not equal or suitable for the Project.

GENERAL CONTRACTOR'S CERTIFICATION OF EQUAL PERFORMANCE AND ASSUMPTION OF LIABILITY FOR EQUAL PERFORMANCE

The undersigned General Contractor states that the performance, function, quality and durability are equivalent or superior to the specified item. If General Contractor is a corporation, legal name of corporation shall be indicated below, along with signature(s) of the officer or officer's authorized to sign contracts on behalf of the corporation and corporate seal; if General Contractor is a partnership, the true name of the firm and the name(s) of the general partner(s) shall be indicated below with signature(s) of the partner or partners authorized to sign contracts on behalf of the partnership; and if the CM@R/General Contractor is an individual, his/her signature shall be placed below. Failure to provide legally binding signature(s) will result in non- consideration of Substitution Request.

Submitted By:

Signature/Date:

_____ (Corporate Seal)

Name (Print)

Title

General Contractor Name

Street Address

City, State, Zip

Witnesses

Attachments to this form: List all

ARCHITECT'S ACTION:

<input type="checkbox"/> Accepted	Accepted	By:	_____	Date:	_____
<input type="checkbox"/> as Noted			Signature – A/E		

			Firm Name (Print)		
<input type="checkbox"/> Not Accepted		By:	_____	Date:	_____
<input type="checkbox"/> Received Too Late			Signature – A/E		

			Firm Name (Print)		
Comments:					

VPS ACTION:

<input type="checkbox"/> Accepted		By:	_____	Date:	_____
			Signature – VPS		
<input type="checkbox"/> Not Accepted		By:	_____	Date:	_____
			Signature – VPS		

SECTION 012973 - SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Conditions/Provisions of Contract, including Contractual Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes: Schedule of Values.
 - 1. Per General Conditions.
 - 2. When requested by the A/E and or County, support values given with substantiating data.
 - 3. Use Schedule of Values without limitation as a basis for the Applications for Payment.
- B. Time Coordination: In coordination of initial submittals and other administrative start-up activities, submit Schedule of Values to the A/E at the earliest feasible date, but in no case later than ten (10) days after NTP for review by A/E and County. Submit Schedule of Values per General Conditions of Contract. The Contractor's Application for Payment cannot be processed for payment until the Contractor has submitted a Schedule of Values acceptable to the A/E and County.

1.3 FORM OF SUBMITTAL

- A. Use AIA Document G-703 Continuation Sheet for the submittal format and or provide to the OAR in a MS Excel electronic file.
- B. Use Table of Contents of the Project Manual as a basis for format or if a unit price contract use unit price schedule.
- C. Identify each line with number and title as listed in Table of Contents of the Project Manual.

1.4 PREPARING AND SUBMITTING SCHEDULE OF VALUES

- A. The Schedule of Values shall be used as a basis for determining progress payments on a contract. The Schedule of Values shall be a schedule of cost loaded construction activities equal, in total, to the awarded bid price and shall be in a form and sufficient detail to correctly represent a reasonable apportionment of the Contract price. Prepare Schedule of Values, in coordination with Progress Schedule. Correlate line items with other administrative schedules and forms required for the Work, including progress schedule, payment request form, listing of subcontractors, schedule of alternates, schedule of allowances, listing of products and principal suppliers and fabricators, and schedule of submittals.

- B. Provide breakdown of Contract Sum in sufficient detail to facilitate continued evaluation of payment requests and progress reports. Breakdown amounts of major cost items into several line items. Round off to nearest whole dollar, but with total equal to Contract Sum.
- C. Submit one (1) copy of the Schedule of Values to the A/E and County.
- D. Arrange schedule with columns to indicate generic name of item, related Specification Sections; subcontractor, supplier, manufacturer, or fabricator; change orders which have affected value; dollar value of item, and percentage of Contract Sum to nearest one-hundredth percent and adjusted to total 100 percent.
- E. Margins of Cost:
 - 1. Show line items of indirect costs, and margins on actual costs, only to extent such items will be individually listed in payment requests.
 - 2. Establish each item in Schedule of Values and in payment requests to be complete with total expenses and proportionate share of general overhead and profit margin.
 - 3. Major cost items, which are not directly cost of actual work-in-place, such as distinct temporary facilities, may be either shown as line items in Schedule of Values or distributed as general overhead expense.
- F. Break down installed cost into:
 - 1. Cost of product, delivered and unloaded at Job Site with taxes paid. (List under Column F, G-703)
 - 2. Total installed cost, with overhead and profit. (List under Column C, G-703).

1.5 SUBSCHEDULE OF UNIT MATERIAL VALUE

- A. Submit a sub-schedule of unit costs and quantities for products that progress payments will be requested for stored materials.
- B. The form of submittal shall parallel that of the Schedule of Values, with each item identified the same as the line item in the Schedule of Values.
- C. The unit quantity for bulk materials shall include an allowance for normal waste.
- D. The unit values for the materials: the cost of the material including taxes, delivered and unloaded at the Site.
- E. The installed unit value multiplied by the quantity listed shall equal the cost of that item in the Schedule of Values.

1.6 REVIEW AND RESUBMITTAL

- A. After review by the A/E and County, revise and re-submit Schedule (and Schedule of Material Value) as required.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 012973

SECTION 013113 - PROJECT COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Conditions/Provisions of the Contract, including Contractual Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:
 - 1. General project coordination procedures.
 - 2. Conservation.
 - 3. Coordination Drawings.
 - 4. Administrative and supervisory personnel.
 - 5. Cleaning and protection.

1.3 COORDINATION

- A. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
 - 3. Make provisions to accommodate items scheduled for later installation.
- B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
 - 1. Prepare similar memoranda for the A/E and separate contractors where coordination of their work is required.

- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of schedules.
 - 2. Installation and removal of temporary facilities.
 - 3. Delivery and processing of submittals.
 - 4. Progress meetings.
 - 5. Project closeout activities.

- D. Conservation: Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the Work.

1.4 SUBMITTALS

- A. Coordination Drawings: Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
 - 1. Show the relationship of components shown on separate Shop Drawings.
 - 2. Indicate required installation sequences.
 - 3. Comply with the Article "Submittals" contained in each section.

- B. Staff Names: At the Pre-Construction meeting, submit a list of the Contractor's principal staff assignments, including the superintendent and other personnel in attendance at the Project Site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.
 - 1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

PART 2 - PART 2 - PRODUCTS (Not Applicable) PART 3

- PART 3 - EXECUTION

3.1 GENERAL COORDINATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

- B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

3.2 CLEANING AND PROTECTION

- A. General: Refer to the General Conditions of the Contract for Construction.
- B. Cleaning: Cleaning shall be performed by the Contractor on a daily basis. The entire Work area shall be left in a broom clean, or equivalent condition.
 - 1. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration until Substantial Completion is accepted.
 - 2. Clean and provide maintenance on completed construction necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.
- C. Protection - Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

END OF SECTION 013113

SECTION 013114.13 – SPECIAL PROCEDURES

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

The Contractor and their subcontractors shall comply with all system interruptions and utility outage notification requirements, procedures and/or forms specified herein.

A. Documents

1. Use the latest version of the UON Procedures for Contractors

1.2. DEFINITIONS

<u>Acronym</u>	<u>Refers to:</u>
UON	Utility Outage Notification
VPN	Destin-Fort Walton Beach Airport
RPR	Resident Project Representative
MSDS	Material Safety Data Sheet
PPE	Personal Protection Equipment
LOTO	Lock-Out Tag-Out (electrical safety procedures)
BHS	Baggage Handling Systems
IT	Information Technology
GPR	Ground Penetrating Radar
SAM	Security Area Monitor
MOT	Maintenance of Traffic
AOC	Airport Operations Center
AOA	Airport Operations Area
AHJ	Authority Having Jurisdiction

1.3. GENERAL INSTRUCTIONS

- A. System interruptions and utility outage notifications (UONs) are required during maintenance tasks, renovation work, tenant moves, and new construction work (the Work) in any and all instances where existing systems, utilities, services or operations are understood to be impacted by the Work.
- B. The Contractor is required to plan, research, communicate, conduct and close out all utility outage notifications issued as required for the Contractor to effectively and expeditiously conduct the Work.
- C. The Contractor is required to ensure that all execution steps, those outlined herein and those implied, and those required to plan, research, communicate, conduct and close out all utility outage notifications, have been followed to minimize interruptions to existing operations while completing the Work.

- D. The Contractor is required to submit the completed UONs at least 120 hours (144 hours for a Security UON) in advance of execution of the Work.
- E. UONs shall be sent to the Clearinghouse by the RPR for Action; the Clearinghouse has a 48 hour clock to Accept, Reject, or Accept the UON with Modifications. The Owner (Airport Department Sponsor or RPR) will authorize the UON.
- F. UONs associated with Security systems require 96-hour advance notification, whereas all other UONs require 72-hour advance notification. Note that advance notification time starts after Owner Authorization of the UON.
- G. In cases where there is both a Security UON and another type of UON (2nd UON) needed for the work, the Security UON shall be approved prior to sending the 2nd UON; Both UONs shall be sent together for Clearinghouse Action; the Clearinghouse has a 48 hour clock to Accept, Reject or Accept the UON with Modifications; after the Owner Authorization of the UON, the 72 hour notification clock begins. Holidays and weekends count as 12-hour days.
- H. The Contractor is required to follow/make use of the latest revision of the *UON Construction Forms* and associated *UON Procedures for Contractors* and the *UON Checklist*.

PART 2 - PRODUCTS (not applicable)

PART 3 - EXECUTION

3.1. UON PLANNING

- A. Research
 - 1. The Contractor is required to research all available information, including review of conformed documents, as-built drawings, previous and associated UONs, and, as required, field installations and conditions, for preparation of a complete UON.
 - 2. The Contractor is required to provide all required permits prior to execution of the Work.
- B. Site Installation Crew Conference
 - 1. The Contractor is required to conduct and evidence a site installation UON conference with the trade crew personnel that will be executing the Work outlined in the UON, on location.
- C. MOT (where required)
 - 1. The Contractor is required to include MOT information should the UON or any activity to enable the Work as outlined in the UON, impact existing vehicular or pedestrian traffic flow or patterns.
- D. UON Which Includes Slab Drilling

1. The Contractor is required to include Ground Penetrating Radar or X-Ray services for all UONs that involve drilling into or through ground or elevated slabs.
- E. Site Safety Plan Review and Briefing
1. The Contractor is required to review the site-specific safety plan with the trade crew personnel, and evidence that the review/briefing covered proper requirements and procedures associated with Arc Flash Studies, Personal Protection Equipment (PPE), and Lock-Out/Tag-Out, as required for the Work outlined in the UON.
- F. UON Affecting BHS
1. The Contractor is required to coordinate with Airport Operations on all work anticipated to affect the Baggage Handling Systems.
- G. UON Affecting IT
1. The Contractor is required to formally request access into Communications Rooms to the RPR who will then coordinate with the Owner. Access into any Communications Room is limited to experienced and certified personnel having Airport photo identification badges, performing the Work and for a limited amount of time. The Owner will most likely limit access to only the firm actually performing the work in the Communications Rooms. The Contractor shall allow sufficient time (a minimum of 72 hours) for the processing of an access request for Communications Rooms.
 2. The Contractor is required to coordinate with Airport IT, through the RPR, all work anticipated to affect the infrastructure, telecommunication systems, and/or emergency telephones at the elevators.
- H. UON Affecting Life Safety
1. The Contractor is required to research sprinkler valve locations and Fire Alarm Point Numbers affected; this information MUST be included in any UON submitted and must be coordinated with Airport Life Safety, through the PRP.
 2. The Contractor MUST be in communication with the COMM Center at every step outlined in the *UON Checklist*
 3. The Contractor CANNOT leave a closed valve unattended for ANY reason (or leave property) in the closed position without either restoring the valve to its normal operating condition or establishing an RPR-approved, ongoing fire watch.
- I. External Resources to Support UON
1. It is not unusual for UONs to require external resources that enable and support the actual work to be performed as outlined in the UON. The Contractor is required to provide all external resources necessary to successfully execute the UON.

2. The Contractor is required to identify the external resources required to complete the UON.
3. External resources may include, but are not limited to; personnel to direct the public around affected areas (Greeters), Security Area Monitors (SAMs), Off- Duty law enforcement officers, flagmen, certified systems technicians (Life Safety – CSG), and/or temporary signage.

3.2. SITE PERMITS

A. Energized Electrical Work Permit

1. All UON work associated with an energized electrical power source will require an Electrical Work Permit. The Contractor is required to have a qualified and licensed electrician complete all information required on the Energized Electrical Work Permit.
2. The Contractor is required to coordinate, through the RPR, with Airport Safety for its review and authorization of the Work once the appropriate safe work items and tasks have been verified.
3. The Contractor is required to display the completed and signed-off Energized Electrical Work Permit in the area of Work.

B. Hot Work (Burn) Permit

1. All UON work that involves grinding, welding, or dust-generating tasks will require a Hot Work (Burn) Permit. The Contractor is required to have a qualified supervisor complete all information required on the Hot Work (Burn) Permit.
2. The Contractor is required to coordinate with the Airport's Safety Consultant for its review and authorization of the Work once the Hot Work (Burn) Permit information is deemed accurate.
3. The Contractor is required to display the completed and signed-off Hot Work (Burn) Permit in the area of Work.

C. Sunshine 1 Notification for non-Airport Owned Utility Work

1. The Contractor is required to obtain required Sunshine 1 notifications for all non-Airport owned utility work and submit to the RPR prior to start of the UON. The Contractor is required to display notifications at the area of Work.

3.3. PRIOR TO EXECUTION OF UON WORK

A. Prior to the execution of the Work as outlined in the UON, the Contractor is required to;

1. Ensure that all equipment, tools and materials required for the Work is on site

2. Ensure adequate number of qualified personnel required for the Work is on site
 3. Reassess and confirm that the timeframe to conduct the Work is adequate
 4. Revisit the UON work plan and trade crew logic to complete the Work
 5. Ensure the UON has been approved, and that a signed copy is in hand and displayed at the Work areas
 6. When applicable, verify transfer switches go to an alternate power source before the start of the outage
- B. Should temporary electrical power be required to execute the Work as outlined in the UON, the Contractor is required to:
1. Ensure the temporary electrical power source or generation unit(s) has been adequately sized to handle the load
 2. Ensure the temporary electrical power source or generation unit(s) is on site and ready
 3. Ensure its location has been approved by the RPR and Owner
 4. Ensure proper conductors to connect the temporary electrical power generation unit(s) and transfer switch(es) are on site
 5. Ensure the temporary electrical power source or generation unit(s) has been started, and voltage and rotation verified
 6. Ensure sufficient fuel for the temporary electrical power generation unit(s)
 7. Ensure a refueling source and spill kit have been set up
 8. Ensure a dedicated fire extinguisher is available for the temporary electrical power generation unit(s)
 9. Ensure a successful test run of the temporary electrical power generation unit(s) and transfer switch(es) through a complete cycle
 10. Ensure that emergency contact information is displayed on the temporary electrical power generation unit(s)
 11. Ensure that the temporary electrical power generation unit(s) and transfer switch(es) have been left in their proper configuration

3.4. VERBAL NOTIFICATION PRIOR TO EXECUTION OF UON WORK

- A. Prior to the execution of the Work outlined in the UON, the Contractor is required to complete all tasks associated with verbally notifying interested or affected parties. The Contractor is required to complete the *UON Checklist* with the entities listed below:
1. Revisit recipients on Call List

2. Briefly describe the UON work to those on the Call List
3. Contact Maintenance Dispatch / Central Plant on ALL UONs: Phone number to be provided at NTP.
4. Contact Airport Operations Center on ALL UONs: Phone to be provided at NTP
 - a. Including assessment of late flight departures and arrivals and/or other potential operational impacts to airlines or airlines use of BHS
5. Contact Airport Operations BHS on ALL UONs: Phone number to be provided at NTP.
6. Contact Airfield Operations on UONs where high-mast lighting is involved or if traffic movement on AOA will be affected: Phone number to be provided at NTP.
7. Contact Communications Center on UONs where Fire Alarm and/or Life Safety systems (including fire doors or suppressions systems) are affected: Phone number to be provided at NTP.
8. Coordinate with Life Safety Department to ensure that proposed UON does not interfere with other previously scheduled work

3.5. EXECUTION OF UON WORK

- A. The Contractor is required to ensure that only qualified, and where required, licensed personnel will be performing the Work as described in the UON.
- B. For Life Safety- Sprinkler Valves
 1. Once a valve is closed, verification from the COMM Center/Airport Operations MUST confirm that the management system has flagged that particular valve in a trouble state and it notes that the valve has been closed.
 2. A tag must be affixed to the valve, by the Contractor to include the following information:
 - a. Company Name
 - b. Technician Closing the Valve
 - c. Time and Date of Closure
 - d. Contact Information of person closing the valve
 - e. Project number
 - f. Expected duration (or attach a copy of the UON)
 - g. Area affected (or attach copy of the UON)

3.6. POST EXECUTION OF UON WORK

- A. After completion of the Work as outlined in the UON, the Contractor is required to have its qualified supervisor;
1. For Life Safety – Sprinkler Valves
 - a. Once the valve is put back to its normal position, the COMM Center/Airport Operations must be called to reset the valve—give location
 - b. Once the valve is confirmed reset and back to normal, only then can the TAG be removed by the Contractor
 - c. If for some reason the Contractor finds an issue with the valve and it cannot be opened, tamper switch malfunctions, leaks, or won't reset, a work order must be submitted immediately for Airport to address.
 - d. Contractor CANNOT leave the valve unattended for ANY reason (or leave property) in the closed position without either restoring the valve to its normal operating condition or establishing an RPR-approved, ongoing fire watch.
 - e. The Contractor's Project Manager (PM)/Superintendent is responsible to confirm that the system is back to normal before shift's end
 - f. In the event of a malfunction in the Tamper Switch which causes the valve to remain in trouble (which would "indicate" still closed) but the valve is actually open, the Contractor's PM/Superintendent MUST call the COMM Center to make sure the trouble is annotated **and** written confirmation that the valve **IS** open
 - g. In **NO CASE** shall a sprinkler valve **ever** be disabled electronically on the fire alarm system.
 2. Ensure that the Work has been in fact completed as planned
 3. Ensure that no tools have been left inside electrical gear/equipment
 4. Authorize removal of LOTO items, only after confirming completion of the UON Work, and as described in items 1 and 2 above
 5. Ensure posted UON is removed as soon as the Work has been completed
 6. Verbally notify all recipients on the Call List, as described in section 3.4, that the UON Work has been completed
 7. Ensure that a weekly inspection/test plan is in place and communicate inspection dates to the RPR
 8. Notify, in writing, to the RPR, of any and all Code compliant items or other anomalies encountered during the UON Work for resolution
 9. Update panel schedules with any new information immediately after the completion of the UON work. The Contractor is hereby notified that a typed panel schedule update, per NEC 408.4, must be in place within seven (7) days of the UON work completion

3.7. FAILURE TO COMPLY

1. The Contractor's adherence to the UON process and procedures herein outlined is critical in ensuring minimal impacts to ongoing airport operations during and after the completion of the Work requiring UONs.
2. Adverse impacts to the Contractor's schedule caused by the Contractor's failure to comply with the process and procedures herein outlined, will require the Contractor to recover the time and any and all associated costs will be borne by the Contractor.
3. Should the Contractor's noncompliance turn symptomatic, the Owner will contract the required resources to complete the UON process and procedures, but the associated costs, if any, will be borne by the Contractor.

END OF SECTION 013114.13

SECTION 013119 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Conditions/Provisions of the Contract, including Supplemental Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project meetings, including, but not limited to, the following:

1. Job coordination meetings (JCM's).
2. Pre construction/preinstallation conferences.

1.3 PROGRESS MEETINGS

- A. General: Conduct Job Coordination Meetings (JCM's) at the Project Site, or at an alternate location designated by the A/E, Owner or RPR on a bi-weekly basis.

1. The Owner may request additional Job Coordination Meetings or may require the Contractor to increase the frequency of JCM's, to once-a-week, depending upon project progress. Additional meetings or changes in meeting frequency, as directed by the RPR, shall not affect the cost of the original Contract.

- B. Attendees: In addition to the Contractor, A/E and RPR (Resident Project Representative), each subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

- C. Agenda: The RPR will record meeting minutes and update the agenda.

1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Discuss whether schedule revisions are required to insure that current and subsequent activities will be completed within the Contract Time.
2. Contractors Look Ahead: Contractor shall present and distribute a fourteen (14) day look ahead schedule during the "Schedule" portion of the meeting.
3. Review the present and future needs of each entity present, including such items as:

- a. Interface requirements.
- b. Status of permits
- c. Time/schedule status/look ahead schedule.
- d. Sequences.
- e. Deliveries.
- f. Off-site fabrication issue.
- g. Access.
- h. Site utilization.
- i. Submittals.
- j. Requests for information.
- k. Non-compliance notices.
- l. Temporary facilities and services.
- m. Hours of work.
- n. Resource allocation.
- o. Hazards and risks.
- p. Housekeeping.
- q. Quality and work standards.
- r. Safety issues.
- s. Change orders, Field orders
- t. Documentation of information for payment requests.
- u. Other pertinent Construction matter.

- D. Reporting: Transcript copies of each meeting will be distributed to each attendee and to those parties who were scheduled but unable to attend.
- E. Schedule Updating: Refer to Section 01 32 13, Scheduling of Work.
- F. As-Built Documents: Review progress of as-built documents for all disciplines of work. The Contractor and RPR shall coordinate a time to review the as-built documents the same day as the JCM.

1.3 PRECONSTRUCTION/ PREINSTALLATION CONFERENCES

- A. General: Where required by the RPR, A/E or by individual specification sections, conduct preconstruction conferences at the Project Site before each construction activity that requires coordination with other construction. Preconstruction or preinstallation conferences will be held after review of shopdrawings is completed and returned to the G.C. by the A/E.
- B. Attendees: The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the RPR and A/E of scheduled meeting dates.
 - 1. Review the progress of other construction activities and preparations for the particular activity under consideration at each preconstruction conference, including, but not limited to, the following:

- a. Contract Documents.
 - b. Options.
 - c. Shop Drawings, Product Data, and quality-control samples.
 - d. Coordination requirements.
 - e. Time schedules.
 - f. Weather limitations.
 - g. Manufacturer's recommendations.
 - h. Warranty requirements.
 - i. Governing regulations.
 - j. Inspecting and testing requirements.
 - k. Recording requirements.
 - l. Protection.
 - m. Related change notices.
 - n. Purchases.
 - o. Deliveries.
 - p. Possible conflicts.
 - q. Compatibility problems.
 - r. Acceptability of substrates.
 - s. Temporary facilities.
 - t. Space and access limitations.
 - u. Safety.
 - v. Required performance results.
2. Record significant discussions of each conference, and the approved schedule. Promptly distribute a typewritten copy of the record of the meeting to all attendees.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 013119

SECTION 013213 – SCHEDULING OF WORK

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Conditions/Provisions of Contract, including Contractual Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section provides for the comprehensive depiction, measurement, assessment and reporting of project progress and status pursuant to the sub-articles entitled "Contractor's Construction Schedules" of the General Conditions/Provisions. The Contractor's responsibility shall include scheduling of all work within its contractual scope of work, creation of a Preliminary Schedule, a Baseline Schedule, production of reports, narratives, execution of the plan described by the current accepted schedule, participation in meetings with the RPR, and submission of Progress Schedules and revision data, as set forth herein. Conventional Critical Path Method (CPM) techniques must be utilized to satisfy the requirements of this section.

1.3 DEFINITIONS

- A. Activity: A discrete entity of a project schedule that when combined relationally with others develop a network that can be used for planning, scheduling and monitoring of a construction project. Activities contain duration derived from applied resources such as cost, manpower, equipment and material.
 - 1. Critical Activity: An activity that must start and finish as planned.
 - 2. Predecessor Activity: An activity preceding another activity in a network.
 - 3. Successor Activity: An activity succeeding another activity in a network.
- B. Critical Path Method (CPM): An analytical process of scheduling activities using formalized procedures such as "forward pass" and "backward pass" establishing the optimum sequence and duration of operation inclusive of the interrelation of the effort required for the timely completion of the project. Forward pass calculations provide the earliest time in which a project can complete providing "early" dates. Backward pass calculations provide the latest time in which a project can complete providing "late" dates.
- C. Total Float: The difference between the early and late dates and is the amount of time an activity can be delayed without delaying the overall project completion.

1. Float is not intended for the exclusive use or benefit of either the Owner or Contractor. It is considered jointly owned by both parties and is a resource available as needed to meet the Contract Times.
 2. Float suppression techniques such as use of discretionary logic, inflated activity duration and/or lag/lead is prohibited.
- D. Critical Path: The longest continuous path of interrelated activities with the least amount of total float establishing the minimum overall duration of the project from the data date to completion.
- E. Data Date: The date (and time) by which all progress is captured for a given time period.
- F. Work Breakdown Structure (WBS): A hierarchical arrangement that defines the project by phases, deliverables and work packages.
1. WBS shall be the Contractor's primary means to organize the schedule. The RPR may need to dictate the Contractor's WBS levels to adhere to the overall program organization.
 2. Activity Coding at the PROJECT LEVEL can be used by the Contractor as a secondary means of organizing the schedule but GLOBAL Activity Coding is prohibited.
- G. Cost Loading: The allocation of the schedule of values necessary for the completion of an activity as planned. The sum of the costs for all activities must equal the total Contract Price unless otherwise approved by the RPR.
1. Cost Loading, at a minimum, must inherently depict the monthly cash flow derived from the CPM Schedule.
- H. Resource Loading: The allocation of manpower, material and equipment necessary for the completion of an activity as planned.
1. Manpower loading must be defined utilizing manhours per activity.
- I. Relationship Types: Activity dependency or CPM Schedule logic
1. Finish-to-Start (FS) - A relationship between activities in which the start of a successor activity depends on the finish of its predecessor activity.
 2. Start-to-start (SS) - A relationship between activities in which the start of a successor activity depends on the start of its predecessor activity.
 3. Finish-to-Finish (FF) - A relationship between activities in which the finish of a successor activity depends on the finish of its predecessor activity.
 4. Start-to-Finish (SF) - A relationship between activities in which the finish of a successor activity depends on the start of its predecessor activity. (Rarely used)

- J. Open-Ends: Activities without predecessor or successor activities.
- K. Dangling Activities: Activities with FF or SF predecessor relationship types (open start) or SS or SF successor relationship types (open finish).

1.4 QUALITY ASSURANCE

- A. Scheduling Qualifications: The Contractor must employ a designated Project Scheduler or Scheduling Consultant. This specialist must be experienced in CPM Schedule development, management and reporting and have a minimum of 5 years' experience with Primavera Scheduling Software, preferably P6, on Projects of similar size and complexity.
 - 1. At any time the OAR may order the Contractor to replace the designated scheduler with another if the current scheduler is deemed unacceptable based on qualifications or performance.
- B. Required Computerized CPM Scheduling System: For Projects exceeding \$2 million in Contract Price, Oracle Primavera P6 Professional Project Management (P6 PPM) or Oracle Primavera P6 Enterprise Project Portfolio Management (P6 EPPM) must be the computer scheduling software system utilized. For Projects less than \$2 million, any other planning software may be employed (e.g. Primavera Contractor, Microsoft Project, etc.) providing the Critical Path can be derived.
- C. Schedule Alignment Meeting: Conduct a Prescheduling conference at Project Site to ensure compliance with all requirements within this Section as well as related documents as it relates to CPM Schedule development, management and reporting including but not limited to:
 - 1. Review Planning Software.
 - 2. Verify Scheduling Qualifications.
 - 3. CPM Schedule Organization (WBS) and Detail.
 - 4. Owner / Interface Milestones between concurrent or other Projects.
 - 5. Review time required for Owner / OAR activity such as submittal review, testing and inspecting, commissioning, training and closeout.
 - 6. Updating Procedures.
 - 7. Activity ID Coding and File Nomenclature and submission.
 - 8. Coordination and time commitments for subcontractors and all other entities involved.

1.5 SUBMITTALS

- A. Format: Submit required submittals via email unless directed otherwise by the RPR in the following format:
 - 1. Working P6 electronic (XER) file with the following File Naming Structure indicative of

Bid Package Number, Data Date and file extension:

- a. BP-###_DD=dd-mmm-yy.xer(mpp)
2. PDF files for Detailed (All Activities) CPM Schedule and Longest Path with the following Title Block information (use Header and/or Footer):
 - a. Contractor's Name
 - b. Owner's Bid Package Number & Project Name
 - c. Schedule Type (e.g. "Detailed Schedule", "Longest Path", etc.)
 - d. Data Date
 - e. Run Date
 - f. File Name
 - g. Symbol Legend
 - h. P6 Project ID
 - i. Layout & Filter Name

PART 2 - PRODUCTS

2.1 CONTRACTOR'S PROJECT SCHEDULES

A. Produce the following Construction Schedules.

1. Preliminary Schedule
2. Baseline Schedule
3. Progress Schedules

B. Produce the following Schedules as required as applicable.

1. Recovery Schedules
 - a. If at any time the Contractor's Progress Schedule indicates the project is two or more weeks (14 calendar days) behind any current contractual completion date(s), the Contractor must first submit both a graphic (Longest Path) and written (narrative) report measuring the extent of the delay regardless of assumed causation and then a separate Recovery Schedule indicating means by which the Contractor intends to regain schedule compliance.
2. Job Coordination Meeting (JCM) Look-Ahead Schedules
 - a. With each monthly Progress Schedule, the Contractor must develop a Four Week Look-Ahead Schedule derived from the update indicating one week of As-Built progress prior to the Data Date and four weeks of As-Planned progress beyond the Data Date. It is intended that this document shall serve as the working schedule document at the JCM to ascertain incremental weekly progress until the following

monthly Progress Schedule is updated. If at the discretion of the RPR this document becomes unusable due to out of sequence progress or for other reasons such that the incremental weekly progress cannot be ascertained, the Contractor must implement weekly updates until the RPR is satisfied that the progress is being accurately depicted.

- b. Look-Ahead Schedules must be submitted in colored .pdf format via email to the OAR at least 48 hours prior to the JCM.

3. Delay Claim Entitlement Schedules

- a. If at the Contractor's discretion a delay beyond the Contractor's control is encountered and after the Contractor has made every effort and reasonable attempt to mitigate the impacts of the delay without additional costs to the Owner or disruption to the project, a request for additional time may be requested. All requests for extensions of time must be submitted within the confines of the Contract and accompanied by a reputable delay analysis technique and narrative. Time extensions shall only be granted if the delay is excusable and impacts the critical path of the project at the time of the delay.

4. As-Built Schedules

- a. After all Contract work items are complete, and prior to final payment, the Contractor shall submit the final Progress Schedule that will be called the "As-Built" Schedule, showing actual start and actual finish dates for all schedule activities and milestones.

5. Early Completion Schedules

- a. The contract completion date shall not be changed by submission of a schedule that shows an early completion unless specifically authorized by RPR Change Order.

2.2 CONTRACTOR'S SCHEDULE NARRATIVES

- A. Any and all Project Schedules (e.g. Preliminary, Baseline, Progress, Recovery and/or Request for Time Extension) shall be submitted with an accompanying narrative explaining the schedule consistent with its purpose.

2.3 MONTHLY REPORTS

- A. Summary Level Schedules, Cash Flow Curves and physical percent complete based on manpower analysis derived from the monthly Progress Schedule must accompany the Contractor's Monthly Reports.

PART 3 - EXECUTION

3.1 SCHEDULE REQUIREMENTS

- A. Activity Types: In addition to construction activities, the CPM Schedules shall include other individual activities and milestones as applicable:
1. Contractual milestones, such as Notice to Proceed, Substantial Completion, Certificate of Occupancy, Final Completion or any other Contract milestones.
 2. Design deliverables and milestones as applicable.
 3. Permitting Activities as applicable.
 4. Procurement Activities such as: subcontractor scope review and buyout, submittal and shop drawing preparation, submittal approval, release and order of material and equipment, material and equipment fabrication and delivery.
 5. Interim Contractor's milestones as applicable.
 6. All Utility Outage Notifications (UON's) as required.
 7. Owner Activities such as Owner Furnished Contractor Installed (OFCI), Owner Furnished and Owner installed (OFOI), Tenant move-out and occupancy, swing space and Owner required utility payments or any other Owner activity that may affect schedule.
 8. Completion Activities such as Commissioning, testing, turnover, training, Contractor and RPR punch and final inspections by system.
- B. The RPR may identify additional interfaces during the course of the Work and the Contractor will incorporate these in the Progress Schedule as required. No composite activities allowed. The CPM Schedules must break out all activities into their respective trades. At a minimum, at least one construction activity and one procurement string must be identified in the CPM Schedules for each subcontractor on the project as applicable.
- C. Activity ID's: The Contractor's CPM Schedule shall contain an intelligent activity identification coding system that must include the Project Number (C19-2811) as a prefix to all Activity ID's in the schedule. If activities are deleted from the schedule after the Baseline has been accepted, the Contractor must log these occurrences and submit this information to the RPR consistent with the schedule submission inclusive of the activity deletions. It is recommended that the Contractor include this information with the accompanying schedule narrative. Duplication of Activity ID's with differing activity descriptions is prohibited.
- D. Activity Duration: With exception to the Preliminary Schedule, the duration for each activity shall be based on manpower assignment and production rates estimated in work days and may not exceed 20 days except for:
1. Procurement Activities such as fabrication or lead time. Procurement activity strings must include separate activities for submittal preparation, approval, release and order, fabricate

and delivery. Any procurement activity requiring duration greater than 60 days must be explained by the Contractor before accepted into the CPM Schedules by the RPR relationship types shall be utilized to show activity dependence. At a minimum, each activity shall have one FS or SS predecessor and one FS or FF successor with the exception of the first and last activities in the network such that no other activities shall be open-ended or dangling.

- E. Lags and Leads: The use of lags or leads between activities is not encouraged. Instead, it is preferable to use an activity to represent the time lapse between two activities. The use of negative lags is prohibited.
- F. Date Constraints: The use of constraints is not encouraged but at times necessary especially considering internal Owner operation and external Owner projects that may be occurring simultaneously with inter-project dependency. Any use of constraints must be explained by the Contractor consistent with the schedule submission inclusive of the constraint(s). Depending on the type of constraint(s) used and where the constraint(s) are applied may lead to suspect schedule calculations specifically related to total float. It is the responsibility of the Contractor to verify the accuracy of the schedule calculations derived from the use of constraints.
- G. Calendars: With the sole exception of the required Global Resource Calendar, all calendars must be represented on the Project Level and shall not inherit holidays or exceptions derived from their originating Global Calendar. Any other use of Global Calendars is prohibited. Any schedule submitted with Global Calendars will be rejected and not accepted until remedied. It is recommended that the Contractor develop the following Project Calendars with the following labels:
 - 1. CXX-XXXX: 5 Day-8hrs/day (with 7 standard holidays) depicting the standard work week (M-F) with Saturday, Sundays and the Standard Holidays represented as non-work days. Standard holidays include: New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Friday after and Christmas Day.
 - a. Assign this calendar to all Contractors' general work activities.
 - b. Assign this calendar to all Owner activity.
 - CXX-XXXX: 7 Day-8hrs/day (All Days) depicting all days containing no holidays or non-work days.
 - a. Assign this calendar to all Summary or Level of Effort Activities.
 - b. Assign this calendar to Contractual Milestones.
- H. Other Project Calendars may be used as needed by the Contractor on a case by case basis but in each case, supporting documentation explaining its use must be submitted to the OAR for acceptance. All Project Calendars detailed work hours by work day must be set to 8:00am-12:00pm and from 1:00pm-5pm with 12:00pm-1:00pm represented as a non-work hour such that

each work day is representative of 8 hours unless approved otherwise by the RPR.

- I. Activity Coding: The Contractor must utilize WBS to organize the CPM Schedules. Prior to and part of the RPR's Baseline Schedule acceptance, the Contractor must provide the RPR their proposed WBS for OAR approval.
- J. Data Dates: The Data Date shall be controlled by the RPR so that all Contractors are using the exact same dates each month consistent with the Owner's overall program. The Owner shall provide the Contractor reporting calendar information where monthly update Data Dates will be specified.

3.2 CONTRACT MODIFICATIONS

- A. For each proposed contract modification and concurrent with its submission, the Contractor shall prepare a delay analysis demonstrating the impact of the proposed change on the overall project schedule or interim contract milestone(s) if applicable. If said change is approved by the RPR, the Contractor shall incorporate the contract modification into the Progress Schedules for the period in which the change was issued.

3.3 SCHEDULE CALCULATIONS AND DIAGNOSTICS

- A. Multiple Project Schedules will be maintained within the RPR's scheduling system. As such, all schedule data submitted by the Contractor must be submitted on the Project Level. No Global data shall be accepted unless specified otherwise herein.
- B. Schedule Calculations and Settings:
 - 1. Maintain open-ended activities as non-critical.
 - 2. All project schedule files shall be updated with actual progress using retained logic prior to submission. Progress override is prohibited.
 - 3. Start-to-Start lag shall be calculated from Early Start.
 - 4. Define critical activities as Longest Path providing it is a continuous path emanating from the Data Date to project completion. Otherwise, use total float less than or equal to zero days.
 - 5. Compute total float as finish float.
 - 6. Relationship Lag shall be calculated based on the Predecessor Activity Calendar.
 - 7. Use Remaining Duration to ascertain activity progress and not percent complete.
- C. Schedule Diagnostics: All Project Schedules shall be calculated and analyzed then corrected for all open ended and dangling activities, out of sequence progress and associated schedule corrections as applicable. No activities shall be progressed beyond the Data Date.

3.4 SPECIAL SCHEDULE REPORTS

- A. At times and within reason, the RPR may direct the Contractor to develop special reports as needed.

END OF SECTION 013213

SECTION 013223 – FIELD ENGINEERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Conditions/Provisions of the Contract, including Contractual Conditions and other Division 1 Specification Sections, apply to this Section.
- B. See Civil specification for additional field engineering requirements.

1.2 SUMMARY

- A. General: This Section specifies administrative and procedural requirements for field- engineering services including, but not limited to, the following:
 - 1. Land survey work.
 - 2. Building Layout
 - 3. As-Built documentation

1.3 SUBMITTALS

- A. Certificates: Submit a certificate signed by the land surveyor or professional engineer certifying the location and elevation of improvements.
- B. Final Property Survey and As-Built documentation Survey: Submit 2 paper copies, 1 mylar and and CD/DVD of AutoCAD & PDF files of the final property survey (42”x30” format).

1.4 QUALITY ASSURANCE

- A. Surveyor Qualifications: Engage a land surveyor registered in the State of Florida to perform required land-surveying services.
- B. Engineer Qualifications: Engage an engineer of the discipline required, licensed in the State of Florida to perform required engineering services.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Identification: The Contractor will be required to establish its own Project control points.
- B. Verify layout information shown on the Drawings, in relation to the property survey and existing benchmarks, before proceeding to lay out the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.

1. Do not change or relocate benchmarks or control points without prior written approval of the RPR. Promptly report lost or destroyed reference points or requirements to relocate reference points because of necessary changes in grades or locations.
 2. Promptly replace lost or destroyed Project control points utilizing the original survey control points.
- C. Establish and maintain a minimum of 2 permanent benchmarks on the site, referenced to data established by survey control points.
1. Record benchmark locations, with horizontal and vertical data, on Project As-Built Documents.
- D. Existing Utilities and Equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction.
1. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping. Document the information on the As-Built Documents.

3.2 PERFORMANCE

- A. Work from lines and levels established by the contract documents. Establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.
1. Advise entities engaged in construction activities of marked lines and levels provided for their use.
 2. As construction proceeds, check every major element for line, level, and plumb.
- B. Surveyor's Log: Maintain a surveyor's log of control and other survey work. Make this log available for reference to the RPR and the Designer.
1. Record deviations from required lines and levels, and advise the RPR when deviations that exceed indicated or recognized tolerances are detected. On Project As-Built Drawings, record deviations that are accepted and not corrected.
- C. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes, and invert elevations.

- D. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels, and control lines and levels required for mechanical and electrical work.
- E. Existing Utilities: Furnish information necessary to adjust, move, or relocate existing structures, utility poles, lines, services, or other appurtenances located in or affected by construction. Coordinate with the appropriate Utility and the local Authorities Having Jurisdiction.
- F. As-Built Documents: All concealed and underground utilities, equipment, foundations or other permanent conditions shall be surveyed and documented on the As-Built Documents. This includes all discovered conditions. All shall be tied to permanent benchmarks showing horizontal and vertical data. GPS coordinates are to be provided for all beginning/end points and changes in direction. See Project Close-out 017800 for all As-built requirements.
 - 1. Recording: At Substantial Completion, have the final property survey recorded by or with local governing authorities as the official "property survey."

END OF SECTION 013223

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Conditions/Provisions of Contract, including Contractual Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes: construction video

1.3 SUBMITTALS

- A. Submit two Recordable Discs (CD-R, DVD ± R) of the entire construction site prior to the commencement of any work. Video format shall be compatible with the latest release of Windows Media Player. The discs shall be reviewed and approved by the RPR prior to the commencement of construction activity.
- B. Submit two recordable discs (CD-R, DVD+R) of monthly status aerial photo of overall site/construction building

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION RECORDABLE DISCS

- A. Before starting construction, record video of the site and surrounding properties from different points of view as selected by the RPE and A/E. Record pre-existing conditions of the site and abutting properties obtained from several perspectives. Provide narrative describing the vantage point and area being recorded.
 1. Take videos in sufficient number to show existing conditions adjacent to the property before starting work.
 2. Take videos of existing improvement adjoining the property in sufficient detail to record accurately the physical conditions at the start of construction.

END OF SECTION 013233

SECTION 013323 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and General Conditions/Provisions of Contract, including Contractual Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY:

- A. Section includes administrative and procedural requirements for submittal of Shop Drawings, Product Data and Samples to verify that products, materials and systems proposed for use comply with provisions of the Contract Documents.
- B. Shop Drawings include, but are not limited to, the following:
 - 1. Fabrication Drawings.
 - 2. Installation Drawings.
 - 3. Setting diagrams.
 - 4. Shop-work manufacturing instructions.
 - 5. Templates and patterns.
 - 6. Schedules.
 - 7. Design mix formulas.
 - 8. Coordination Drawings.
- C. Product Data include, but are not limited to, the following:
 - 1. Manufacturer's product Specifications.
 - 2. Manufacturer's installation instructions.
 - 3. Standard color charts.
 - 4. Catalog cuts.
 - 5. Roughing-in diagrams and templates.
 - 6. Standard wiring diagrams.
 - 7. Printed performance curves.
 - 8. Operational range diagrams.
 - 9. Mill reports.
 - 10. Standard product operating and maintenance manuals.
 - 11. Safety Data Sheets (SDS) Previously MSDS.
- D. Samples include, but are not limited to, the following:
 - 1. Partial Sections of manufactured or fabricated components.
 - 2. Small cuts or containers of materials.
 - 3. Complete units of repetitively-used materials.
 - 4. Swatches showing color, texture and pattern.
 - 5. Color range sets.
 - 6. Components used for independent inspection and testing.

E. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:

1. Schedule of Submittals
2. Permits.
3. Applications for payment.
4. Performance and payment bonds.
5. Insurance certificates.
6. Listing of subcontractors.
7. Contractor's construction schedule.
8. Progress Schedules
9. Progress reports.

1.3 SUBMITTAL PROCEDURES:

A. Coordination: Coordinate preparation and processing of submittals with performance of the Work.

1. Contractor shall submit Schedule of Submittal to the RPR, ten days after NTP.
2. Contractor shall review submittals before submitting to the RPR (Resident Project Representative). Transmit each submittal to the RPR sufficiently in advance of scheduled performance of related construction activities to avoid delay, but in no case later than thirty (30) days after the Notice to Proceed. If any submittals will be delayed, inform the RPR in writing giving reasons for the delay and a revised submittal schedule. Delays will be subject to RPR's approval. No extension of time will be authorized because of a Contractor's failure to transmit submittals to the RPR sufficiently in advance of the Work to permit processing.
3. The RPR and A/E will review all Administrative Submittals. The RPR will review all other submittals for conformance with the Contract Documents prior forwarding the submittals to the A/E.
4. Request for payment of stored materials will not be considered until submittals have been received and approved by the RPR.
5. Transmit submittals to the RPR to prevent delays. The Contractor is responsible for delays accruing directly or indirectly from submission or resubmission of submittal date.
6. Coordinate each submittal with other submittals and related activities that require sequential activity including:
 - a. Testing.
 - b. Purchasing.
 - c. Fabrication.
 - d. Delivery.
7. Coordinate transmittal of different types of submittals for the same element of the Work and different elements of related parts of the Work so that processing will not

- be delayed by the RPR's and A/E's need to review submittals concurrently for coordination.
- a. The RPR and A/E reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are delivered to the RPR and A/E.
8. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for re-submittals.
- a. Allow Fourteen (14) days for the RPR and A/E's initial review of each submittal. Where processing must be delayed to permit coordination with subsequent submittals, allow additional time. The RPR will advise the Contractor promptly when a submittal being processed must be delayed for coordination.
 - b. Where necessary to provide an intermediate submittal between the initial and final submittals, process the intermediate submittal in the same manner as the initial submittal. Allow fourteen (14) days for reprocessing each submittal.
 - c. No extension of time will be authorized because of a Contractor's failure to transmit submittals to the RPR sufficiently in advance of the Work to permit processing.
- B. Submittal Preparation - Division 2 through 49: Place a permanent label or title block on each submittal for identification, and submit the information in Submittal Binders. The Contractor has the option to provide Submittals in electronic (PDF) format for the Contractor's own uses, but if hard copies are submitted the specified number of hard copy submittals shall be met. PDF files will be required for all O&M and Close-out documents. The PDF file shall be enabled for Adobe Reader's Comment and Markup functionality. All stamps and markings described herein shall be electronically duplicated or added before scanning. The PDF files shall be transmitted / uploaded to an agreed to Cloud Share file service to the RPR.
1. Binders shall be identified using CSI Divisions and Classification of work, as follows:
 - a. Architectural- (Divisions 02-15) White
 - b. Mechanical- (Divisions 21-23) Green or Red
 - c. Electrical – Power (Divisions 25-26) Black
 - d. Electrical – Systems (Divisions 27-28) Blue
 - e. Civil - (Divisions 31-35) Yellow
 2. Place a permanent label or title block on each submittal for information.
 3. Indicate the name of the firm or entity that prepared each submittal on the label or title block.
 4. Provide a space approximately 4 inches by 5 inches on the label or adjacent to the title block to record the Contractor's review and approval markings and the action taken by the RPR and Designer.
 5. Include the following information on the label for processing and recording action taken.

- a. Project name.
 - b. Date.
 - c. Name and address of RPR.
 - d. Name and address of A/E.
 - e. Name and address of Contractor.
 - f. Name and address of subcontractor.
 - g. Name and address of supplier.
 - h. Name of manufacturer.
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Similar definitive information as necessary.
6. Stamp each page (sheet) of the submittal with the Contractor's certification statement, or other approval statement, as follows:
- "I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is that proposed to be incorporated in the work, is in compliance with the Contract Documents, can be installed in the allocated spaces, and is submitted for review by the RPR and A/E.
- Certified by Submittal Reviewer _____ . Date: _____ "
- a. Sign the certifying statement or approval statement. The signatures shall be in original ink. Stamped or photocopied signatures are not acceptable.
7. Provide additional tabs (blank sections) in each manual for future submittals.
- C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to RPR, as indicated, by use of a transmittal form. Submittals received from sources other than the Contractor will be returned to the sender without action. Electronic transmittals must have descriptive subject lines for ease of retrieval. The transmittal form should be the first page in the attached PDF.
1. Record relevant information and requests for data on the transmittal form. On the form, or an attached separate sheet, call attention to deviations from requirements of the Contract Documents, including minor variations and limitations.
 2. Include the Contractor's signed certification stating that information submitted complies with requirements of the Contract Documents.
 3. Prepare a draft of a transmittal form and submit it to the OAR review and acceptance. Provide places on the form for the following information:
 - a. Project name.
 - b. Date.
 - c. Destination (To:).
 - d. Source (From:).

- e. Names of subcontractor, manufacturer and supplier.
- f. Category and type of submittal.
- g. Submittal purpose and description.
- h. Submittal and transmittal distribution record.
- i. Remarks.
- j. Signature of transmitter.

1.4 COST OF HARD COPY SUBMITTALS: IF REQUIRED BY OWNER:

1. The contractor shall pay delivery and return, postage, expedited service delivery FEDX, UPS and or Courier services if Hard copy submittals is the selected method of review of submittals.

1.5 SPECIFIC SUBMITTAL REQUIREMENTS:

- A. Shop Drawings: Submit newly prepared information, drawn to accurate scale. **DO NOT REPRODUCE CONTRACT DOCUMENTS OR COPY STANDARD PRINTED INFORMATION AS THE BASIS OF SHOP DRAWINGS. USE OF DRAWINGS WITH THE ARCHITECTS NAME AND OR A/E BORDER SHEET IS PROHIBITED.**

1. Include the following information on Shop Drawings:
 - a. Dimensions.
 - b. Identification of products and materials included.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
2. Submit Coordination Drawings where required for integration of different construction elements. Show construction sequences and relationships of separate components where necessary to avoid conflicts in utilization of the space available.
3. The Contractor shall prepare drawings to LOD 400 or greater Per AIA G202-2013.
4. Encircle, identify with arrow, or otherwise indicate deviations from the Contract Documents on the Shop Drawings.
 - a. DO NOT USE COLORED HIGHLIGHTERS TO INDICATE SELECTIONS.
5. Do not allow Shop Drawing copies which do not have an appropriate final stamp or other marking indicating action taken by the General Contractor, RPR and A/E to be used for construction.
6. Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 30" x 42". Shop drawings submitted as PDF files shall be *generated full size of the original and not scale to fit*.
7. Submittals may be in electronic format or if submitting in paper format, submit a sufficient number of copies to enable the County, A/E and the RPR to retain 4 copies of each required Product Data submittal; submit two (2) additional copies where copies are required for operating and maintenance manuals. The RPR will return the other marked copies with the action taken and corrections or

- modifications required. One (1) print of each drawing larger than 11" x 17" for review will be returned to the Contractor.
8. Leave a blank area, approximately 4 inches by 2.5 inches, near the title block for the RPR's and A/E 's review stamp in print.
- B. Product Data: Collect Product Data into a single submittal for each element of construction or system.
1. Encircle, identify with arrow, each copy to show which choices and options are applicable to the Project.
 - a. Do not use colored highlights to indicate selection.
 2. Where Product Data has been printed to include information on several similar products, some of which are not required for use on the Project, or are not included in this submittal, mark copies to clearly indicate which information is applicable.
 3. Where Product Data must be specially prepared for required products, materials or systems, because standard printed data are not suitable for use, submit as "Shop Drawings" not "Product Data."
 4. Include the following information in Product Data:
 - a. Manufacturer's printed recommendations.
 - b. Compliance with recognized trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Application of testing agency labels and seals.
 - e. Notation of dimensions verified by field measurement.
 - f. Notation of coordination requirements.
 5. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
 6. Submittals may be in electronic format or if submitting in paper format, submit a sufficient number of copies to enable the County and the RPR to retain 4 copies of each required Product Data submittal; submit two (2) additional copies where copies are required for operating and maintenance manuals. The RPR will return the other marked copies with the action taken and corrections or modifications required.
 - a. Unless the RPR and or A/E observes noncompliance with provisions of the Contract Documents or requires re-submittal for other reasons, the initial submittal may serve as the final submittal.
 7. Furnish copies of final Product Data submittal to manufacturers, subcontractors, suppliers, fabricators, installers, governing authorities and others as required for performance of the construction activities. Show distribution on transmittal forms.

- a. Do not proceed with installation of materials, products and systems until a copy of Product Data applicable to the installation is in the installer's possession.
 - b. Do not permit use of unmarked copies of Product Data in connection with construction.
- C. Samples: Submit Samples physically identical with the material or product proposed for use; submit full-size, fully fabricated Samples, cured and finished in the manner specified.
 1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match Designers' Sample where so indicated. Include the following information:
 - a. Generic description of the Sample.
 - b. Size limitations.
 - c. Sample source.
 - d. Product name or name of manufacturer.
 - e. Compliance with recognized standards.
 - f. Compliance with governing regulations.
 - g. Availability.
 - h. Delivery time.
 2. Submit three samples (sets); one set will be returned marked with the action taken. The RPR and A/E will each retain copies.
- D. Operating and Maintenance Manuals: Operating and maintenance manuals shall be initially submitted for review at the appropriate 30 percent completion stage of Work under these Sections. The manuals will be reviewed and returned to the Contractor. Corrections shall be made before submittal of the manuals at Project Close-out.
- E. In order to facilitate review of product data and shop drawings, they shall be noted, indicating by cross reference the contract drawing sheet number, note, and specification paragraph numbers, where and what item(s) are used for and where item(s) occur in the contract documents.

1.6 RPR AND OR A/E(S) ACTION:

- A. Except for submittals for the record, for information and similar purposes, where action and return on submittals is required or requested, the RPR and A/E will review each submittal, mark with appropriate "action," and where possible return within fourteen (14) days of receipt. Where the submittal must be held for coordination the RPR will so advise the Contractor without delay.
 1. Compliance with specified characteristics is the Contractor's responsibility, and not considered part of the RPR or A/E review and indication of action taken.

- B. The RPR and or A/E will stamp each submittal sheet or page to be returned with a uniform, self explanatory action stamp appropriately marked and executed to indicate whether the submittal returned is for unrestricted use (no exceptions taken), final-but- restricted use (as marked), must be revised and resubmitted (use not permitted), or without action (as explained on the transmittal form), or other similar type wording.
- C. The RPR's and or A/E's review of submittals is for design conformity and general conformance of the contract documents only and does not relieve the Contractor from responsibility for any deviations from the requirements of the Contract Documents. The RPR and or A/E's review shall not be construed as a complete check nor shall it relieve the Contractor from responsibility for errors of any sort in shop drawings or schedules, of from the necessity of furnishing any work required by the Contract Documents which may have been omitted on the shop drawings. The RPR and or A/Es' review of a separate item shall not indicate review of the complete assembly in which it functions.

1.7 SUBMITTAL BROCHURE BINDERS: Applicable only to hard copy submittals.

- A. Brochure Binders: 3-ring, vinyl covered, with clear view insert type cover and spine.
 - 1. Binder Size: 8.5 x 11.0 inches x size (spine) adequate to easily contain the required submittals. Minimum spine size shall be 1-inch, maximum shall be 3-inches. Provide additional binders if the 3-inch size is not sufficient to properly contain submittals.
 - 2. Binder Cover: Binders shall have a clear view, vinyl pocket on the front cover, adequate to hold an 8.5 inch by 11 inch description sheet. The binder shall have a clear view, vinyl spine pocket adequate to hold an 11 inch long description sheet.
- B. Binder Contents: Include the following.
 - 1. Cover sheet; cover sheet shall be white with black letters, minimum 11-inches high and full width of spine pocket. See "EXAMPLES" included at end of this Section.
 - 2. First page shall be a copy of the Specification table of contents.
 - 3. Second page shall be a list of project addresses (see "EXAMPLE").
 - 4. Third page shall be Project information (see "EXAMPLE").
 - 5. Provide reinforced separation sheets tabbed with appropriate specification reference number.
 - 6. Product data sheets.
 - 7. Shop drawings.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SCHEDULE OF SUBMITTALS DESCRIPTION (SD) AND SUBMITTAL REGISTER

- A. General: The following is a description of each submittal type, specified in other Sections, required for the Project. Include each submittal description (SD) in the Submittal Register included as part of this Section.
1. SD-01: Product Data; submittals that provide calculations, descriptions or other documentation regarding the work.
 2. SD-02: Manufacturer's Catalog Data (Product Data); data composed of information sheets, brochures, circulars, specifications and product data, and printed information in sufficient detail and scope to verify compliance with requirements of the Contract Documents.
 3. SD-03: Manufacturer's Standard Color Charts (Product Data); preprinted illustrations displaying choices of color and finish for a material or product.
 4. SD-04: Shop Drawings; graphic representations which illustrate relationship of various components of the work, schematic diagrams of systems, details of fabrications, layout of particular elements, connections, and other relational aspects of the work.
 5. SD-05: Design Data (Shop Drawings); design calculations, mix designs, analyses, or other data written and pertaining to a part of the work.
 6. SD-06: Instructions (Product Data); preprinted material describing installation of a product, system, or material, including special notices and Material Safety Data Sheets, if any, concerning impedance, hazards, and safety precautions.
 7. SD-07: Schedules (Shop Drawings); a tabular list of data or a tabular listing of locations, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.
 8. SD-08: Statements (Shop Drawings); a document, required of the Contractor, or through the Contractor by way of a supplier, installer, manufacturer, or other lower tier contractor, the purpose of which is to further the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verification of quality.
 9. SD-09: Reports (Product Data); reports of inspection and laboratory tests, including analysis, an interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.
 10. SD-10: Test Reports (Product Data); a report signed by an authorized official of a testing laboratory that a material, product, or system identical to the material, product or system to be provided has been tested in accordance with requirements specified by naming the test method and material. The test report must state the test was performed in accordance with the test requirements; state the test results; and indicate whether the material, product, or system has passed or failed the test. Testing must have been within three years of the date of award of this Contract.
 11. SD-11: Factory Test Reports (Shop Drawings); a written report which includes the findings of a test required to be performed by the Contractor or an actual portion of the work or prototype prepared for this project before it is shipped to the job site. The report must be signed by an authorized official of a testing laboratory and must state the test was performed in accordance with the test requirements; state the test results; and indicate whether the material, product, or system has passed or failed the test.

12. SD-12: Field Test Reports (Shop Drawings); a written report which includes the findings of a test made at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation. The report must be signed by an authorized official of a testing laboratory or agency and must state the test was performed in accordance with the test requirements; state the test results; and indicate whether the material, product, or system has passed or failed the test.
13. SD-13: Certificates (Shop Drawings); statements signed by responsible officials of a manufacturer of a product, system, or material attesting that the product, system, or material meet specified requirements. The statements must be dated after the award of this contract, name the project, and list the specific requirements which it is intended to address.
14. SD-14: Warranties (Product Data); statements signed by responsible officials of a manufacturer of a product, system, or material attesting that the product, system, or material will perform its specific function over a specified duration of time. The statement must be dated, and include the name of the project, the Owner's name, and other pertinent data relating to the warranty.
15. SD-15: Samples; samples, including both fabricated and non-fabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.
16. SD-16: Color Selection Samples (Samples); samples of the available choice of colors, textures, and finishes of a product or material, presented over substrates identical in texture to that proposed for the work.
17. SD-17: Sample Panels (Samples); an assembly constructed at the project site in a location acceptable to the RPR and using materials and methods to be employed in the work; completely finished; maintained during construction; and removed at the conclusion of the work or when authorized by the RPR. A type of sample.
18. SD-18: Sample Installations (Samples); a portion of an assembly or material constructed where directed and, if approved, retained as a part of the work.
19. SD-19: Records; documentation to ensure compliance with an administrative requirement or to establish an administrative mechanism.
20. SD-20: Operating and Maintenance Manuals (Records); data intended to be incorporated in an Operating and Maintenance Manual
21. SD-21: Test Reports of Existing Conditions; a document describing existing conditions and operations of systems and components prior to the start of any work. Testing shall be held in the presence of the RPR and A/E. Provide copies of the test reports to the RPR and A/E.
22. SD-22: Demonstrations; physical operation of equipment and systems by factory authorized representatives to demonstrate to the Owner's facility personnel proper operation of systems. Provide all required documentation that certified completed demonstration.
23. SD-23: As-Built Drawings; delineated documentation accurately depicting final installation location of components and systems of the building.
24. SD-24: Shop Drawings in Electronic format; when drawings are required all materials shall be provided in AUTOCAD latest release and PDF on a CD/DVD.

25. SD-25: Coordination Drawings; special type of Shop Drawing that show the relationship and integration of different construction elements that require close and careful coordination during fabrication or during installation to fit in the restricted space provided or to function as intended.
 26. SD-26: Certification of Approved Disposal of Hazardous Materials; certification signed by the Contractor indicating legal disposal of hazardous materials.
 27. SD-27: CD/DVD Training Tape; taped training instructions to be used by the Owner's personnel.
 28. SD-28: Spare Parts Memo; a listing of spare parts required; refer to Section 01 70 00 Execution and Closeout Requirements.
 29. SD-29: UL Letter of Finding; a document from Underwriters Laboratories Inc., attesting compliance with UL's standard for connection to an existing lightning protection system; a document from Underwriters Laboratories Inc., attesting compliance with UL's standard for UL Master Label.
 30. SD-30: Equipment Check-Out Memos; document signed by the manufacturer's authorized representative stating that equipment has been installed and is operating in accordance with the manufacturer's specifications; refer to Section 01 70 00 Execution and Closeout Requirements.
- B. Submittal Register: The Contractor is to maintain an accurate updated submittal register and will bring this register to each scheduled JCM with the RPR and the A/E. This register should include the following items:
1. Submittal-Description and Number assigned.
 2. Date to RPR
 3. Date to A/E.
 4. Date returned to RPR from A/E.
 5. Date returned to Contractor from A/E.
 6. Submittal Status.
 7. Date of Re-submittal and Return (as applicable).
 8. Date material released (for fabrication).
 9. Projected date of fabrication.
 10. Projected date of delivery to site.
 11. Status of submittal.

END OF SECTION 013323

SECTION 014200 - REFERENCES PART

1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Conditions/Provisions of the Contract, including Contractual Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 DEFINITIONS

- A. General: Basic contract definitions are included in the Conditions of the Contract.
- B. "Approved": The term "approved," when used in conjunction with the RPR's or A/E(s) action on the Contractor's submittals, applications, and requests, is limited to the RPR's or Designer duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the RPR, requested by the RPR, and similar phrases.
- D. "Furnish": The term "furnish" means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- E. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted", "scheduled," and "specified" are used to help the user locate the reference. Location is not limited.
- F. "Install": The term "install" describes operations at the Project site including the actual unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- G. "Installer": An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, who performs a particular activity including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.
- H. "Manufacturer": The manufacturer is the individual entity with responsibility for and control of the assembly of the major components.
- I. "Project site" is the space available to the Contractor for performing installation activities, either exclusively or in conjunction with others performing work as part of the Project. The extent of the Project site is shown on the Drawings.
- J. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.

- K. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the industry that control performance of the Work.
 - 1. The term "experienced," when used with the term "installer," means having successfully completed a minimum of 5 previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- L. "Testing Agencies": A testing agency is an independent entity engaged by the Owner, to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 48-division "MasterFormat" system.
- B. Specification Content: These Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words will be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.
 - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.4 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with the standards in effect as of the date of the Contract Documents, unless otherwise indicated.

- C. **Conflicting Requirements:** Where compliance with 2 or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different but apparently equal to the OAR for a decision before proceeding.
 - 1. **Minimum Quantity or Quality Levels:** The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to the RPR for a decision before proceeding.
- D. **Copies of Standards:** Each entity engaged in installation on the Project must be familiar with industry standards applicable to its installation activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required installation activity, the Contractor shall obtain copies directly from the publication source and make them available on request.
- E. **Abbreviations and Names:** Trade association names and titles of general standards are frequently abbreviated. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-generating organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Gale Research Inc.'s "Encyclopedia of Associations," which is available in most libraries.

1.5 GOVERNING REGULATIONS AND AUTHORITIES

- A. **Copies of Regulations:** Obtain copies of the current codes and regulations being utilized by the Authority Having Jurisdiction and retain at the Project site to be available for reference by parties who have a reasonable need.

1.6 SUBMITTALS

- A. **Permits, Licenses, and Certificates:** For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 014200

SECTION 014339 - VISUAL MOCK-UP REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies full size mock-up requirements of building components to verify material selections, demonstrate aesthetic effects and review construction and workmanship.
- B. Visual Mock-up shall be completed prior to commencement of in-place construction.
- C. Approved mock-up shall establish the standard by which the Work will be judged.
- D. Acceptance of mock-up does not constitute approval of deviations from the Contract Documents in mock-up, unless such deviations are specifically approved by Architect in writing.
- E. Retain mock-ups during construction and maintain in an undisturbed condition. Do not demolish alter or remove mock-up until approved by Architect.
- F. Mock-up shall be used to demonstrate quality of materials, finish and workmanship as well as to show compliance with visual criteria.
- G. Submit shop drawings prior to fabrication of visual mock-up, showing plan, elevations and details of mock-up.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. As specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Use the same workers to do work in conjunction with construction of the mock-up as covered by the work of their respective Contracts.
- B. Provide a 2-Faced mock-up as indicated complete with the following conditions (All conditions shall be finished with details identical to those proposed for use in the building and as indicated on the drawings).
 - 1. Curtainwall System
 - 2. Exterior curtainwall corner
 - 3. Curtainwall head, Jamb and sill condition
 - 4. Louver Penetration
 - 5. Louver head
 - 6. Roof Edge and Gutter including expansion joints

7. T-flashing transitions
 8. Roof section
 9. Inside Corner
 10. Splice joints
 11. Control joints
 12. Backer rod/joint installation
 13. Building expansion joint
 14. Stucco wall panels
 15. Restroom wall to floor intersection layout
 16. Add additional details as needed based on design
 17. Or as noted on specifications and indicated on the drawings
- C. Do not use special measures or techniques, which are not representative of those to be used in the building. Finish the various components to show the maximum variation that will exist in the actual building construction between adjacent components.
- D. Notify Architect when construction of mock-up begins and when major components are to be installed.
- E. Complete the mock-up and obtain Architect's approval of each component of the mock-up prior to fabrication or purchase of products for the Project.

3.2 BUILDING EXTERIOR WALL

- A. Fabricate and erect the above described visual mock-up of the typical exterior wall condition with one outside corner returning to the window line.
- B. Mock-up size: As indicated on drawings.
- C. Provide structural steel frame work for support of visual mock up. Frame work shall be designed by a registered professional or structural engineer licensed in the State where the Project is located.
- D. Coordinate with Architect and RPR for location of mock-up on project site. When directed, demolish mock-ups and remove from Project site.
- E. Construct mock-up in such a manner that each type of exterior finishes will be demonstrated in a layered fashion from one side to the other. The purpose in the layers is to facilitate the review of the multiple activities that are required to accomplish the final finish.
- F. Construct mock-up in phases so that proposed construction methodologies can be observed. Mock-up shall be completely constructed, just as if it were the finished exterior wall section. Wall insulation and interior wall finishes are not required.
- G. In addition to specifics in the respective Specification Sections, the mock-up will be reviewed by the RPR and the Architect for the following evaluation purposes:
1. Aesthetic: To review and verify selections made under submittals, as well as to

show compliance with visual criteria. Acceptance criteria is for general and specific aesthetic qualities of construction, and includes, but is not limited to, the following:

- a. Tooling of sealants.
 - b. Color consistency of aluminum window framing.
 - c. Color and clarity of glass.
2. Installation Execution: To review and verify quality of workmanship, and compliance with Drawings, Specification and submittals. Acceptance criteria is for general and specific erection, installation and application qualities of construction, and includes, but is not limited to, the following:
- a. Cold-formed metal framing fabrication and assemblage.
 - b. Glazed aluminum wall system fabrication, anchorage/attachment, and installation quality.
 - c. Glazing integrity.
 - d. Sealant profile consistency and bonding integrity.
 - e. Attachment of aluminum composite material panels.
 - f. Dimensional tolerances.

3.3 TYPICAL ROOM MOCK-UP

- A. Arrange for the construction of a typical room mock-up located in the building, per mutual agreement between RPR and Contractor.
 1. Typical Restrooms: At the first installation of a typical public restroom, complete finishes, fixtures and accessories in one restroom module as a visual mock-up.
- B. The materials trades Subcontractors shall do all work in conjunction with construction of the mock-up as covered by the work of their respective Contracts.
- C. Typical Room mock-up shall be complete with finishes, fixtures and details identical to those proposed for use in the Project. Do not use special measures or techniques, which are not representative of those to be used in the finish work. Finish the various components to show the quality of material and construction that will exist in the actual construction.
- D. Typical room mock-up shall be of adequate size to contain all samples and demonstrate quality of materials, finish and workmanship as well as to show compliance with visual criteria. Submit shop drawings to show layout of room prior to construction. Mock-up room shall be constructed as soon as sufficient structure is available to allow installation.
- E. Materials or workmanship not approved shall be removed and replaced with acceptable products or workmanship. Fabrication, purchase or installation of materials for the building shall not begin until approved in the mock-up room. OAR's approval of samples will be required on all visual items prior to any contractor's buy-out.
- F. Materials installed in the room mock-up shall include an example of all furnished assemblies, hardware, equipment or accessories required for the Project and shall include, but may not be necessarily limited to the following:
 1. Lavatory countertop, complete with sealant, sink, accessories, trim, etc.

2. Hollow Metal Door Frame
3. Door Hardware
4. Porcelain tile floor and wall
5. Ceramic floor and wall material
6. Toilet Compartment complete with partition, side wall, pilaster, door and hardware.
7. Toilet Room Accessories
8. Water closet and trim
9. Urinal and trim
10. Lighting
11. Electrical Devices and Accessories
12. Access Doors or Panels

END OF SECTION 014339

SECTION 014500 - QUALITY CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Conditions/Provisions of Contract, including Contractual Conditions and other Division 1 Specification sections, apply to this section.

1.2 SUMMARY

- A. Section includes: quality control and quality assurance services.
 - 1. Quality control services: inspections, tests, and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the RPR and A/E. Unless otherwise specified in the contract documents, all quality control services, inspections, tests and related actions shall be coordinated and provided by Contractor.
 - 2. Quality assurance services: Inspection and testing services to assist the RPR and A/E in the determination of compliance of the Work with the Contract Documents. These services will be provided by the Owner but do not relieve the Contractor of responsibility for compliance with Contract Document requirements or for quality control services.
- B. Requirements of this Section relate to customized fabrication, on site construction and installation procedures, not production of standard products.
 - 1. Inspections, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.
 - 2. Requirements to provide quality control services required by the Owner, RPR, A/E, or Authorities Having Jurisdiction are not limited by provisions of this Section.

1.3 TESTING BY THE OWNER

- A. The Owner may engage the services of an independent agency to perform inspections and tests specified as the Owner's responsibilities. The RPR will inform the Contractor of such services.
 - 1. Where the Owner has engaged a testing agency or other entity for testing and inspection of a part of the Work, and the Contract Documents require the Contractor to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Owner, unless otherwise agreed in writing with the Owner.
- B. Owner Responsibilities: The Owner may provide inspections, tests and similar quality assurance services to determine whether the Work is in conformance with the requirements of the Contract Documents. Costs for these services are not included in the Contract Price.
 - 1. The Owner may employ and pay for the services of an independent agency, testing

- laboratory or other qualified firm to perform acceptance and quality assurance testing.
2. The Owner may employ threshold inspection services.

1.4 CONTRACTOR RESPONSIBILITIES

- A. Contractor Responsibilities: Provide inspections, tests and similar quality control services, specified in individual specification sections and required by governing authorities, except where they are specifically indicated to be the Owner's responsibility, or are provided by another identified entity. Costs for these services shall be included in the Contract Price.
1. Testing Agency: Employ and pay an independent agency, to perform specified quality control services.
 2. Re-testing: Provide the cost of re-testing where results of required inspections, tests or similar services prove non-compliance with Contract Document requirements.
 - a. Provide the cost of re-testing construction revised or replaced.
 3. Associated Services: Cooperate with the RPR and with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the RPR and the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to the following:
 - a. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
 - b. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
 - c. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
 - d. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
 - e. Security and protection of samples and test equipment at the Project site.
- B. Duties of the Testing Agency: The independent testing agency engaged by the Contractor to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the RPR, A/E and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.
1. The agency shall notify the RPR, A/E and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.
 3. The agency shall not perform any duties of the Contractor.
- C. Coordination: The Contractor and each agency engaged by the Contractor to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition, coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

1. Schedule times for inspections, tests, taking samples, and similar activities. Provide a minimum of one (1) day (excluding weekends and holidays) notification to the RPR and A/E for each inspection, test, sampling, and similar activities.

1.5 SUBMITTALS

- A. The independent testing agency shall submit two (2) certified copies of the written report of each inspection, test or similar service, to the RPR unless the Contractor is responsible for the service. If the Contractor is responsible for the service, submit four (4) certified copies of the written report of each inspection, test or similar service through the Contractor to the RPR.
 1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
 2. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:
 - a. Date of issue.
 - b. Project title and number.
 - c. Name, address and telephone number of testing agency.
 - d. Dates and locations of samples, tests, and inspections.
 - e. Names of individuals making the inspection or test.
 - f. Designation of the Work and test method.
 - g. Identification of product and Specification Section.
 - h. Complete inspection or test data.
 - i. Test results and interpretations of test results.
 - j. Ambient conditions at the time of sample-taking and testing.
 - k. Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements.
 - l. Name and signature of laboratory inspector.
 - m. Recommendations on re-testing.

1.6 QUALITY ASSURANCE

- A. Qualification for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are pre-qualified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.
 1. Each independent inspection and testing agency engaged on the Project shall be authorized by Authorities Having Jurisdiction to operate in the State of Florida.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching."
 - 1. Remove all deficient Work and replace it with Work of specified quality, or take such other corrective action as the RPR and A/E may direct. No increase will be made in the Contract Sum or in Contract Time as a result of authorizing a change in methods or equipment under this Article.
- B. Protect construction exposed for quality control services.

END OF SECTION 014500

SECTION 014516 - FIELD TEST FOR WATER LEAKAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Field test to determine resistance to water leakage in wall systems in accordance with performance requirements indicated including joints in adjacent construction which are designed to remain permanently closed and watertight.
- B. Contractor will pay costs of testing laboratory for this test.

1.2 DEFINITIONS

- A. Water Leakage: Any uncontrolled water that appears on any normally exposed interior surfaces, that is not contained or drained back to exterior, or that can cause damage to adjacent materials or finishes. Water contained within drained flashings, gutters, and sills is not considered water leakage.

1.3 SUBMITTALS

- A. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- B. Qualification Data: For testing agency.
 - 1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and OARs, and other information specified.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- B. Field Water Spray Testing: Selective field testing will be conducted in accordance with AAMA Standard 501.2: "Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtainwalls, and Sloped Glazing Systems".
 - 1. Water Spray Test without Air Pressure Difference: Designated areas shall be tested according to AAMA 501.2 and shall not evidence water penetration.
 - 2. Test shall be performed prior to installation of interior finishes.
- C. Field Chamber Testing: Selective field testing will be conducted in accordance with ASTM E 1105 "Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors by Uniform or Cyclic Static Air Pressure Difference" and ASTM E 783 "Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors".
- D. Water Penetration Test with Static Air Pressure Difference: Designated areas shall be

tested according to ASTM E 1105 at a minimum static air pressure differential specified for laboratory testing in "Performance Requirements" and shall not evidence water penetration.

- E. Test chamber shall include adjacent joints and interior/exterior construction.
- F. Section of wall shall include a entire bay section of curtain wall and masonry /stucco finished wall.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Refer to Technical Sections for performance requirements of each system or product to be tested.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Exterior wall construction shall be completed, and shall be fully glazed to provide complete wall installation. Work shall be done in strict accord with approved shop drawings and job specifications.

3.4 FIELD QUALITY CONTROL TESTING

- A. Testing Services, General: Testing and inspecting of representative areas of exterior walls shall take place as installation proceeds to determine compliance of installed assemblies with specified performance requirements.

- B. Testing Agency Field Service: Engage a qualified independent testing agency employed by Contractor and approved by Architect to perform field quality control.
Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense
- C. Architect shall designate test procedure and areas of completed walls to be checked.
1. Field Testing shall be performed at intervals and locations including but not limited to the following:
 - a. Field Water Spray Testing per AAMA 501.2: Perform tests at intervals and locations in each test area as directed by Architect; however, not less than 1-percent of total units or 5 units minimum, whichever is greater, shall be tested for each type of glazing system and configuration.
 - b. Field Chamber Testing per ASTM E 1105: Perform tests at intervals and locations in each test area as directed by Architect; however, not less than 3 static water test minimum, shall be tested for each type of glazing system and configuration.
 2. Systems shall be tested in accordance with definitions and at performance requirements indicated in Technical Sections.
 3. Test wall at 15-percent, 50-percent, and 75-percent completion unless directed otherwise.
- D. All joints or other conditions within designated areas where leakage may occur will be tested.
- E. Indoor side of wall in this area shall be unfinished and left open and unobstructed, permitting full length of joints to be examined from indoor side.
- F. If operable joints such as those around doors and operable parts of windows occur within wall area involved, appropriate modifications both of procedure and performance requirements will be made in respect to such joints.

3.5 TEST REPORTS

- A. Testing laboratory shall be responsible for conducting and reporting tests, shall state in report whether or not test specimen conforms to requirements of Contract Documents approved drawings, and shall specifically note any deviations.
- B. Testing laboratory shall submit its report directly to Contractor and Architect. Necessary corrections shall be performed in presence of Architect. Tests shall be witnessed by Architect/Consultant. Approval of test assembly and test results rests with the Architect.
- C. Test Reports: Shall be prepared according to testing standard indicated.

3.6 REMEDIAL WORK BY CONTRACTOR

- A. In event of failure to initially meet test requirements called for hereinabove, Contractor and respective subcontractors shall, as required, redesign, rework, and/or re-fabricate, reship and re-erect assemblies until said requirements are met, at no additional cost to RPR.
- B. Wherever leakage has occurred, joints shall be made watertight in manner acceptable to Architect.
- C. Remedial work involving use of curing-type compounds shall be allowed to set for one week before it is re-checked for leakage.
- D. After necessary remedial work has been completed, and required curing time, if any, has elapsed, repaired joints shall be retested.
- E. Should leakage still be found, further remedial measures shall be taken and checking shall be repeated until joints in designated area are found to be satisfactory.
- F. Re-checking, when required, shall be performed by testing laboratory originally employed by Contractor.

END OF SECTION 014516

SECTION 014529 - STRUCTURAL TESTING AND INSPECTIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for quality assurance and quality control to be completed by the Testing Laboratory, Contractor, and/or the Geotechnical Engineer for the following structural items:
 - 1. Concrete Reinforcing.
 - 2. Cast-in-Place Concrete.
 - 3. Masonry.
 - 4. Structural Steel.
 - 5. Steel Joists or Steel Joists and Joist Girders.
 - 6. Steel Decking.
 - 8. Cold-Formed Metal Framing.
 - 10. Rough Carpentry – blocking, nailers, etc.
 - 11. Earthwork.
- B. Related Requirements:
 - 1. General Contract Provision Sections 50 and 60 for other independent testing agency procedures and administrative requirements.
 - 2. Refer to the drawings for the Threshold Inspection Plan for requirements for additional inspections to be completed by the Threshold Inspector.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Unit Prices:
 - 1. Cost Proposal: The Testing Laboratory's proposal shall contain unit price stipulations for specified tests and inspections and on an hourly basis for personnel. A total price shall also be submitted with bid.
- B. Measurement and Payment
 - 1. Payment of the Testing Laboratory: The contractor will pay for the Laboratory services for inspection and testing of materials for compliance with the requirements of the Contract Documents.
 - 2. Payment for Substitution Testing: The Contractor shall arrange for and pay for any additional samples and tests above those required by the Contract Documents as requested by the Contractor for his convenience in performing the work.
 - 3. Payment for Retesting: When initial tests indicate work does not comply with the requirements of the Contract Documents, the Contractor shall be liable for the cost for any additional inspections, sampling, testing, and retesting done by the Testing Laboratory.
 - 4. Payment by Contractor: The Contractor shall furnish and pay for the following items if required:

- a. Soil survey of the location of borrow soil materials, samples of existing soil materials, and delivery to the Contractor's Testing Laboratory.
 - b. Samples of concrete aggregates and delivery to the Contractor's Testing Laboratory.
 - c. Concrete mix designs as prepared by his concrete supplier.
 - d. Site-situated storage boxes for concrete cylinders
 - e. Concrete coring, tests of below strength concrete, and load tests, if ordered by the RPR, Architect, or Engineer.
 - f. Certification of reinforcing steel and prestressing steel mill order.
 - g. Certification of structural steel mill order.
 - h. Certification of portland cement, lime, fly ash.
 - i. Certification of welders and preparation of Welding Procedure Specifications.
 - j. Tests, samples, and mock-ups of substitute material where the substitution is requested by the Contractor and the tests are necessary in the opinion of the RPR, Architect or Engineer to establish equality with specified items.
 - k. The making and testing of concrete cylinders for the purpose of evaluating strength at time of form stripping or for post-tensioning or the time spent evaluating the in situ strength of concrete using the Maturity Method.
 - l. Any other tests when such costs are required by the Contract Documents to be paid by the Contractor.
 - m. Concrete Testing and sampling.
5. Payment for Tests of Suspected Deficient Work: If, in the opinion of the Building Official, RPR, Architect, or Engineer, any of the work of the Contractor is not satisfactory, the Contractor shall furnish and pay for all tests that the RPR, Architect, or Engineer deem advisable to determine its proper construction. The RPR shall pay all costs if the tests prove the questioned work to be satisfactory.

1.3 ADDITIONAL CONTRACTOR TESTING RESPONSIBILITIES

- A. Threshold Inspection: The Contractor shall engage a separate agency to serve as a Threshold Inspector to provide Threshold Inspection services for the items outlined in the Threshold Inspection Plan. The scope of these services is not included in this section and is to be provided separately as outlined in the Threshold Inspection Plan. These inspections are mandatory for conformance to the legal requirements of the Florida Building Code and shall be in addition to the inspections and tests otherwise defined in this specification.
- B. The General Contractor shall engage a Geotechnical Engineer to provide inspection services for the foundations as outlined below in Paragraph 3.12.E.
- C. The General Contractor shall provide a copy of the project plans and specifications to the Testing Laboratory prior to the start of construction and prior to any pre- installation meetings.

1.4 CONTRACTOR RESPONSIBILITIES

- A. **Furnishing Samples and Certificates:** The Contractor shall provide to the laboratory certificates and representative samples of materials proposed for use in the work in quantities sufficient for accurate testing as specified.
- B. **Furnishing Casual Labor, Equipment and Facilities:** The Contractor shall furnish casual labor, equipment, and facilities as required for sampling and testing by the laboratory and otherwise facilitate the required inspections and tests.

1.5 TESTING LABORATORY RESPONSIBILITIES

- A. **The Testing Laboratory shall sample and test materials as they are being installed for compliance with specified acceptance criteria.** The Testing Laboratory will report and interpret the test results. The Laboratory shall monitor and report on the installation of construction work and shall perform tests on the completed construction as required to indicate Contractor's compliance with the various material specifications governing this work.
- B. **The Testing Laboratory shall provide inspections on the following items:**
 - 1. Welding of reinforcing steel.
 - 2. Inspection of structural steel, bolting, and welding material.
 - 3. Welding of structural steel.
 - 4. High-strength bolting.
 - 5. Compacted earth fill.
 - 6. Concrete Sampling and Lab testing of concrete cylinders.
- C. **Inspections Required by Government Agencies:** The Testing Laboratory shall perform inspections and submit reports and certifications as required by government agencies having jurisdiction over the aspects of the project covered by this specification.
- D. **Notification of Deficiencies in the Work:** The Testing Laboratory shall notify the Architect, Engineer, and Contractor within 24 hours of discovery of observed irregularities and deficiencies of the Work and other conditions not in compliance with the requirements of the Contract Documents. Notification shall be by telephone or e-mail and then in writing. The Testing Laboratory shall provide reports for all testing and visual inspection of work.
- E. **Accounting:** The Testing Laboratory shall submit all billing costs to the Contractor.
- F. **Monitoring Product and Material Certifications:** The Testing Laboratory shall be responsible for monitoring the submittals of product and material certifications from manufacturers and suppliers as specified in the Specifications and shall report to the RPR, Architect, and Engineer when those submittals are not made in a timely manner.
- G. **Limitations of Authority:** The Testing Laboratory is not authorized to revoke, alter, relax, enlarge upon, or release any requirements of the Specifications or to approve or accept any portion of the work or to perform any duties of the Contractor and his Subcontractors.

1.6 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. The Testing Laboratory shall cooperate with the Architect, Engineer, and Contractor and provide qualified personnel promptly on notice.
 - 2. The Contractor shall cooperate with Testing Laboratory personnel and provide access to the work and to manufacturers' operations.
 - 3. Notification of Source Change: The Contractor shall be responsible for notifying the RPR,
 - 4. Architect, Engineer, and Testing Laboratory when the source of any material is changed after the original tests or inspections have been made.
- B. Pre-installation Meetings RPR, Architect, Engineer, Contractor, and material suppliers as required to coordinate materials inspection and testing requirements with the planned construction schedule and shall participate in such meetings throughout the course of the project.
- C. Scheduling:
 - 1. Advance Notice: The Contractor shall be responsible for notifying the Testing Laboratory sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests. Failure to sufficiently notify may result in additional costs incurred by the Testing Laboratory to the Contractor.

1.7 SUBMITTALS

- A. Quality Control Reports:
 - 1. Information on Reports: The Testing Laboratory shall submit copies of reports of inspections and tests promptly. The reports shall contain at least the following information:
 - a. Project name.
 - b. Date report issued.
 - c. Testing Laboratory name and address.
 - d. Name and signature of inspector/technician.
 - e. Date of inspection and/or sampling.
 - f. Date of test.
 - g. Identification of product and Specification section.
 - h. Location in the project.
 - i. Identification of inspection or test.
 - j. Record of weather conditions and temperature (if applicable).
 - k. Results of test regarding compliance with Contract Documents.
 - 2. Copies: The Laboratory shall send signed electronic (PDF) copies of test and inspection reports to the following parties:
 - a. RPR or his/her representative.
 - b. Contractor.
 - c. Architect.
 - d. Engineer of Record.
 - e. Threshold Inspector.
 - 3. Discrepancy Log: The Testing Laboratory shall create and maintain a log of all discrepancies throughout the duration of the project.

4. Information on Log: This log shall include, but is not limited to:
 - a. Discrepancy date.
 - b. Description of discrepancy.
 - c. Drawing and/or detail reference.
 - d. Description of as-built condition.
 - e. Description of any remedial work performed.
 - f. Status of discrepancy.
 5. Submission Schedule: This log shall be submitted to the Architect/Engineer on a periodic basis for review and comment. Upon completion of the Project, this log shall be submitted in its entirety as an attachment to the final signed report described below under Certifications.
- B. Certification: Upon completion of the job, the Laboratory shall furnish to the RPR, Architect, and Engineer of Record, a statement signed by a licensed professional engineer that, to the best of their knowledge, required tests and inspections were made in accordance with the requirements of the Contract Documents.

1.8 QUALITY ASSURANCE

- A. Qualifications of Testing Laboratory:
1. The Testing Laboratory shall meet the basic requirements of ASTM E 329 and shall submit to the OAR, Architect, and Engineer evidence of current accreditation from the American Association for Laboratory Accreditation, the AASHTO Accreditation Program or the "NIST" National Voluntary Laboratory Accreditation Program.
 2. The Testing Laboratory shall be an Approved Agency by the Building Official to perform Special Inspections and other tests and inspections as outlined in the applicable building code.
 3. Tests and inspections shall be conducted in accordance with specified requirements, and if not specified, in accordance with the applicable standards of the American Society for Testing and Materials or other recognized and accepted authorities in the field.
 4. Qualifications of Welding Inspectors
 - a. Inspectors performing visual weld inspection shall meet the requirements of AWS D1.1 Section 6.1.4. Inspectors shall have current certification as an AWS Certified Welding Inspector (CWI). Assistant inspectors, if any, shall be supervised by an Inspector and shall be qualified by training and experience to perform the specific functions to which they are assigned.
 - b. Inspectors performing nondestructive examinations of welds other than visual inspection (MT, PT, UT, and RT) shall meet the requirements of AWS D1.1, Section 6.14.6.
- B. The Contractor shall not engage the same testing laboratory for construction services quality assurance testing, unless agreed to by the RPR.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCOPE OF WORK

- A. The work to be performed by the Testing Laboratory shall be as specified in this Section of the Specification and as determined in meetings with the RPR, Architect, and Engineer.

3.2 CONCRETE REINFORCING

- A. Quality Assurance:
1. Review the Welding Procedure Specification (WPS) submitted by the contractor for any reinforcing steel other than ASTM A 706 that is proposed to be welded for consistency with acceptable welding practices and AWS.
 2. Review welder qualifications by certification or verify by retesting. Obtain welder certificates.
- B. Field Testing: The following tests shall be completed by the Testing Laboratory:
1. Mechanical Tension Splices: The Laboratory shall conduct monotonic tension tests in accordance with ASTM A 1034 of mechanical tension splices of the type as specified on the structural drawings. It is not necessary that the specimens to be tested are production splices, however, the specimens to be tested shall have been made by the Contractor's personnel under field conditions. The rate of testing shall be as follows:
 - a. Two specimens for the first 50 splices (or fraction thereof) at the beginning of the job. Splices not meeting tension requirements shall be retested at Contractor's expense until all splices meet the tension requirements.
 - b. One specimen for every 100 (or fraction thereof) additional splices occurring on the job. Any splices not meeting tension requirements shall be retested at Contractor's expense until all splices have passed the test.
 - c. A minimum of one test specimen shall also be selected from transition splices (splices of one bar size to another bar size), if any.

3.3 CAST-IN-PLACE CONCRETE

- A. Quality Assurance:
1. Concrete Mix Designs: The Testing Laboratory shall review the submitted mix designs for conformance to the specifications and for suitability for use in the project.
 2. Preinstallation Meetings: The Testing Laboratory shall attend the preinstallation meetings as noted in Specification 03 3000 "Cast-in-Place Concrete."
- B. Field Testing: The following tests shall be completed by the Testing Laboratory:
1. During Concrete Placement:
 - a. Record the amount of water added and note if it exceeds the amount allowed to be added shown in the approved mix design.
 - b. Mold concrete test cylinders as specified below in Paragraph 3.a.
 - c. Perform tests to determine slump, concrete temperature, unit weight, and air entrainment as specified below.

- d. Record information for concrete test reports as specified below.
 - e. Pick up and transport to Laboratory cylinders cast the previous day.
 - f. After Concrete Placement:
 - g. In-situ Concrete Strength Verification for Form Stripping: The Testing Laboratory shall perform the tests necessary to determine the concrete strength prior to form stripping:
 - 1) If concrete strength for form stripping is to be determined using field-cured cylinders, the cylinder shall be broken at the time of form removal as directed by the Contractor.
 - 2) If concrete strength for form stripping is to be determined using the Maturity Method, the Testing Laboratory shall verify that the requirements of ASTM C 1074 are being followed and that the proper criteria for determining concrete strength by this method has been established and is being followed.
 - h. Investigation of Low Strength Concrete Test Results:
 - 1) Cost of Investigations for Low Strength Concrete: The Contractor shall be responsible for the costs of investigations of low strength concrete, as defined in Part I above.
 - 2) Scope of Investigations: See Specification Section 03 30 00 "Cast- In-Place Concrete" for the investigations that may be required by the Engineer. The Testing Laboratory will conduct these investigations if required.
 - i. Post-Installed Anchors in Concrete:
 - 1) Verify maximum anchor tightening torque for all applicable post-installed anchors.
 - 2) Provide pull tests on individual anchors as specified in the ICC Evaluation Services Report, on the drawings, or as directed by the Engineer-of-Record.
 - j. Floor Flatness and Levelness Measuring: Perform tests as defined below.
 - k. Testing of Concrete Floor Slabs for Acceptability to Receive an Adhesive-Applied, Low-Permeable Floor Covering: Perform tests as defined below.
 - l. Testing of Non-Shrink Grout for Base Plates, Bearing Plates, and Precast Wall Panels:
 - 1) Compressive Strength Tests: Compressive strength of grout shall be determined by testing grout cubes according to the requirements of ASTM C 109 - Modified. Test one set of three cubes at one day, and one set of three cubes at 28 days. Testing Laboratory shall discuss with the contractor the addition of a third set of grout cubes if the contractor anticipates the higher strength grouts might not achieve the 28-day strength. These shall be paid by the contractor.
 - 2) Frequency of Testing: One set of cubes (6 cubes) shall be made for every ten base plates and bearing plates or fraction thereof but not less than one set for each day's operation. One set of cubes shall be made for each day's operation of grouting wall panels.
2. Standards for Concrete Tests:

- a. Concrete Test Cylinders: Mold and test concrete cylinders as described below:
- 1) Cylinder Molding and Testing: Cylinders for strength tests shall be molded and Laboratory cured in accordance with ASTM C 31 and tested in accordance with ASTM C 39. Cylinders may be either 6" in diameter by 12" or 4" in diameter by 8", however, the diameter of the cylinder shall be at least three times the nominal maximum size of the coarse aggregate in the mix tested. All of the cylinders for each class of concrete shall be of the same dimension for all sets of that class.
 - 2) Field Samples: Field samples for strength tests shall be taken in accordance with ASTM C 172 at the point of placement.
 - 3) Quantity of Cylinders: Each set of test cylinders shall consist of a minimum of four standard test cylinders. If concrete strength for form stripping is to be determined using field-cured cylinders, one additional cylinder per set will be required for formed slab for the purpose of evaluating the concrete strength at the time of form stripping. This cylinder shall be stored on the floor where form removal is to occur under the same exposure conditions as the floor concrete. The cylinder shall be cured under field conditions in accordance with ASTM C 31. Field-cured test cylinders shall be molded at the same time and from the same samples as laboratory-cured test specimens. The Contractor shall pay for the cost of making and testing these cylinders.
 - 4) Frequency of Testing: A set of test cylinders shall be made according to the following minimum frequency guidelines:
 - a) One set for each class of concrete taken not less than once a day.
 - b) Piles: One set for each 50 cubic yards or fraction thereof.
 - c) Spread Footings: One set for each 50 cubic yards or fraction thereof.
 - d) Pile Caps: One set for each 50 cubic yards or fraction thereof.
 - e) Floors: One set for each 150 cubic yards or fraction thereof but not less than one set for each 5,000 square foot of floor area.
 - f) Columns: One set for each 50 cubic yards or fraction thereof with a minimum of two sets per floor.
 - g) Shear Walls: One set for each 50 cubic yards but not less than two sets per floor.
 - h) Tilt-Up Panels: One set for every 50 cubic yards or fraction thereof.
 - i) All Other Concrete: A minimum of one set for each 150 cubic yards or fraction thereof but not less than one set for each 5,000 square foot of area for walls.
 - j) No more than one set of cylinders at a time shall be made from any single truck.
 - k) If the total volume of concrete is such that the frequency of testing as specified above would provide less than five

strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.

- l) The above frequencies assume that one batch plant will be used for each pour. If more than one batch plant is used, the frequencies cited above shall apply for each plant used.
 - The cylinders shall be numbered, dated, and the point of concrete placement in the building recorded.
 - For concrete specified on the drawings to reach the required strength at 28 days, break one cylinder of the set at seven days, two 6" by 12" cylinders or three 4" by 8" cylinders at 28 days, and keep one in reserve for testing at the Engineer's direction.
 - For concrete specified on the drawings to reach the required strength at 56 days, break one cylinder of the set at seven days, one cylinder at 28 days, two 6" by 12" cylinders or three 4" by 8" cylinders at 56 days, and one kept in reserve for testing at the Engineer's direction.
 - Cylinder Storage Box: The Contractor shall be responsible for providing a protected concrete cylinder wooden storage box at a point on the job site mutually agreeable with the Testing Laboratory for the purpose of storing concrete cylinders until they are transported to the Laboratory. The box shall be constructed and equipped to maintain the environment specified for initial curing in ASTM C 31.
 - Transporting Cylinders: The Testing Laboratory shall be responsible for transporting the cylinders to the Laboratory in a protected environment such that no damage or ill effect will occur to the concrete cylinders including loss of moisture, freezing temperatures or jarring.
 - Information on Concrete Test Reports: The Testing Laboratory shall make and distribute concrete test reports after each job cylinder is broken. Such reports shall contain the following information:
 - m) Truck number and ticket number.
 - n) Concrete Batch Plant.
 - o) Mix design number.
 - p) Accurate location of pour in the structure.
 - q) Strength requirement.
 - r) Date cylinders made and broken.
 - s) Technician making cylinders.
 - t) Concrete temperature at placing.
 - u) Air temperature at point of placement in the structure.
 - v) Amount of water added to the truck at the batch plant and at the site and whether or not it exceeds the amount allowed by the mix design.
 - w) Slump.
 - x) Unit weight.
 - y) Air content.

- z) Cylinder compressive strengths with type of failure if concrete does not meet Specification requirements. Seven day breaks are to be flagged if they are less than 60% of the required 28 day strength. 28 day breaks are to be brought to the attention of the Architect and Engineer in writing if either cylinder fails to meet specification requirements.
- b. Slump Tests: Slump Tests (ASTM C 143) shall be completed at the beginning of concrete placement for each batch plant and for each set of test cylinders made. The slump test shall be made from concrete taken from the end of the concrete truck chute. The concrete shall be considered acceptable if the slump is within the slump tolerance noted on the mix design submittal form for that class of concrete.
- c. Air Entrainment: Air entrainment tests (ASTM C 231 or C 173, C 173 only for lightweight concrete) shall be made at the same time slump tests are made as cited above. Samples for air entrainment tests shall be taken at the point of placement.
- d. Concrete Temperature: Concrete temperature at placement shall be measured (ASTM C 1064) at the same time slump tests are made as cited above.
- e. Unit Weight Test: ASTM C 138.
- f. Floor Flatness and Levelness Measuring:
 - 1) The Testing Laboratory shall measure the floor for flatness and levelness according to ASTM E 1155.
 - 2) Measurement of the finished concrete surface profile for any test section shall be made when requested by the Representative at his option. Notwithstanding, measurements shall be made within 24 hours after completion of finishing operations. For structural elevated floors measurement shall also be made prior to removal of forms and shores. The Contractor shall be notified immediately after the measurements of any section are complete and a written report of the floor measurement results shall be submitted within 72 hours after finishing operations are complete.
 - 3) The concrete surface profile shall be measured using equipment manufactured for the purpose such as a Dipstick Floor Profiler as manufactured by the Edward W. Face Company in Norfolk, Virginia, F-Meters manufactured by Allen Face & Company in Norfolk, Virginia, optical, or laser means or other method specified in ASTM E 1155.
 - 4) Each floor test section and the overall floor area shall conform to the two-tiered measurement standard as specified herein.
 - a) Minimum Local Value (MLV). The minimum local FF/FL values represent the absolute minimum surface profile that will be acceptable in any one floor test section.
 - b) Specified Overall Value (SOV). The specified overall FF/FL values represent the minimum values acceptable for all combined floor test sections representing the overall floor.
 - 5) For purposes of this specification a floor test section is defined as the smaller of the following areas:
 - a) The area bounded by column and/or wall lines.

- b) The area bounded by construction and/or control joint lines.
 - c) Any combination of column lines and/or control joint lines.
 - d) Test sample measurement lines within each test section shall be multidirectional along two orthogonal lines as defined by ASTM E 1155.
 - e) The precise layout of each test section shall be determined by the Testing Laboratory and shall be submitted for Architect/Engineer review and approval.
- g. Testing of Concrete Floor Slabs for Acceptability to Receive an Adhesive-Applied, Low-Permeable Floor Covering:
- 1) The following tests shall be performed by the Testing Laboratory as a part of quality assurance testing to insure that the proper moisture condition and alkalinity of the substrate has been achieved prior to installing adhesive-applied, low-permeability floor coverings such as vinyl composition tile (VCT), linoleum, sheet vinyl, vinyl-backed carpet, rubber, athletic flooring, synthetic turf, wood, acrylic terrazzo, thin-set tile, epoxy overlays and adhesives, waterproofing, et.al.
 - 2) Moisture Vapor Emission Rate: Perform testing according to ASTM F 1869 to determine if the moisture emission rate from the floor is below the flooring manufacturer's maximum recommended value but not greater than five pounds per 1,000 square feet per 24 hours.
 - 3) Relative Humidity Determination Test: As an alternate to the Moisture Vapor Emission Rate Test, and if agreed to by the Contractor, Architect and OAR, perform testing according to ASTM F 2170 to determine if the relative humidity of the concrete slab is below the flooring manufacturer's maximum recommended value but not greater than 75%.
 - 4) Alkalinity Testing: Perform testing in accordance with ASTM F 710, Paragraph 5.3, to determine if the pH level of the concrete slab surface is below the flooring manufacturer's maximum recommended value but not greater than 10. Perform one test per 1,000 square feet with a minimum of three tests within the total area being tested.
3. Evaluation and Acceptance of Concrete:
- a. Strength Test: A strength test shall be defined as the average strength of two six-inch cylinder breaks or three four-inch cylinder breaks from each set of cylinders tested at the time indicated above.
 - b. Quality Control Charts and Logs: The Testing Laboratory shall keep the following quality control logs and charts for each class of concrete containing more than 2,000 cubic yards. The records shall be kept for each batch plant and submitted on a weekly basis with cylinder test reports:
 - 1) Number of strength tests made to date.
 - 2) Strength test results containing the average of all strength tests to date, the high test result, the low test result, the standard deviation, and the coefficient of variation.
 - 3) Number of tests under specified strength.

- 4) A histogram plotting the number of strength test cylinders versus compressive strength.
 - 5) Quality control chart plotting compressive strength test results for each test.
 - 6) Quality control chart plotting moving average for strength where each point plotted is the average strength of three previous test results.
 - 7) Quality control chart plotting moving average for range where each point plotted is the average of 10 previous ranges.
- c. Acceptance Criteria: The strength level of an individual class of concrete shall be considered satisfactory if both of the following requirements are met:
- 1) The average of all sets of three consecutive strength tests equal or exceed the required f'_c .
 - 2) No individual strength test falls below the required f'_c by more than the greater of 10% of f'_c or 500 PSI.
- d. If either of the above Acceptance Criteria requirements is not met, the Testing Laboratory shall immediately notify the Engineer by telephone. Steps shall immediately be taken to increase the average of subsequent strength tests.
- C. Causes for Rejection of Concrete: The Contractor shall reject concrete delivered to the site for any of the following reasons:
1. Wrong class of concrete (incorrect mix design number).
 2. Environmental Conditions: Environmental condition limits shall be as follows unless appropriate provisions in concreting practices have been made for cold or hot weather:
 - a. Cold Weather: Air temperature must be 40°F and rising or the average daily temperature cannot have been lower than 40°F for 3 consecutive days unless the temperature rose above 50°F for at least one-half of any of those 24 hour periods.
 - b. Hot Weather: Environmental conditions must be such that cause an evaporation rate from the concrete surface of 0.2 lb./sq. ft./hr. or less as determined by Figure 2.1.5 in ACI305R-91.
 - c. Concrete may be placed at other environmental condition ranges only with approval of the job inspector for the Testing Laboratory or other duly appointed representative.
 3. Concrete with temperatures exceeding 95°F shall not be placed in the structure.
 4. Air contents outside the limits specified in the mix designs.
 5. Slumps outside the limits specified.
 6. Excessive Age: Concrete shall be discharged within 90 minutes of plant departure or before it begins to set if sooner than 90 minutes unless approved by the Laboratory job inspector or other duly appointed representative.
- D. Concrete Batch Trip Tickets: Concrete batch trip tickets shall be collected and retained by the Contractor. Compressive strength, slump, air, and temperature tests shall be identified by reference to a particular trip ticket. Tickets shall contain the information specified in ASTM C 94. Each ticket shall also show the amount of water that may be added in the field for the entire batch that will not exceed the specified

water cement ratio for the design mix. The Contractor and Testing Laboratory shall immediately notify the Architect/Engineer and each other of tickets not meeting the criteria specified.

3.4 PRECAST STRUCTURAL CONCRETE

- A. **Scope of Work:** The Testing Laboratory shall furnish the necessary technicians and equipment to perform the following tests and inspections. Schedule the time for visits to the precast plant in consultation with the Supplier, Architect, Engineer, and RPR. Submit a proposed unit price for each visit and base the total proposed price on providing three visits. Inspections shall be performed by a qualified technician with a minimum of two years of experience in precast concrete testing and inspection.
- B. **Quality Assurance:**
 - 1. Verify that the fabricator's fabrication and quality control procedures provide a sound basis for inspection control of workmanship and of the ability to conform to construction documents and industry standards. Review the procedures for completeness and adequacy relative to code requirements for the fabricator's finished product.
- C. **Source Inspection:**
 - 1. Preliminary plant inspection prior to the start of fabrication including the following:
 - a. Inspection of the batching facilities including aggregate stock piles, material handling facilities, concrete batching and mixing facilities, and in plant concrete handling, placing, and consolidating procedures and equipment.
 - b. Inspection of the in-plant testing and curing facilities.
 - c. Inspection of the casting beds shall be made to check for cleanliness, alignment, and surface condition of the bed.
 - d. Inspection of the stressing blocks and stressing procedures including verification of the calibration of the stressing jacks to be used in the work.
 - e. A review of the concrete mix designs proposed for use in the work.
 - 2. Inspection prior to placing concrete including the following:
 - a. Inspect formwork for finish condition, dimensions, and dimensional tolerances.
 - b. Verify reinforcing steel placement and concrete cover.
 - c. Inspect 100% of hardware and embedded items for proper size, location, and finish.
 - d. For prestressed members, observe and inspect the stressing operation recording the following information:
 - 1) Initial and final gauge load reading during tendon stressing.
 - 2) Tendon elongation measurement.
 - 3) Obvious irregularities or stress loss during anchoring procedures.
 - 3. Inspection during concrete placement including the following:
 - a. Verify that environmental conditions and concrete temperatures are within the limits stipulated.

- b. Verify that the proper class of concrete is being used for the members being poured.
 - c. Inspect plastic concrete to verify proper batching and mix consistency.
 - d. Verify the molding, curing and testing of concrete cylinders by the Precast Producer are in accordance with the specifications and project requirements.
4. Inspection after concrete placement including the following:
- a. For prestressed members:
 - 1) Verify minimum concrete strength at time of stress transfer.
 - 2) Witness transfer of stress to concrete and report procedures used including release sequence of multi-tendon transfer.
 - b. After form stripping:
 - 1) Check dimensions of precast units.
 - 2) Verify required cambers.
 - 3) Visually inspect the precast units for proper finish, cracks, and other surface defects and imperfections.
- D. Field Testing: Refer to Article 3.4 for testing requirements of cast-in-place concrete elements associated with precast structural concrete, such as topping slabs.
- E. Reporting:
- 1. The Testing Laboratory shall write an inspection report promptly after each plant and site visit for distribution to the parties specified.
 - 2. Any irregularities in the work shall be immediately reported by telephone to the Engineer and Architect.

3.5 MASONRY

- A. Quality Assurance:
- 1. Concrete Masonry Unit: For each type of concrete masonry unit indicated, verify compliance with ASTM C 90 and the strength required by design. Verification may be by reviewing certification from unit producer showing compliance.
 - 2. Review field welder qualifications by certification or verify by retesting. Obtain welder certificates.
- B. Field Testing:
- 1. Masonry Strength Testing:
 - a. Verification Testing Frequency: Verification of masonry strength ($f'm$) will be performed at the beginning of masonry construction.
 - b. Mortar:
 - 1) Throughout construction, verify the proportions of the site-prepared mortar mix comply with the requirements of ASTM C 270 for the type specified.
 - 2) Verify the proportions of materials in premixed or preblended mortar comply with the requirements of ASTM C 270 for the type specified as delivered to the site.
 - 3) Mortar Tests: Verify mortar composition with specified requirements according to ASTM C 780, Annex A4; made at following times during Work:

- a) First day
 - b) 5 percent
 - c) 15 percent
 - d) 30 percent
 - e) 60 percent
 - c. Grout:
 - 1) Prior to grouting, verify the proportions of site-prepared grout mix comply with the requirements of ASTM C 476 for each type of grout used.
 - 2) Verify the proportions of materials in premixed or pre-blended grout comply with the requirements of ASTM C 476 as delivered to the site.
 - 3) For grout pre-mixed at a batch plant or otherwise not prepared on site, grout shall be sampled and tested in accordance with ASTM C 1019. Prepare one set of grout samples for testing at seven days and two sets for testing at 28 days.
 - 4) Test each mix provided, according to ASTM C 1019 for compressive strength. Perform one set of tests for each 5000 sf of wall area or portion thereof unless otherwise indicated.
 - d. Report test results in writing and in form specified under each test method, to Architect and Contractor, on same day tests are made.
 - e. Retests: Where prism tests indicate non-compliance with specified requirements, additional testing shall be performed at the frequency of two additional tests for each unsatisfactory test. The cost of such additional testing shall be the responsibility of the Contractor. Where retesting fails to indicate conformance with specified requirements, any masonry construction represented by unsatisfactory tests shall be removed and replaced with acceptable masonry construction.
2. Testing of Non-Shrink Grout for Base Plates and Bearing Plates:
- a. Compressive Strength Tests: Compressive strength of grout shall be determined by testing grout cubes according to the requirements of ASTM C 109 - Modified. Test one set of three cubes at one day, and one set of three cubes at 28 days.
 - b. Frequency of Testing: One set of cubes (6 cubes) shall be made for every ten base plates and bearing plates or fraction thereof but not less than one set for each day's operation. One set of cubes shall be made for each day's operation of grouting wall panels.
- C. Field Inspection:
- 1. Anchors:
 - a. Verify maximum anchor tightening torque for all post-installed anchors.
 - b. Provide pull tests on individual anchors as specified on the drawings or as directed by the Engineer-of-Record.
 - c. Welding of Reinforcing Bars: Observe the welding of reinforcing bars.

3.6 STRUCTURAL STEEL

- A. Scope of Work:
 - 1. Contract Obligations:
 - a. Contractor Responsibility: The contractor shall pay for shop and field

- inspections and tests as required during the fabrication and erection of the structural steel.
- b. **Testing Laboratory Responsibility:** The inspection by the Testing Laboratory of the Fabricator's work shall be in sequence, timely, and performed in such a manner so that corrections can be made without delaying the progress of the work. Inspections shall be performed by qualified technicians with a minimum of two years of experience in structural steel testing and inspection. Refer to Paragraph 1.9.4.b for special requirements for welding inspectors. The Testing Laboratory shall provide test reports of inspections. All test reports shall indicate types and locations of defects found during inspection, the measures required and performed to correct such defects, statements of final approval of welding and bolting of shop and field connections, and other fabrication and erection data pertinent to the safe and proper welding and bolting of shop and field connections. Weld inspection reports shall be signed by an inspector with current certification as an AWS Certified Welding Inspector (CWI). In addition to the parties listed in this Specification the Fabricator and Erector shall receive copies of the test reports.
 - c. **Rejection of Material or Workmanship:** The OAR, Architect, Engineer, and Testing Laboratory reserve the right to reject any material or workmanship not in conformance with the Contract Documents at any time during the progress of the work. However, this provision does not allow waiving the obligation for timely, in sequence inspections.
- B. **Quality Assurance:**
- 1. Verify the fabrication shop's certification from AISC.
 - 2. Verify that the fabricator's fabrication and quality control procedures provide a sound basis for inspection control of workmanship and of the ability to conform to construction documents and industry standards. Review the procedures for completeness and adequacy relative to code requirements for the fabricator's finished product.
 - 3. Review field welder qualifications by certification or verify by retesting. Obtain welder certificates.
- C. **Source Testing:** The Testing Laboratory shall provide the following tests at the designated fabrication shops:
- 1. Test welds completed in the shop according to Paragraph G "Weld Testing" below.
 - 2. Test bolted connections completed in the shop according to Paragraph I "High-Strength Bolt Testing."
- D. **Source Inspection:** The Testing Laboratory shall provide the following inspections at the designated fabrication shops:
- 1. An initial shop inspection prior to the start of any fabricating work shall be made to accomplish the following:
 - a. Perform tasks outlined in Paragraphs G.1, G.2 and G.3 of welding inspection duties described below in Paragraph G "Weld Inspection and Process Monitoring" when shop welding is to be performed.
 - b. Perform tasks outlined in paragraph J.1 of bolt inspection duties described below in Paragraph I "High-Strength Bolt Inspection and

- Process Monitoring” when shop bolting involves joints that are designated on the plans as Pretensioned or Slip-Critical.
2. Process Monitoring:
 - a. Provide continuous or periodic monitoring of welding as described below in Paragraph G “Weld Inspection and Process Monitoring.”
 - b. Provide continuous or periodic monitoring of bolting as described below in Paragraph J “High-Strength Bolt Inspection and Process Monitoring” of high-strength bolt installation in pre-tensioned or slip-critical joints using turn-of-the-nut without matchmarking or calibrated wrench method of bolt installation.
 - c. Provide periodic verification of specified camber of steel beams.
- E. Field Testing: The Testing Laboratory shall provide the following tests in the field:
1. Test welds completed in the field according to Paragraph H “Weld Testing:” below.
 2. Test bolted connections completed in the field according to Paragraph I “High-Strength Bolt Testing.”
 3. Perform bend tests on completed shear connectors attached to beams as required according to procedures outlined in AWS D1.1. In addition, perform field bend tests on an additional 2% of completed shear connectors on each beam but not less than one connector per beam.
 4. Testing of Non-Shrink Grout for Base Plates, Bearing Plates, and Precast Wall Panels:
 - a. Compressive Strength Tests: Compressive strength of grout shall be determined by testing grout cubes according to the requirements of ASTM C 109 - Modified. Test one set of three cubes at one day, and one set of three cubes at 28 days.
 - b. Frequency of Testing: One set of cubes (6 cubes) shall be made for every ten base plates and bearing plates or fraction thereof but not less than one set for each day's operation. One set of cubes shall be made for each day's operation of grouting wall panels.
- F. Field Inspection: The Testing Laboratory shall provide the following inspections in the field:
1. Inspect galvanized HSS and other cold-worked structural steel members for cracking or other damage resulting from galvanizing process. Endeavor to complete inspections prior to erection of these members. Immediately notify Contractor and Architect/Engineer of any irregularities discovered.
 2. Provide continuous or periodic monitoring of field welding as described below in Paragraph G “Weld Inspection and Process Monitoring.”
 3. Provide continuous or periodic monitoring of field bolting as described below in Paragraph I “High-Strength Bolt Inspection and Process Monitoring” of high-strength bolt installation in pre-tensioned or slip-critical joints using turn-of-the-nut without matchmarking or calibrated wrench method of bolt installation.
 4. Inspect welded or bolted connections that were completed, but not inspected, in the shop. Perform inspections according to Paragraph G “Weld Inspection and Process Monitoring” and/or Paragraph I “High-Strength Bolt Inspection and Process Monitoring” as appropriate.
 5. Obtain the planned erection procedure, and review with the Erector’s supervisory personnel.

6. Check the installation of base plates for proper leveling, grout type, and grout application.
 7. Check structural steel as received in the field for possible shipping damage, workmanship, and identification marking to conform to AISC 360 for structural steel and specified ASTM standards for other steel.
 8. Verify that surveys are occurring as specified to check plumbness and frame alignment as erection progresses. Review the submitted survey report.
 9. Periodically inspect the steel frame for such items as bracing and stiffening details, member locations, and joint details at each connection for compliance with approved construction documents.
 10. Inspect 100% of the column compression and base joints for verification that gaps in contact bearing do not exceed 1/16 inch. Gaps greater than 1/16 inch but less than 1/4 inch shall be reported to the OAR and Engineer for assessment. All gaps greater than 1/4 inch shall be shimmed according to Specification 05 12 00 "Structural Steel Framing."
 11. Endeavor to guard the RPR against the Contractor cutting, grinding, reaming, or making any other field modification to structural steel without the prior approval of the Engineer. Report any noted unauthorized modifications to the RPR and Engineer.
- G. Weld Inspection and Process Monitoring: The Testing Laboratory shall make the following inspections of the welds and welding processes. Welds performed in the fabricating shop may be inspected in the field unless continuous monitoring of the welding process is herein specified or if access in the field due to other work or shop finishes makes field inspection impractical:
1. Approve Welding Procedure Specifications submitted by the Contractor. Approve any changes submitted by the Contractor to any WPS that has already been approved. Obtain the Welding Procedure Qualification Record (WPQR) for each successful WPS qualification.
 2. Periodically verify welding electrodes to be used and other welding consumables as the job progresses.
 3. Periodically observe joint preparation, assembly practice, welding techniques including preheating and sequence, and the performance of welders with sufficient frequency to assure compliance with code and contract document requirements. Check preheating to assure conformance with AWS D1.1, Section 5.6. Verify procedure for control of distortion and shrinkage stresses.
 4. Continuously observe joint preparation and fit up, backing strips, and runout plates for welded moment connections and column splices.
 5. Periodically provide visual inspection of the root pass of partial and complete joint penetration welds.
 6. Visually inspect 100 % of welds for proper size, length, location, and weld quality in accordance with AWS D1.1 requirements. Unless specifically noted otherwise, all welding shall be considered statically loaded nontubular connections.
 7. Visually inspect 100% of completed shear connectors on each beam.
 8. Visually inspect 100% of the welds of anchors to embedded plates that are to be cast into concrete elements.
 9. In addition to the inspections above, perform the following:
 - a. Continuously monitor and observe joint preparation, assembly practice, welding techniques including preheating and sequence, and the

- performance of welders for 100% of complete and partial joint penetration welds, plug and slot welds, multiple-pass fillet welds, and single-pass fillet welds greater than 5/16 inch.
- b. Check preheating to assure conformance with AWS D1.1, Section 5.6. Verify procedure for control of distortion and shrinkage stresses.
 - c. Periodically monitor welding of single-pass fillet welds that are less than or equal to 5/16 inch.
 - d. Periodically monitor the welding of headed studs to floorbeams.
 - e. Periodically monitor the welding of anchors to embedded plates that are to be cast into concrete elements.
- H. Weld Testing:
1. Perform nondestructive examination services using a qualified technician with the necessary equipment to perform the following:
 - a. Nondestructive examination conducted in accordance with the specific requirements for the item being examined including radiographic (RT), ultrasonic (UT), magnetic particle (MT), or dye-penetrant inspection (PT). Nondestructive inspection procedures shall conform to AWS D1.1.
 - b. Interpret, record, and report results of the nondestructive tests.
 - c. Mark for repair, any area not meeting Specification requirements. Correction of rejected welds shall be made in accordance with AWS D1.1.
 - d. Re-examine repair areas and interpret, record, and report the results of examinations of repair welds.
 - e. Verify that quality of welds meet the requirements of AWS D1.1.
 2. Fillet Welds: Provide the following:
 - a. MT test a minimum of 10% of the length of each fillet weld exceeding 5/16".
 - b. Periodic MT testing of representative fillet welds 5/16" and less but need not exceed 10% of all such welds, except as required for high rejection rates as indicated in the following paragraph.
 - c. Increase MT testing rate for welders having a high rejection rate as required to ensure acceptable welds.
 3. Partial Joint Penetration (PJP) Welds, including Flare-Bevel Groove Welds: Provide the following:
 - a. MT test a minimum of 25% of the length of each PJP weld exceeding 5/16" effective throat.
 - b. Periodic MT testing of representative PJP welds 5/16" and less but need not exceed 10% of all such welds, except as required for high rejection rates as indicated in the following paragraph.
 - c. Increase MT testing rate for welders having a high rejection rate as required to ensure acceptable welds.
 4. Complete Joint Penetration (CJP) Welds: Provide the following:
 - a. All CJP welds exceeding 5/16" thickness shall be 100% UT tested per AWS D1.1 Clause 6 Part F. The Testing Laboratory shall review the CJP joints to determine where geometry or accessibility precludes the use of standard scanning patterns per AWS D1.1 Clause 6 Part F. At these locations the testing laboratory shall develop and submit for approval a written testing procedure in accordance with AWS D1.1

- Annex S.
- b. Periodic MT testing of representative CJP welds 5/16" and less not to exceed 10% of all such welds, except as required for high rejection rates as indicated in the following paragraph.
 - c. Increase MT testing rate for welders having a high rejection rate as required to ensure acceptable welds.
5. Acceptance Criteria:
 - a. Visual, MT, PT shall be per AWS D1.1 Table 6.1.
 - b. UT testing shall be per AWS D1.1 6.13.1 and Table 6.2.
 6. Base metal thicker than 1.5 inches, where subjected to through-thickness weld shrinkage strains, shall be UT tested for discontinuities behind and adjacent to such welds. UT testing shall occur no sooner than 24 hours after the weld has cooled to ambient temperatures. Any material discontinuities shall be recorded on the basis of ASTM A 435 or ASTM A 898 (Level 1 criteria) and reported for Engineer disposition.
 7. Welds of Anchors to Embedded Plates:
 - a. Headed Studs: Perform field bend tests according to AWS D1.1 on 2% of the studs welded to plates, but not less than one stud per plate.
 - b. Deformed Bar Anchors: Perform MT testing on 10% of deformed bar anchors larger than #5 bar.
 8. The costs of repairing defective welds and the costs of retesting by the Testing Laboratory shall be borne by the Contractor. If removal of a backing strip is required by the Testing Laboratory to investigate a suspected weld defect, such cost shall be borne by the Contractor.
 - a. High-Strength Bolt Inspection and Process Monitoring: The Testing Laboratory shall perform the following inspections for connections joined with high-strength bolts. Bolting performed in the shop may be inspected in the field unless continuous monitoring of the bolting operation is specified herein:
 9. Observe pre-installation verification testing of the pretensioning method to be used in accordance with the requirements of the "Specification for Structural Joints Using High-Strength Bolts".
 10. Check daily the calibration of impact wrenches used in field bolted connections.
 11. Inspect bolt installation for 100% of high strength bolted connections according to inspection procedures outlined in the "Specification for Structural Joints Using High-Strength Bolts".
 12. Monitoring of Bolting Installation:
 - a. Continuous Monitoring: The Testing Laboratory shall be continuously present and monitor the bolting installation for compliance with the selected procedure for installation as specified in the "Specification for Structural Joints Using High-Strength Bolts" for joints using high-strength bolts that are designated on the plans as Pretensioned (PT) or Slip-Critical (SC) type joints and that are being installed using the calibrated wrench method or the turn-of-nut without match-marking method of installation.
 - b. Periodic Monitoring: All joint types and bolt installation methods shall be monitored on a periodic basis.
 - c. High-Strength Bolt Testing: The Testing Laboratory shall perform the

- following tests for connections joined with high-strength bolts:
13. Perform Arbitration Testing according to procedures outlined in the "Specification for Structural Joints using High-Strength Bolts" when a disagreement exists between the Testing Laboratory and the Fabricator as to the minimum tension of installed bolts that have been inspected according to paragraph below.

3.7 STEEL JOISTS

- A. Scope of Work: The Testing Laboratory shall perform inspection of steel joists as described herein.
- B. Quality Assurance:
 1. Verify that the fabricator maintains detailed quality control procedures that provide a basis for inspection control of workmanship and of the ability to conform to approved construction documents and industry standards. Verify that these procedures are complete and adequate relative to code requirements for fabricator's scope of work.
 2. Verify welding procedures, welder qualifications and weld material prior to the start of work.
 3. Review field welder qualifications by certification or verify by retesting. Obtain welder certificates.
- C. Source Inspection:
 1. Provide periodic inspection of the welding work in progress. Visually inspect 100% of welds prior to shipment of shop welded assemblies.
 - a. Verify camber requirements.
- D. Field Testing:
 1. Perform Magnetic Particle testing (MT) on representative field welds not to exceed 10% of such welds unless rejection rates become high, in which case, frequency of inspection shall be increased to ensure acceptable welding.
- E. Field Inspection: The duties of the Testing Laboratory shall be as follows:
 1. Inspect joists for damage during shipment.
 2. Visually inspect 100% of welded chord splices for compliance with SJI and project specifications.
 3. Confirm bolting of joists to supports at column lines as required by OSHA requirements.

3.8 STEEL DECKING

- A. Field Inspection:
 1. Check steel deck as received in the field for possible shipping damage, workmanship, and identification marking to conform to specified ASTM standards for steel deck.
 2. Periodically monitor the method of attaching the steel floor and roof decking to the structural frame.
 3. Visually inspect 100% of the welding or other attachment method of steel deck to the structure and at side laps.

3.9 COLD-FORMED METAL FRAMING

- A. Field Inspection:
 - 1. Periodically inspect welding of main wind-force-resisting systems.
 - 2. Periodically inspect screwing, bolting, anchoring and other fastening techniques used to attach components of the main wind-force-resisting systems, including shear walls, braces, diaphragms, collectors, and hold downs.

3.10 EARTHWORK

- A. Quality Assurance:
 - 1. Welder Qualifications: Verify welder qualifications either by certification and/or by retesting. Obtain welder certificates.
- B. Source Inspection:
 - 1. Precast Concrete Piles:
 - a. Plant Inspection: Inspect forms, placement of reinforcing steel, and strands, placement and finishing of concrete, and tensioning of strands.
- C. Field Testing:
 - 1. Compacted Fill:
 - a. Verification of Fill Material: Perform classification and testing to verify that the fill material to be used complies with the project specifications.
 - b. Field Density Testing: Perform field density testing as described below:
 - 1) Field density tests shall be run according to ASTM D 2937 or ASTM D 6938 as applicable.
 - 2) Acceptance Criteria: The results of field density tests by the Laboratory will be considered satisfactory if the average of any three consecutive tests has a value not less than the required density with no single test falling more than 2 percent below the required density and the moisture content conforms to the requirements of the specification.
 - 3) Test Frequency for Paved Areas and Building Slab Subgrade:
 - a) Make at least one field density test of the natural subgrade for every 2500 square feet of paved area or building slab but in no case less than three tests.
 - b) In each compacted fill layer or lift, make one field density test for every 2500 square feet of building slab or paved area but in no case less than three tests.
 - 4) Test Frequency for Foundation Wall Backfill: Make at least one field density test for each 200 lineal feet of wall with a minimum of 4 tests for the basement walls around the perimeter of each building and a minimum of one test for every other type of foundation wall on the site. Tests shall be performed in random lifts along each wall.
 - 5) Test Frequency for Compacted Fill beneath Column and Wall Footings and Mat Foundations: Make at least one field density test in each compacted fill layer or lift for each column footing, one for each twenty-five lineal feet of wall and one for each 2,500 square

- feet of mat foundation area or fraction thereof.
- c. Report Copies: Moisture-density curves and results of field density tests shall be submitted to the parties specified earlier in this section.
 - d. Additional Testing: If reports by the Laboratory indicate field densities lower than specified, additional tests will be run by the Laboratory with at least the frequencies scheduled above on recompacted fill and/or natural subgrade. The Testing Laboratory shall notify the Contractor on a timely basis for any required retesting so as not to delay the work. The costs of such tests shall be borne by the Contractor.
2. Spread (Excavated) Footings
- a. Concrete Cylinders: Make and test concrete cylinders as specified for Cast-in-Place Concrete.
- D. Field Inspection by the Testing Laboratory:
- 1. The Testing Laboratory shall provide inspection of materials used in foundation elements as described below.
 - 2. Compacted Fill:
 - a. Subgrade below Compacted Fill: Observe and verify that the subgrade below compacted fill has been properly prepared before compact fill construction begins.
 - b. During placement and compaction of fill, determine that the material being used and the maximum lift thickness comply with the specifications.
- E. Foundation Inspection by the Geotechnical Engineer: The Geotechnical Engineer of Record shall provide inspection service for the following items before and during foundation installation as appropriate for the foundation type. The Geotechnical Engineer shall submit written field inspection reports promptly after inspection to the parties listed above and report his findings after each inspection by telephone or e- mail to the Engineer.
- 1. Spread (Excavated) Footing:
 - a. Subgrade: Verify that foundation bearing conditions are consistent with soil report tests and that the footing is being installed in the proper soil strata at the proper elevation. Make recommendations regarding adjustment to subgrade or bearing elevation if subgrade is not adequate to support footing.

END OF SECTION 014529

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Conditions/Provisions of the Contract, including Contractual Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, maintenance of traffic, security and protection.
- B. Temporary utilities which may be required include but are not limited to:
 - 1. Temporary electric power and light.
 - 2. Telephone service.
 - 3. Temporary project identification sign - all other signs are prohibited.
 - 4. Drinking water.
 - 5. Sanitary facilities.
- C. Temporary construction and support facilities which may be required include but are not limited to:
 - 1. Storage sheds.
 - 2. Dewatering facilities and drains.
 - 3. Temporary enclosures including demising walls.
 - 4. Waste disposal services.
 - 5. Construction aids and miscellaneous services and facilities.
 - 6. Storm and sanitary sewer.
 - 7. Fuel tanks larger than 15 gallons.
 - 8. Temporary Wayfinding Signage.
- D. Temporary construction and support facilities, Contractor's option:
 - 1. Field office.
 - a. Temporary field offices WILL be allowed on the construction site.
 - b. If a field office is used it shall be located within the secure fence enclosure of the site of project.
- E. Security and protection facilities which may be required include but are not limited to:
 - 1. Temporary fire protection.
 - 2. Barricades, warning signs, lights.

3. Sidewalk bridge or enclosure fence for the site.
4. Environmental protection.

1.3 SUBMITTALS

- A. Temporary Utilities: Maintain reports of tests, inspections, meter readings and similar procedures performed on temporary utilities for review by the OAR.
- B. Implementation and Termination Schedule: Show implementation and termination of temporary utilities in the baseline schedule required by Section 01 32 15 Scheduling of Work.
- C. Maintenance of Traffic Plan: Submit a "Maintenance of Traffic Plan" within fourteen (14) days of the date established for commencement of work requiring the maintenance of traffic.

1.4 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations of Authorities Having Jurisdiction, including but not limited to:
 1. Building Code requirements.
 2. Health and safety regulations.
 3. Utility company regulations.
 4. Environmental protection regulations.
- B. Standards: Comply with NFPA Code 241, "Building Construction and Demolition Operations," ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."
 1. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services", prepared jointly by AGC and ASC, for industry recommendations.
 2. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

- A. Temporary Utilities: Include in the project schedule dates for implementation and termination of each temporary utility. Coordinate with the OAR change over from use of temporary service to use of the permanent service.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Where visible to the public, provide new materials suitable for the use intended. Where not visible to the public, Contractor may provide undamaged previously used materials, suitable for the use intended.
- B. Lumber and Plywood: Comply with requirements in Division-6 Section "Rough Carpentry."
- C. Tarpaulins: Provide waterproof, fire-resistant, UL labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures provide translucent nylon reinforced laminated polyethylene or polyvinyl chloride fire retardant tarpaulins.
- D. Water: Provide potable water meeting the requirement of the local health authorities.

2.2 EQUIPMENT

- A. General: Provide new equipment or previously used equipment in serviceable condition suitable for use intended.
- B. Electrical Outlets: Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment.
- C. Electrical Power Cords: Provide grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress. Eliminate trip hazards.
- D. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.
- E. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to the type of fuel being consumed.
- F. Temporary Toilet Units: Provide self-contained single-occupant toilet units of the chemical type, properly vented and fully enclosed with a glass fiber reinforced polyester shell.
- G. First Aid Supplies: Comply with governing regulations.
 - 1. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.
 - 2. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Comply with all applicable codes. Relocate and modify facilities as required.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.
 - 1. Arrange with the utility company for a time when service can be interrupted, where necessary, to make connections for temporary services.
 - 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
 - 3. Cost or use charges for temporary facilities are not chargeable to the Owner, RPR or the Designer, and will not be accepted as a basis of claims for a Change Order.
 - A. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction.
 - 1. Provide a backflow prevention device.
 - A. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period.
 - B. Temporary Lighting: Whenever overhead floor or roof deck has been installed, provide temporary lighting with local switching.
 - 1. Install and operate temporary lighting that will fulfill security and protection requirements, without operating the entire system, and will provide adequate illumination for construction operations and traffic conditions.
 - C. Temporary Telephones: Provide temporary telephone service for personnel engaged in construction activities, throughout the construction period.
 - D. Temporary Communication to the internet via Telephone service provider to temporary office.
- ### 3.3 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION
- A. General: Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities as indicated.

1. Maintain temporary construction and support facilities until near Final Acceptance. Remove prior to Final Acceptance. Personnel remaining after removal will be permitted to use permanent facilities, under conditions acceptable to the OAR.
 2. Provide non-combustible construction for offices, shops and sheds located within the construction area, or within 30 feet of building lines. Comply with requirements of NFPA 241.
 3. Obtain permits with AHJ for temporary facilities.
- A. Temporary Heat: Provide temporary heat required by construction activities, for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
- B. Heating Facilities: Except where use of the permanent system is authorized, provide vented self-contained LP gas with individual space thermostatic control.
- C. Use of gasoline-burning space heaters, open flame, or salamander type heating units is prohibited.
- D. Storage and Fabrication Sheds: Install storage and fabrication sheds, sized, furnished and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere on the site.
- E. Sanitary Facilities: Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with local health authorities for the administration of these facilities.
1. Provide toilet tissue, paper towels, paper cups and similar disposable materials for each facility. Provide covered waste containers for used material.
 2. Temporary Toilets shall be self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.
 3. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.
 4. Drinking Water Accommodations: Provide drinking water accommodations as necessary, including paper supply.
- F. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Division 2 Sections. Where feasible, utilize the same facilities. Maintain the site, excavations and construction free of water.
- G. Temporary Lifts and Hoists: Provide facilities for hoisting materials, if required.
- H. Project Identification/Construction Company Identification Sign: Prepare project identification sign of the size indicated; install sign where indicated to inform the public and persons seeking entrance to the Project. Securely attach, as required. Install sign at commencement of construction and remove upon issuance of the Certificate of Occupancy/Certificate of Completion (CofO).

1. Size: Two and one-half feet by five feet with four inch radius corners.
 2. Quality Assurance: Engage an experienced sign painter to apply graphics.
 3. Location: Locate on demising wall.
 4. Graphic Description: Information shall include the Owner, Contractor, and Designer name, project name, and completion date.
 - a. Type Style: Frutiger 55 or Helvetica Medium.
 - b. Color: Jetport Brown background with white lettering.
 - c. Quantity: One sign per project.
- I. Pardon our dust sign may be provided via the Owner's sign shop.
- J. Collection and Disposal of Waste: Collect waste from construction areas daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than seven (7) days during normal weather or three (3) days when the temperature is expected to rise above 80 degrees F (27 degrees C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner.
1. The Contractor shall not use the Owner's waste disposal systems.
 2. The Owner will not provide waste disposal services.
- K. Fuel tanks larger than 15 gallons
1. All Equipment
 - a. The Contractor will follow the guidance provided with regard to all equipment used on the work site. All equipment with Aboveground Storage Tanks (AST's) fuel tanks that have a capacity of 15 gallons or more but less than 550 gallons will adhere to the following guidelines. Equipment with tanks that have a capacity of 550 and more gallons will adhere to Florida Administrative Code 62-761.
 - b. Each piece of equipment with a tank capacity of 15 gallons or more will be required to have secondary containment. The capacity of the secondary containment will be 110% of the tank. As a minimum, five sheets of 10-mil visqueen will be used to line the secondary containment. The visqueen will overlap the outside walls of the secondary containment a minimum of 24 inches. The Owner recommends a single sheet of puncture resistant neoprene of ¼ inch thick as a liner in the secondary containment or concrete containment.
 - c. The secondary containment will be checked on a periodic basis and the fluid buildup will be disposed accordingly. Visible sheen will indicate contaminated water and will be disposed on in accordance with Florida Administrative Code (FAC) 62-777.
 - d. Mobile storage tanks that meet the criteria of FAC 62-677 are exempt from these procedures.
- L. Temporary Wayfinding Signage
1. Provide temporary signs as required to maintain proper airport operations during all aspects of the Work.
 2. Provide temporary signage that duplicates any removed or hidden permanent signs as a

result of the Work.

3. Coordinate all temporary signs with the RPR and airport. Develop a temporary sign plan for review by the RPR and airport. At a minimum, the plan shall show where all temporary signs are to be located, the messages that are to appear, when the signs will be installed, how the signs will be installed, when the signs will be installed, when the signs will be removed, the sign face layouts, the sign colors, and the materials to be used.
4. Temporary signs shall be safely and securely installed. Repair any damage to any walls, building surfaces, or building finishes resulting from the installation or the removal of the temporary signs. Once they have been taken down, remove from the site and properly dispose of the temporary signs.
5. Coordinate the installation and removal of the temporary signs with the RPR and Airport. Also coordinate the installation and removal of the temporary signs with the Project phases and construction progress.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. General: Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer as requested by the RPR and Airport.
- B. Temporary Fire Protection: Install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."
 1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
 2. Store combustible materials in containers in fire-safe locations.
 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, exitways and other access routes for fighting fires.
 4. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.
- C. Barricades, Warning Signs and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed provide lighting, including flashing red or amber lights.
- D. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.5 OPERATION, TERMINATION AND REMOVAL

- A. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by the elements.

- B. Termination and Removal: Unless the RPR requests that it be maintained longer, remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, or no later than Final Acceptance. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of the Contractor.
 2. Prior to Final Acceptance, clean and renovate permanent facilities that have been used during the construction period, including but not limited to:
 - a. Repair of any and all damages to existing materials or finishes. Repair shall be complete and made to the satisfaction of the RPR at no additional cost.
 - b. Replace air filters and clean inside of ductwork and housings.
 - c. Replace existing significantly work parts and parts that have been subject to unusual operating conditions due to the Work.
 - d. Replace lamps that are burned out or noticeably dimmed by substantial hours of use.

END OF SECTION 015000

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Conditions/Provisions of the Contract, including Contractual Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements governing the Contractor's selection of products for use in the Project.

1.3 DEFINITIONS

- A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well- recognized meanings in the construction industry.

1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - a. "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
 - b. "Foreign Products," as distinguished from "domestic products," are items substantially manufactured (50 percent or more of value) outside the United States and its possessions. Products produced or supplied by entities substantially owned (more than 50 percent) by persons who are not citizens of, nor living within, the United States and its possessions are also considered to be foreign products.
2. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.4 SUBMITTALS

- A. Product List: Prepare a list of specified products. Include the manufacturer's name and proprietary product names for each item listed.
1. Coordinate product list with the Contractor's Construction Schedule and the Schedule of Submittals.
 2. Form: Prepare product list with information on each item tabulated under the following column headings:
 - a. Related Specification Section number.
 - b. Generic name used in Contract Documents.
 - c. Proprietary name, model number, and similar designations.
 - d. Manufacturer's name and address.
 - e. Supplier's name and address.
 - f. Installer's name and address.
 - g. Projected delivery date or time span of delivery period.
 3. Submit list following procedures and requirements as outlined in Division 1 Specifications Section Shop Drawings, Product Data, and Samples.

1.5 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.
1. When specified products are available only from sources that do not, or cannot, produce a quantity adequate to complete project requirements in a timely manner, consult with the OAR to determine the most important product qualities before proceeding. Qualities may include attributes, such as visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources producing products that possess these qualities, to the fullest extent possible.
- B. Compatibility of Options: When the Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
1. The Contractor is responsible for providing products and construction methods that are compatible with products and construction methods of the subcontractors.
 2. If a dispute arises over concurrently selectable, but incompatible products, the OAR will determine which products shall be retained and which are incompatible and must be replaced.

- C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior.
1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
 2. Equipment Nameplates: Provide a permanent nameplate on each item of service- connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.
 - f. UL Listing or other Owner approved listing agency.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to the site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
 5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
 6. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.

7. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.
 1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. Product Selection Procedures: The Contract Documents and governing regulations govern product selection. Refer to Section 01 60 00 Product Requirements.
 1. Visual Matching: Where Specifications require matching an established Sample, the Designer(s) decision will be final on whether a proposed product matches satisfactorily.
 - a. Where no product available within the specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category.
 2. Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Designer will select the color, pattern, and texture from the product line selected.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
 1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration.

END OF SECTION 016000

SECTION 017329 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Conditions/Provisions of Contract, including Contractual Conditions and other Division 1 Specification Sections, apply to this Section. Refer to other Specification Sections for specific requirements and limitations applicable to cutting and patching individual parts of the work.

1.2 SUMMARY

- A. This Section includes cutting into existing construction to provide for installation or performance of the Work, subsequent fitting, and patching required to restore surfaces to original condition.
 - 1. Execute cutting, fitting, and patching, including excavation and backfill, required to perform Work and to:
 - a. Make parts fit together properly.
 - b. Remove and replace defective work.
 - c. Remove and replace Work not conforming to requirements of Contract Documents.
 - d. Uncover Work to allow for the RPR's and A/E's observation of covered Work which has been covered prior to required observation of the RPR and A/E.
 - 2. Drilling of holes for the installation of fasteners and similar operations is not considered to be cutting and patching.

1.3 BUILDING MODIFICATIONS

- A. General: Modifications to existing facilities and structures shall be provided as indicated and as necessary to accomplish the Work of these Contract Documents.
 - 1. Modifications shall include the removal of existing structure, relocation of materials indicated, termination and relocation of utilities, cutting, patching, cleaning, adjusting, and refinishing, and all incidental work related and required for the installation of new Work.
 - 2. It is intended to maintain daily occupancy functions during the progress of this Work. The Contractor shall closely coordinate his Work to minimize any inconvenience to the Owner or Owner's operations.

3. No Public Services or utility systems shall be interrupted without first notifying the RPR and obtaining concurrence for the interruption as instructed in the Summary of Work.

1.4 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable:
 1. Describe the extent of cutting and patching required and how it is to be performed.
 2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
 3. List products to be used and firms that will perform Work.
 4. Indicate dates when cutting and patching is to be performed.
 5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
 6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
 7. Approval by the RPR to proceed with cutting and patching does not waive the Owner's right to later require complete removal and replacement of Work found to be cut and patched in an unsatisfactory manner.
- B. Hot Work and Dust Hazard - Notify the RPR 48 hours (excluding weekends and holidays) in advance of any welding, cutting, burning, soldering, dust activities or any hot work. Utilize the Owners Hot Work/Dust Hazard Permit Forms.

1.5 QUALITY ASSURANCE

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.
- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Electrical wiring systems.
 - d. Control systems.
 - e. Communications systems.
 - f. Conveying systems.
 - g. Shoring, bracing, and sheeting.
 - h. Primary operational systems.
 - i. Air or smoke barriers.
 - j. Fire protection systems.
 - k. Noise and vibration control elements and systems.
 - l. Water lines.
 - m. Sewer lines.
 - n. Other special construction.

- C. Visual Requirements: Do not cut and patch construction in a manner that would degrade the building's aesthetics, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched unsatisfactorily.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, obtain the OAR's approval to use substitute materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

- B. Verify that new materials are compatible with existing materials in all respects where cutting and patching occurs.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.
 1. Before proceeding, meet at the site with all parties involved in cutting and patching. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts with RPR before proceeding.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
 - 1. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- C. Cutting: Take all precautions necessary to avoid cutting existing pipe or conduit serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
 - 1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.
 - 1. In general, where cutting is required, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
 - 4. Comply with requirements of applicable sections of Division 2 specifications where cutting and patching requires excavating and backfill.
 - 5. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of

pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

- C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
 - 1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
 - 2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - 3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.
 - a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing the patch, after the patched area has received primer and second coat.
 - 4. Patch, repair, or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

3.4 CLEANING

- A. Thoroughly clean areas where cutting and patching is performed or used as access. Remove completely any paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION 017329

SECTION 017423 - FINAL CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Conditions/Provisions of the Contract, including Contractual Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes: final cleaning at Substantial Completion.
- B. Environmental Requirements: Conduct cleaning and waste-disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and antipollution regulations.
 - 1. Do not dispose of volatile wastes, such as mineral spirits, oil, or paint thinner, in storm or sanitary drains.
 - 2. Burning or burying of debris, rubbish, or other waste material on the premises is not permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by the manufacturer or fabricator of the material to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Provide final-cleaning operations. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
- B. Cleaning Operations: Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for the entire Project or a portion of the Project.

1. Clean the Project Site, yard and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and foreign substances.
2. Sweep paved areas broom clean. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
3. Broom clean concrete floors in unoccupied spaces.
4. Remove petrochemical spills, stains, and other foreign deposits.
5. Remove tools, construction equipment, machinery, and surplus material from the site.
6. Vacuum clean carpet and similar soft surfaces, removing debris and excess nap. Shampoo, if required.
7. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
8. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, and similar spaces.
9. Remove marks, stains, fingerprints, and other soils or other dirt from painted, decorated, and natural finished woodwork and other Work.
10. Clean cabinet work removing stains, paint, dirt and dust.
11. Remove spots, plaster, soil and paint from ceramic tile, marble, and other finished materials, and wash or wipe clean.
12. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision- obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
13. Clean flooring materials thoroughly, comply with materials manufacturer's instructions and recommendations.
14. Remove labels that are not permanent labels.
15. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

- a. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
16. Clean food-service equipment to a sanitary condition, ready and acceptable for its intended use.
17. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
18. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
19. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs and defective and noisy starters in fluorescent and mercury vapor fixtures.
20. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
21. Clean ductwork, blowers, and coils of units that were operated during construction.
22. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
23. Leave the Project clean and ready for occupancy.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests. Comply with regulations of local authorities.
- D. Removal of Protection: Remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of the construction period.
- E. Compliances: Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from the site and dispose of lawfully.
 1. Where extra materials of value remain after completion of associated Work, they become the Owner's property. Dispose of these materials as directed by the OAR.
 2. The Contractor shall not dispose of debris or waste materials on the Owner's property without the prior approval of the Owner.

- F. Maintenance: Provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.

3.2 PROTECTIONS

- A. General: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading.
2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Thermal shock.
5. Excessively high or low humidity.
6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
9. Chemicals.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining, and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
18. Combustion.
19. Electrical current.
20. High-speed operation.
21. Improper lubrication.
22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Destructive testing.
25. Misalignment.
26. Excessive weathering.
27. Unprotected storage.
28. Improper shipping or handling.
29. Theft.

END OF SECTION 01 74 23

SECTION 017800 - CLOSEOUT SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Conditions/Provisions of Contract, including Contractual Conditions and other Division 1 Specification Sections, apply to this Section. Refer to other specification sections for requirements and limitations applicable to Project Closeout.

1.2 SUMMARY

- A. Closeout is defined to include general requirements near end of Contract Time, in preparation for Substantial Completion, Final Completion and Acceptance, Final Payment, normal termination of Contract, occupancy by Owner and similar actions evidencing completion of the Work. Specific requirements for individual units of Work are specified in other sections.

1.3 SUBSTANTIAL COMPLETION

- A. General: Refer to the General Conditions/Provisions of the Contract for Construction.
- B. Procedures to achieving Substantial Completion:
 - 1. The Contractor shall, five (5) business days prior to requesting inspection for certification of Substantial Completion, prepare and submit to the OAR the following:
 - a. The Contractor's prepared comprehensive punch list of items to be completed or corrected. The punch list shall include all incomplete Work items and the schedule to complete each item.
 - b. Draft Operation and Maintenance (O&M) Manuals for review by the RPR for conformance with the Contract documents. These will be returned to the Contractor.
 - c. As-Built Documents (from Contractor) for review by the RPR for conformance with the Contract Documents. These will be returned to the Contractor.
 - 2. The Contractor will request a preliminary inspection from the RPR for the determination that the Project is ready for the Substantial Completion Inspection. The Contractor will prior to the request:
 - a. Complete its punch list and provide a copy to the RPR.

- b. Schedule inspections from the Authorities Having Jurisdiction and provide the time and date to the RPR.

If the RPR's preliminary inspection discloses any item that is not in accordance with the requirements of the Contract Documents, whether or not included on the Contractor's punch list, the RPR shall so notify the Contractor and the Contractor shall add the items to its punch list. The Contractor shall proceed to complete or correct every item on the revised punch list and request re-inspection from the RPR.

3. If the RPR determines that the Work is ready, the Substantial Completion Inspection will be scheduled at a minimum of three (3) business days after the RPR's preliminary inspection.
4. Form #008 Substantial Completion Acceptance (SCA) will be used to: document the time and place of the project closeout inspections, establish the participants to be involved in the inspections, establish the date of Substantial Completion, document the acceptance of the Substantial Completion punch list, document the date all Substantial Completion punch list items were completed and document the date of Final Completion.
5. The following parties will attend the Substantial Completion inspection: the RPR, the Contractor, and the A/E. The following Owner representatives may attend: VPS ARFF, VPS Engineering, VPS Environmental, VPS IT, VPS Maintenance, VPS Operations, VPS Properties, VPS Risk Management, and any involved tenant(s).
6. Following the inspection, the RPR and A/E will determine if the Work is substantially complete. If it is determined to be Substantially Complete, the RPR will use this date in the preparation of Form #007 Certificate of Substantial Completion (CoSC) and the Contractor in the preparation of the written warranties. The following will be used in the determination of the Substantial Completion date:
 - a. Certificate of Occupancy/Certificate of Completion (CofO) or Agency Sign Off (as required). The date of the CofO does not establish the date for Substantial Completion.
 - b. Recommendation from the RPR and A/E that determine the Project is Substantially Complete.
 - c. Acceptance from the Contractor and RPR that the preliminary Substantial Completion punch lists represent most of the items required for completion of the Work. The RPR shall distribute the preliminary Substantial Completion punch lists to the Contractor within a maximum of three (3) business days after the date of Substantial Completion.
 - d. Acceptance by the RPR of the draft warranties.

- e. Acceptance by the RPR of the draft Operation & Maintenance Manuals.
 - f. Agreement from the Contractor and RPR that the Owner will have complete use or occupancy and may use, operate, and maintain the Project in all respects, for its intended purpose and without undue interference by the Contractor's Final Completion efforts.
 - g. If any of the above items are not accepted or incomplete the Contractor shall correct any items found not to be in accordance with the requirements of the Contract Documents and once the items have been corrected, the Contractor shall provide a written request for re-review and or re-inspection.
7. When the Project is determined to be Substantially Complete the RPR will prepare a typed Substantial Completion punch list which includes any items from the preliminary Substantial Completion punch list that have not yet been completed plus all punch list items from the A/E, RPR, Owner and others, and Form #007 Certificate of Substantial Completion (CoSC) within a maximum of fifteen (15) business days from the date of Substantial Completion and will schedule a meeting with the Contractor, A/E, and any Owner's representatives to:
- a. Review Form #007 CoSC, all of its requirements and submit to the Contractor for appropriate acceptance and signature.
 - b. Review the attachments: Form #008 SCA, Substantial Completion punch list and the CofO.
 - c. Establish the date for the completion of the Substantial Completion punch list items.
 - d. Establish the responsibilities of the Owner and Contractor for security, maintenance, operations, cleaning and housekeeping, heating and cooling, utilities, damage to the Work and insurance.
 - e. Review and accept the Contractor's written warranties and guarantees from its Subcontractors and Suppliers bearing the date of Substantial Completion stating the period of warranty as required by the Contract Documents, the Final Operation & Maintenance Manuals, and As-built Documents.

1.4 PARTIAL OCCUPANCY OR USE

- A. General: Refer to the General Conditions/Provisions of the Contract for Construction.
- B. The Owner may occupy or use any completed or partially completed portion of the Work at any stage and, if the Owner chooses such partial occupancy, the Contractor and

Owner shall designate by an agreement the conditions of such partial occupancy, provided such occupancy or use is consented to by the Owner's insurer and authorized by public authorities having jurisdiction over the Work.

1. Such partial occupancy or use may commence whether or not the portion is Substantially Complete.
- C. Procedures to achieving partial occupancy or use:
1. The Owner will request the RPR to coordinate with the Contractor for a partial occupancy or use of a portion of the Work.
 2. If the RPR determines that the Work is ready, a partial occupancy or use inspection will be scheduled at a minimum of three (3) business days after the RPR's preliminary inspection.
 3. Immediately prior to such partial occupancy or use inspection, the Owner, RPR, Contractor and A/E shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.
 - a. The following parties will attend the partial occupancy or use inspection: the RPR the Contractor, and the A/E. The following Owner representatives may attend: VPS Engineering, VPS Environmental, VPS Maintenance, VPS Operations, VPS Properties, VPS Risk Management, VPS ARFF, and any involved tenant(s).
 4. Following the inspection, the RPR and A/E will determine if the Work is ready for partial occupancy or use. If it is determined to be ready, the RPR will use this date in the preparation of Form #009 Partial Occupancy/Use (POUA) and the Contractor in preparation of any agreed upon written warranties. The following will be used in the determination of the POUA date:
 - a. Certificate(s) of Occupancy (CofO) / Agency Sign Off (as required) for the area being occupied.
 - b. Recommendation from the RPR and A/E that determine the Project is ready for partial occupancy or use.
 - c. Acceptance from the Contractor and RPR that the preliminary punch lists represent most of the items required for completion of the Work. The RPR shall distribute the preliminary punch lists to the Contractor within a maximum of three (3) business days after the date of the POUA.
 - d. Acceptance by the RPR of the draft warranties if requested.

- e. Acceptance by the RPR of the draft Operation & Maintenance Manuals if requested.
 - f. Agreement from the Contractor and RPR that the Owner will have complete occupancy or use and may use, operate, and maintain the Project in all respects, for its intended purpose and without undue interference by the Contractor's Final Completion efforts.
 - g. Agree that partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work which is not in conformance with the requirements of the Contract Documents.
5. When the Project is determined to be ready for partial occupancy or use the RPR will prepare a typed punch list which includes any items from the preliminary Substantial Completion punch list that have not yet been completed plus all punch list items from the Designer, RPR, Owner and others, and Form #009 Partial Occupancy/Use (POUA) within a maximum of fifteen (15) business days of the date of POUA and will schedule a meeting with the Contractor, Designer, and any Owner's representatives to:
- a. Review Form #009 POUA, all of its requirements and submit to the Contractor for appropriate acceptance and signature.
 - b. Review the attachments: punch list and the CofO.
 - c. Establish the date for the completion of the punch list items.
 - d. Establish the responsibilities of the Owner and Contractor for security, maintenance, operations, cleaning and housekeeping, heating and cooling, utilities, damage to the Work and insurance.
 - e. Review and accept the requested Contractor's written warranties and guarantees from its Subcontractors and Suppliers bearing the date of the POUA stating the period of warranty as required by the Contract Documents.

1.5 FINAL COMPLETION

- A. General: Refer to the General Conditions/Provisions of the Contract for Construction.
- B. Procedures: Complete the following.
 - 1. Before requesting final inspection for certification of Final Completion and final payment, prepare and submit to the RPR the following:
 - a. Contractor's certified copy of the Substantial Completion punch list of items to be completed or corrected, stating that each item has been completed or

otherwise resolved for acceptance, and the list has been endorsed and dated by the RPR.

- b. Final meter readings for utilities, and similar data as of the date of Substantial Completion, or when the Owner took possession of and responsibility for corresponding elements of the Work.
 - c. Closeout Documentation Manual.
2. If the RPR determines that the Work is ready, the Final Completion Inspection will be scheduled at a minimum of three (3) business days after the RPR's preliminary inspection.
 3. The following parties will attend the Final Completion inspection: the RPR, the Contractor, and the A/E. The following Owner representatives may attend: VPS ARFF, VPS Engineering, VPS Environmental, VPS IT, VPS Maintenance, VPS Operations, VPS Properties, VPS Risk Management, and any involved tenant(s).
 4. Upon acceptance of the Final Completion Inspection, the A/E, RPR and VPS Maintenance are to sign off on Part IV of Form #008 SCA and provide the final inspection date. The RPR is to provide the Contractor's completed punch list which will be field verified and each item initialed complete by the Designer and the OAR. The RPR is to provide documentation of FAA/FDOT final inspections, as required. Part IV of Form #008 SCA must be completed prior to processing the Contractor's final pay application.
- C. If necessary, re-inspection will be repeated at the Contractor's expense. Re-inspection Procedure: The RPR and A/E will re-inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the RPR and A/E. Repeat Final Completion Procedures above until Final Completion is accepted.

1.5 CLOSEOUT DOCUMENTATION MANUAL

- A. Description: Submit the manual in a vinyl covered, 3-ring binder; white, with hard cover, with clear vinyl pockets on front (sized to hold 8-1/2" x 11" sheets) and spine (minimum spine size 1", maximum 3"). Binder shall be "View Binder" as manufactured by Avery Consumer Products, AVE 0560 series, or approved substitution. Each section shall be divided by an 8-1/2" x 11" reinforced, clear ring binder index, 5 tabs, as manufactured by Wilson Jones, Stock No. WJ-54125, or approved substitution.
1. Full size, machine lettered labels shall be inserted into the front, back, and spine pockets. Labels shall be on white paper with black print, and shall clearly identify the following:

Okaloosa County
Destin-Fort Walton Airport
(ITB AP 59-20, Construct Baggage Handling System
and West Terminal Expansion)
(Manual Title)
(Date)

2. Contents of the Manual shall include:

- a. First page shall be a Cover Page, identifying:

Okaloosa County
Destin-Fort Walton Airport
(ITB AP 59-20, Construct Baggage Handling System
and West Terminal Expansion)
(Manual Title)
(Date)

- b. Second page shall be a Table of Contents.

- c. The next section shall list the Names, Addresses, Contacts, and Phone Numbers for the following:

- 1) RPR(s)
- 2) A/E(s)
- 3) Contractor
- 4) Subcontractors (first-tier)

- d. Change Order Summary (prepared by VPS)

- e. Summary of Disbursements (prepared by VPS)

- f. Receipt/Acceptance Form for As-Built Documents

- 1) Progress and As-Built Drawing Certification(s) for each applicable Subcontractor (Exhibit D; prepared by Contractor)
- 2) Construction Form # 011 (prepared by RPR) with Transmittal to VPS ENGINEERING (signed by VPS Engineering)

- g. Receipt Form for O&M Manuals (Construction Form # 012; prepared by RPR) with Transmittal to VPS MAINTENANCE (signed by VPS Maintenance)

- h. Parking Permit Office Release Form (Construction Form # 001; prepared by Contractor) (signed by VPS Ground Transportation)

- i. Badge & I.D. Office Release Form (Construction Form # 002; prepared by Contractor) (signed by VPS Access Control)
- j. Key Shop Release Form (Construction Form # 003; prepared by Contractor) (signed by VPS Lockshop)
- k. Environmental Group Letter of Concurrence for Closeout (if applicable; prepared by VPS)
- l. Certificate(s) of Substantial Completion (Construction Form # 007; prepared by RPR)
 - 1) Substantial Completion Acceptance with Final Substantial Completion Punch list initialed and dated by Contractor (Construction Form # 008; prepared by RPR)
 - 2) Partial Occupancy / Use Agreement(s), or POUA Construction Form # 009; prepared by PR)
 - 3) FAA / FDOT Final Inspection(s) (if applicable; if project has FAA and/or FDOT funding, provide documentation of the invitation to FAA / FDOT and/or the appropriate sign off)
- m. Certificate(s) of Occupancy / Agency Sign Off (furnished by Contractor)
- n. Current Certificate of Insurance: (furnished by Contractor)
 - 1) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days prior written notice has been given to the Owner: and
 - 2) a written statement that the Contractor knows no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents
- o. Consent of Surety to Final Payment with Power of Attorney (AIA Form # G707; furnished by Contractor) (original)
- p. Final Release Form from General Contractor (prepared by Contractor) (original, notarized with corporate seal)
- q. Final Release Form(s) from Subcontractors / Suppliers (prepared by Subcontractor)

- r. Final Payment Application (2 originals, signed and notarized by Contractor and signed by RPR (DBE Disbursement Page completed with Subcontractor performance rating and total payment)
- s. Executed Originals of Warranties/Guarantees.

1.6 AS-BUILT DOCUMENTS

- A. General: Do not use as-built documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to as-built documents for the RPR's reference during normal working hours.
 - 1. Submit all As-Built Documents to the RPR as specified in General Conditions.
 - 2. Include fire alarm and building control system(s) drawings and specifications.
- B. As-Built Documents: As-Built Documents include Drawings, Specifications, Addenda, Change Orders, and other Modifications. Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
 - 3. Mark As-Built sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
 - 4. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
 - 5. Note related Change Order numbers where applicable.
 - 6. Organize As-Built drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.
 - 7. Mark EVERY PAGE of the Drawings with "As-Built".
- C. Accurate as-built documents are very important for the Owner and serve several important functions. The Owner utilizes the as-built documents for operation and maintenance, and future modifications, renovations, and particularly for mechanical, plumbing and electrical systems, which are mostly hidden from view.
 - 1. The working as-built shall show, but shall not be limited to, the following:

- a. All concealed and underground utilities, equipment, foundations or other permanent conditions shall be surveyed and documented. This includes all discovered conditions. All shall be tied to permanent benchmarks showing horizontal and vertical data including but not limited to: beginning/end points, changes in direction points, inverts, grades of drainage, depths below the surface, all surface or underground components such as valves, manholes, drop inlets, clean outs, meters, corner points, etc. Each of the above shall also include a description of: actual quantity, size, and material. GPS coordinates are to be provided for all.
- b. The location and dimensions of any changes within the building structure and architectural components. The dimensions shall be actual field measurements.
- c. Correct dimensions and details transferred from shop drawings.
- d. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.
- e. Actual location of anchors, construction and control joints, etc., in concrete.
- f. Changes in location of equipment and architectural features.
- g. Where contract drawings or specifications present options, only the option selected for construction shall be shown on the final as-built prints. Cross out such words and phrases as "optimal requirement," "or approved substitution," etc., and list specifically the items of material provided.
- h. Unusual or uncharted obstructions that are encountered in the contract work area during construction.
- i. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.
- j. If borrow material for this project is from sources on the Owner's property, or if Owner's property is used as a spoil area, the Contractor shall furnish a contour map of the final borrow pit/spoil area elevations.
- k. Layout and schematic drawings of electrical circuits and piping. See the Electrical Specifications for the level of detail required to be accurately documented.
- l. Layout and schematic drawings of mechanical and plumbing systems and piping. All shall be tied to permanent benchmarks showing horizontal and vertical data of primary and secondary branches.

- m. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems. All shall be tied to permanent benchmarks showing horizontal and vertical data of primary and secondary branches.
- n. Changes or modifications that result from the final inspection.

1.7 OPERATION & MAINTENANCE MANUALS

- A. General: If all specified information can be submitted in a single binder without being overfilled, submit three (3) copies in a white binder with white labels.
 - 17. If all of the information cannot be submitted in a single binder, submit three (3) per design discipline as follows:
 - a. Architectural; submit in a white binder with white labels.
 - b. Mechanical; submit in a white binder with green labels.
 - c. Fire Protection; submit in a white binder with red labels.
 - d. Electrical; submit in a black binder with white labels.
 - e. Civil; submit in a white binder with yellow labels.
 - 18. Submit O&M Manuals to OAR as specified in Paragraph 1.3.B.
- B. Description: Submit the manual in a vinyl covered, 3-ring binder; with hard cover, with clear vinyl pockets on front (sized to hold 8-1/2" x 11" sheets) and spine (minimum spine size 1", maximum 3"). Binder shall be "View Binder" as manufactured by Avery Consumer Products, AVE 0560 series, or approved substitution. Provide additional binders if a single 3-inch binder is insufficient to contain all closeout information. Each section shall be divided by an 8-1/2" x 11" reinforced, clear ring binder index, 5 tabs. as manufactured by Wilson Jones, Stock No. WJ-54125, or approved substitution.
 - 19. Full size, machine lettered labels shall be inserted into the front, back, and spine pockets. Labels shall be on paper in color(s) specified with black print, and shall clearly identify the following:

Okaloosa County
Destin-Fort Walton Airport
(ITB AP 59-20, Construct Baggage Handling System
and West Terminal Expansion)
(Manual Title)
(Date)

20. Contents of the Manual shall include:

- a. First page shall be a Cover Page, identifying:

Okaloosa County
Destin-Fort Walton Airport
(ITB AP 59-20, Construct Baggage Handling System
and West Terminal Expansion)
(Manual Title)
(Date)

- b. Second page shall be a Table of Contents indicating the contents of the binder(s).

- c. The third page shall list the Names, Addresses, Contacts, and Phone Numbers for the following:

- 1) RPR
- 2) A/E(s)
- 3) General Contractor
- 4) Subcontractors
- 5) Sub-subcontractors
- 6) Suppliers

- d. The remaining portions of the manual shall be separated by each major division of work as identified by the Contract Documents.

- 1) PROJECT INFORMATION (Exhibit A).
- 2) Within each major division of work, each section shall be individually identified by a typed index/tab. For each specification requirement, submit the following information in the order outlined below:
 - a) Copies of all warranties/guarantees, as specifically required by the specification section, and Letters of Certification. Executed original warranties/guarantees shall be included in the appropriate section of the Closeout Manual(s).
 - b) Copies of the "Approved" Shop Drawing/Submittals/ Equipment Manufacturer's Schematics. Oversized drawings shall be folded and inserted in clear vinyl pockets or, for large sets of drawings, provide an insert page stipulating that the drawings are stored at VPS

ENGINEERING. All copies shall be stamped with the appropriate review stamp, marked, signed, and dated.

- c) Operation and Maintenance Instructions, including but not limited to:
 - ◆ Manufacturer's Recommended Care and Cleaning
 - ◆ Installation Instructions
 - ◆ Parts Lists
 - ◆ Lubrication Checklists
 - ◆ Equipment Supplier Lists
 - ◆ Special Instructions
 - ◆ Preventive Maintenance Instructions.
 - d) Service and Maintenance Contracts: Include Name, address, and phone number and contact of Manufacturer's authorized repair company.
 - e) Completed Turnover Forms:
 - ◆ Performance Verification and Demonstration to Owner (Exhibit B) signed by Contractor and VPS representative
 - ◆ Voltage and amperage Readings (Exhibit C) signed by Contractor, A/E and RPR
 - ◆ Motor Test Information (Exhibit D) signed by Contractor and RPR.
 - ◆ Check-out Memo (Exhibit E) signed by Contractor and Manufacturer's representative
 - f) Equipment and/or Systems Test Data and Conductor Insulation Resistance Test Data Sheets by installer and/or manufacturer where required. Form(s) to be provided by the installer and/or manufacturer performing the test [Exhibits G, H (signed by Contractor, A/E and VPS representative), I (signed by Contractor, Subcontractor and GOAA), J (signed by Contractor and RPR) and K (signed by Contractor, A/E and RPR)].
 - g) Copies of electrical panel schedules and directories.
- C. Submit one copy of the O&M manual in PDF format on USB Jump Drive. Create a PDF file for each section of the manual. PDF files shall be named *C19-2811 OM Sec XXXXX.pdf*

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.4 CLOSEOUT PROCEDURES

- A. Operation and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:
1. Operation and Maintenance manuals.
 2. As-Built Documents.
 3. Spare parts and materials.
 4. Tools.
 5. Lubricants.
 6. Fuels.
 7. Identification systems.
 8. Control sequences.
 9. Hazards.
 10. Cleaning.
 11. Warranties and bonds.
 12. Maintenance agreements and similar continuing commitments.
- B. As part of instruction for operating equipment, demonstrate the following procedures:
13. Start-up.
 14. Shutdown.
 15. Emergency operations.
 16. Noise and vibration adjustments.
 17. Safety procedures.

3.4 CLEANING

- A. General: General cleaning during construction is required.

B. Final Cleaning: Refer to Section 01 74 23, Final Cleaning.

3.4 ATTACHMENTS

A. The following information sheets have been included in this Section:

1. Exhibit A: Project Information
2. Exhibit B: Performance Verification and Demonstration to Owner
3. Exhibit C: Check-Out Memo
4. Exhibit D: Progress and As-Built Document Certification
5. Exhibit E: Spare Parts Certification Memo
6. Exhibit F: Existing Facilities Investigation Memo
7. Example: Description Sheet – Cover
8. Example: Description Sheet - Spine

EXHIBIT A
PROJECT INFORMATION
Destin- Fort Walton Beach Airport

Contractor shall fill in the blanks below and insert in the Operation and Maintenance Manuals. Submit one (1) sheet for each major division of Work.

Project Name: _____

Specification Division Number & Name: _____

Subcontractor: _____

Contact: _____ Phone: _____

Date Project Bid: _____

Project Start Date: _____

Days allowed for Construction: _____

Target Completion: _____

Substantial Completion Certification Date: _____

	<u>Date Submitted</u>	<u>Date Provided</u>
Close-out Documentation Manual:	_____	_____
Operation and Maintenance Manuals:	_____	_____
Owner Performance Verification and Demonstrations:	_____	_____
Manufacturer's Performance Verification Memos:	_____	_____
Manufacturer's Test Data:	_____	_____
Record Documents:	_____	_____

EXHIBIT B
PERFORMANCE VERIFICATION AND DEMONSTRATION TO OWNER
Destin-Fort Walton Beach Airport

This form verifies that the Owner has been given a demonstration of the proper operation on the equipment or systems noted below.

Project Name: _____

Specification Division Number & Name: _____

Equipment/Systems Demonstrated: _____

Along with a complete demonstration of the equipment/system, these items have been reviewed at this demonstration and shall be included in the Operation and Maintenance Manuals, under the appropriate specification section:

- 1) Written operating instructions.
- 2) Test data and performance verification information as required by the installer and/or manufacturer.
- 3) Maintenance information published by manufacturer's representative.
- 4) Check-out Memo signed by manufacturer's representative.
- 5) Printed warranties by manufacturer of equipment.
- 6) Explanation of the warranty/guarantee on the system.
- 7) Prints showing actual "As-Built" conditions.

(Name of General Contractor) (Signature, Title, Date)

(Name of Subcontractor) (Signature, Title, Date)

A demonstration of the system/equipment in operation and of the maintenance procedures has been successfully completed.

Destin-Fort Walton Beach Airport

(Signature, Date) (VPS Department)

EXHIBIT C
CHECK-OUT MEMO
Destin-Fort Walton Beach Airport

This form shall be completed and a copy provided to the Owner at the Owner's Performance Verification and Demonstration meeting. A copy shall also be included in the specification section of the Operation and Maintenance Manual for the equipment checked.

Project Name: _____

Type of Equipment Checked: _____

Equipment Number: _____

Name of Equipment Manufacturer: _____

Signature below by the Manufacturer's authorized representative signifies that the equipment has been satisfactorily tested and checked out on the job by the manufacturer.

1. The attached Test Data and Performance Verification information was used to evaluate the equipment installation and operation.
2. The equipment is properly installed, has been tested by the manufacturer's authorized representative, and is operating satisfactorily in accordance with all requirements, except for items noted below. *
3. Written operating and maintenance information has been presented to the Contractor, and gone over with him in detail.
4. Sufficient copies of all applicable operating and maintenance information, part lists, lubrication checklists, and warranties have been furnished to the Contractor for insertion in the Operation and Maintenance Manuals.

Manufacturer's Representative: _____
(Print or Type Name and Title)

(Print or Type Address and Phone Number)

Signature of Manufacturer's Representative: _____

Date Checked

Witnessed By: _____
(Signature and Title of Contractor's Representative)

*Exceptions Noted at Time of Check-Out: (Use additional pages if necessary.)

EXHIBIT D
PROGRESS AND AS-BUILT DRAWING CERTIFICATION
Destin-Fort Walton Beach Airport

This form shall be completed and submitted with the As-Built Documents. Submit one form for each contractor/subcontractor providing as-built information. Include a copy of this form in the Close-out Documentation Manual.

Project Name: _____

Specification Division Number & Name: _____

The Contractor's and Subcontractor's signatures below certify that the attached drawings and specifications were marked and revised as items were installed/changed during the course of construction, and that these documents represent and accurate "As-Built" condition of the work as actually installed.

(Name of General Contractor)

(Signature, Title, Date)

(Name of Subcontractor)

(Signature, Title, Date)

EXHIBIT E
SPARE PARTS CERTIFICATION MEMO
(Refer to Division 16 Specifications)

This form shall be completed and a copy provided to the Owner at the Owner's Performance Verification and Demonstration meeting. A copy shall also be included in the specifications section of each Operation and Maintenance Manual for the equipment checked.

Name of Project: _____

Type of Spare Parts: _____

Specification Reference: _____

Quantity of Spare Parts: _____

Signature below by the Contractor and subcontractor signifies that the spare parts required by the drawings and/or specifications have been turned over to the Owner. Signature by the Owner acknowledges receipt of the same spare parts.

Name of General Contractor: _____

Authorized Signature and Title: _____

Date: _____

Name of Subcontractor: _____

Authorized Signature and Title: _____

Date: _____

Name of Owner: _____

Authorized Signature and Title: _____

Date: _____

EXHIBIT F
EXISTING FACILITIES INVESTIGATION MEMO
(Refer to Specification Section 16061)

Name of Project: _____

The existing systems on the above project have been investigated and checked to determine the existing condition of all existing electrical systems within the area(s) affected by the scope of work on this project. The investigation consisted of testing all electrical systems/devices as required by Section 16061 of these specifications.

All equipment was found to be operational except as noted herein:

Name of Prime Contractor: _____

Authorized Signature and Title: _____

Date

Name of Authorized Owner Representative: _____

Authorized Signature and Title: _____

Date

Note To Contractor: Upon completion of investigation and one week prior to the commencement of work, submit five copies of the completed EXISTING FACILITIES INVESTIGATION MEMO to the Owner's Authorized Representative, signed and dated by the Contractor. The Owner's Resident Professional Representative signature and date is required to verify receipt of memo. Retain copy(ies) and submit copy of MEMO in each Operation and Maintenance Manual. Contractor shall submit quantities of Memos as required to present required information.

EXAMPLE - Description Sheet - Cover

Okaloosa County

Destin-Fort Walton Beach Airport

ITB AP 59-20, Construct Baggage Handling System and West Terminal Expansion

OPERATION AND MAINTENANCE MANUAL

EXAMPLE - Description Sheet - Spine

Okaloosa County

**Destin-Fort Walton Beach
Airport**

**ITB AP 59-20, Construct
Baggage Handling System and
West Terminal Expansion**

ELECTRICAL

**OPERATION
AND
MAINTENANCE
MANUAL**

Okaloosa County

**Destin-Fort Walton Beach
Airport**

**ITB AP 59-20, Construct Baggage
Handling System and West
Terminal Expansion**

SYSTEMS

**OPERATION AND
MAINTENANCE
MANUAL**

END OF SECTION 017800

SECTION 017810 – WARRANTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes sample warranties to be executed by the General Contractor and Subcontractors.

1.2 GENERAL REQUIREMENTS

- A. Forms:
 - 1. Subcontractor Warranty (FORM 01 78 10-1)
 - 2. General Contractor Warranty (FORM 01 78 10-2)

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 FORM

- A. See attached forms in this section

END OF SECTION 017810

FORM 01 78 10-1

SUBCONTRACTOR WARRANTY

PROGRAM: XXXXXXXX

PROJECTNAME: ITB AP 59-20, CONSTRUCT BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION

PROJECTNUMBER: C 19-2811

OWNER: Okaloosa County Board of County Commissioners

Engineer of Record: Graef-USA Inc.

General Contractor: XXXXXXXXXXXXXXXX

SCOPE OF WORK: XXXXXXXXXXXXXXXX

LENGTH OF WARRANTY: X Year(s)

STARTING DATE: XXXXXXXX x, XXXX (Substantial Completion Date)

This document shall warrant that the materials and/or equipment furnished, or work performed by (Company Name), (hereafter called "Subcontractor") in connection with XXXXXXXXXXXXXXXXXXXX (hereafter called "Project") under the Subcontract or Purchase Agreement between _____ (hereafter called "General Contractor") and the Subcontractor fully conforms to all requirements of the Contract Documents and is free of any defect in equipment, material, design furnished, or workmanship performed by the Subcontractor. This warranty shall continue for a period of X year(s) commencing on the Substantial Completion Date for the aforementioned Project as determined by Okaloosa County Board of County Commissioners, (hereafter called "Owner"), except to the extent any longer warranty period is called for by the Contract Documents with respect to equipment, material, design furnished, or workmanship performed by the Subcontractor. Work not conforming to these requirements including substitutions not properly approved and authorized may be considered defective. The Subcontractor agrees to promptly make good, without cost to the General Contractor or the Owner, any and all defects due to faulty equipment, material, design furnished, or workmanship performed by the Subcontractor, which may appear within the established warranty period. Failure to make good such defects within X days after notification may cause the corrective work to be performed by others at the Subcontractor's expense. All expenses necessary to replace or repair work will be the Subcontractor's responsibility including that damaged or disturbed by making replacement or repairs. This warranty is in addition to and not in lieu of all other guarantees, warranties and rights contained in the Contract Documents or applicable law. In the event that an equipment, material, design furnished, or workmanship performed by the Subcontractor is repaired or replaced pursuant to these warranty provisions, the Subcontractor shall extend the warranty period with respect to the equipment, material, design furnished, or workmanship performed by the Subcontractor so

repaired or replaced for any additional period of time after Owner approval of the repair or replacement specified in the Contract Documents.

The Subcontractor hereby acknowledges that this warranty is given for the benefit of the Owner and General Contractor and agrees to honor requests or directives issued to the Subcontractor by the Owner or General Contractor for enforcement of this warranty. The Subcontractor further hereby assigns to the Owner all warranties, express or implied, issued by the Subcontractor and by manufacturers, suppliers, or subcontractors to the Subcontractor for equipment, material, design furnished, or workmanship performed by the Subcontractor in connection with the Project.

IN WITNESS WHEREOF, THE Subcontractor has caused this instrument to be signed and executed this **X** day of XXXXXXXX, 20XX.

FIRM:

BY:

TITLE

:

State of_
County of_

SS.

On _____ (*enter date*) before me, _____ (*enter Notary's Name here*),
Notary Public, personally appeared _____ (*here insert name and title of person signing the instrument*) who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of _____ that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature:

(Seal)

My Commission Expires:

FORM 01 78 10-2

General Contractor WARRANTY

PROGRAM: XXXXXXXXXXXXXXXXXXXX

PROJECTNAME: XXXXXXXXXXXXX

PROJECTNUMBER: XXXXXXXXXXXXXXXX

OWNER: Okaloosa County Board of County Commissioners

Engineer of Record: Graef-USA Inc.

General Contractor: XXXXXXXXXXXXXXXX

SCOPE OF WORK: XXXXXXXXXXXXXXXX

LENGTH OF WARRANTY: X Year(s)

STARTING DATE: XXXXXXXX x, XXXXX (Substantial Completion Date)

This document shall warrant that the materials and/or equipment furnished, or work performed by _____, (hereafter called " General Contractor ")in connection with XXXXXXXXXXXX, (hereafter called "Project") under the Agreement between Okaloosa County Board of County Commissioners (hereafter called "Owner") and the General Contractor fully conforms to all requirements of the Contract Documents and is free of any defect in equipment, material, design furnished, or workmanship performed by the General Contractor. This warranty shall continue for a period of X year(s) commencing on the Substantial Completion Date for the aforementioned Project as determined by the Owner, except to the extent any longer warranty period is called for by the Contract Documents with respect to equipment, material, design furnished, or workmanship performed by the General Contractor. Work not conforming to these requirements including substitutions not properly approved and authorized may be considered defective. The General Contractor agrees to promptly make good, without cost to the Owner, any and all defects due to faulty equipment, material, design furnished, or workmanship performed by the General Contractor, which may appear within the established warranty period. Failure to make good such defects within X days after notification may cause the corrective work to be performed by others at the General Contractor expense. All expenses necessary to replace or repair work will be the General Contractor responsibility including that damaged or disturbed by making replacement or repairs. This warranty is in addition to and not in lieu of all other guarantees, warranties and rights contained in the Contract Documents or applicable law. In the event that equipment, material, design furnished, or workmanship performed by the General Contractor is repaired or replaced pursuant to these warranty provisions, the General Contractor shall extend the warranty period with respect to the equipment, material, design furnished, or workmanship performed by the General Contractor so repaired or replaced for any additional period of time after Owner approval of the repair or replacement specified in the Contract Documents. The General Contractor hereby acknowledges that this warranty is given

for the benefit of the Owner and agrees to honor requests or directives issued to the General Contractor by the Owner for enforcement of this warranty. The General Contractor further hereby assigns to the Owner all warranties, express or implied, issued by the CM@R and by manufacturers, suppliers, or subcontractors to the General Contractor for equipment, material, design furnished, or workmanship performed by the General Contractor in connection with the Project.

IN WITNESS WHEREOF, THE General Contractor has caused this instrument to be signed and executed this **X day of XXXXXXXX, 20XX.**

FIRM:

BY:

TITLE

:

State of_
County of_

SS.

On _____ (*enter date*) before me, _____ (*enter Notary's Name here*),
Notary Public, personally appeared _____ (*here insert name and title of person signing the instrument*) who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.
I certify under PENALTY OF PERJURY under the laws of the State of _____ that the foregoing paragraph is true and correct.
WITNESS my hand and official seal.

Signature:

(Seal)

My Commission Expires:

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel where indicated in other sections, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
 - 2. Demonstration and training video recordings.

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For facilitator.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Owner.
 - d. Name of Architect.
 - e. Name of Construction Manager.
 - f. Name of Contractor.
 - g. Date of video recording.

2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
3. At completion of training, submit complete training manual(s) for Owner's use prepared in same format required for operation and maintenance manuals specified in Section 01 78 00 "Closeout Submittals".

1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements, experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 19 "Project Meetings". Review methods and procedures related to demonstration and training including, but not limited to, the following:

1.6 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.7 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.

- b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - h. Maintenance service agreements and similar continuing commitments.
 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
 5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
 6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
 7. Maintenance: Include the following:

- a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning.
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

1.8 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module.
- B. Set up instructional equipment at instruction location.

1.9 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- F. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.
1. Submit video recordings on DVD or thumb drive.
 2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
 3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:
 - a. Name of Contractor/Installer.
 - b. Business address.
 - c. Business phone number.
 - d. Point of contact.
 - e. Email address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
1. Film training session(s) in segments not to exceed 15 minutes.
 - a. Produce segments to present a single significant piece of equipment per segment.
 - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
 - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.
- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 017900

SECTION 024113 - SITE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identify, disconnect, cap, and remove designated electric, mechanical utilities.
2. Demolish and remove designated pavements.
3. Owner retained material.
4. Material scheduled for re-installation.
5. Remove demolition materials from site.
6. Temporary protection between demolition area and existing buildings or structures to remain.

B. Related Sections:

1. Applicable provisions of Division 01 – General Requirements Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
2. Section 02 41 15 – Utility Removal: Removal or abandonment of designated site services.
3. Section 02 41 16 – Structure Demolition: Demolition of designated structure.
4. Section 31 05 13 – Soils for Earthwork: Subsoil backfill material.
5. Section 31 05 16 – Aggregates for Earthwork: Granular backfill material.
6. Section 31 10 00 - Site Clearing: Site clearing outside perimeter of existing structures.

1.2 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures, Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.
- B. Submit demolition, removal procedures and schedule.
- C. Submit project record documents under provisions of Section 01 70 00 – Execution and Closeout Requirements, Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework.
1. Record drawings should accurately identify location of utilities capped off or abandoned in place, location of foundations or appurtenances abandoned and covered, or items remaining that would affect future work on site.

1.3 REGULATORY REQUIREMENTS

- A. Comply with local, state, and federal codes, rules and regulations applicable to demolition work including but not limited to erosion control, air pollution, noise pollution, and waste disposal.
- B. Contractor shall obtain and pay for permits required for demolition work.

1.4 PROJECT SITE CONDITIONS

- A. Conduct demolition to minimize interference with adjacent structures.
- B. Maintain protected egress and access at all times.

- C. Provide, erect, and maintain temporary barriers and security devices.
- D. Conduct operations with minimum interference to public or private thoroughfares.
- E. Do not close or obstruct roadways and sidewalks without permits.

1.5 SITE DEMOLITION REQUIREMENTS

- A. Traffic Control Signs:
 - 1. Where pedestrian and driver safety is endangered in area of removal work, use traffic barricades with flashing lights.
 - 2. Anchor barricades in a manner to prevent displacement by wind.
- B. Items to Remain in Place:
 - 1. Take necessary precautions to avoid damage to existing items scheduled to remain in place, to be reused, or to remain property of Owner.
 - 2. Repair or replace damaged items as approved by Owner's Representative or Construction Manager.
 - 3. Construct and maintain shoring, bracing, and supports as required.
 - 4. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, or demolition work performed.
 - 5. Do not overload structural elements or pavements to remain.
 - 6. Provide new supports and reinforcement for existing construction weakened by demolition or removal work.
 - 7. Repairs, reinforcement, or structural replacement require approval by Engineer/Architect, Owner's Representative or Construction Manager prior to performing such work.
- C. Existing Conditions:
 - 1. Before beginning any demolition work, survey project site and examine drawings and specifications to determine extent of demolition work.
 - 2. Protect trees within project site which might be damaged during demolition, and which are indicated to be left in place.
 - 3. Replace any tree designated to remain that is damaged during the work under this contract with like and kind or as approved by Engineer/Architect, Owner's Representative or Construction Manager.
 - 4. Maintain existing utilities indicated to stay in service and protect against damage during demolition operations.
 - 5. Prior to start of work, utilities serving each area of alteration or removal will be shut off by Utility Owner and disconnected and sealed by Contractor.

1.6 HAZARDOUS MATERIALS

- A. If Contractor encounters a hazardous material during demolition process, it shall cease operations immediately and notify Owner and Engineer/Architect, Owner's Representative or Construction Manager of its findings.
- B. Owner will employ a Contractor, experienced and certified in removal and disposal of hazardous substances to perform removal and disposal work.

- C. Contractor shall not reinstate demolition operations until areas have been cleared for continuation of demolition work.

PART 2 - PRODUCTS – (Not Used)

PART 3 - EXECUTION

3.1 NOTIFICATION

- A. Contractor, prior to any excavation work, shall notify (1) a designated locating service; (2) all utilities, governmental agencies, entities, known to, or which can reasonably be assumed to have above or below ground pipe, conduit cables, structures, or similar items within limits of project; to locate and mark location of such items.
- B. In accordance with Florida Statutes Chapter 556, "Underground Facility Damage Prevention and Safety Act," every "Person" as defined in 556.102(9) shall be solely responsible to provide advance notice to "Sunshine State One-Call of Florida, Inc." (800-432-4770) not more than five nor less than two working days prior to commencement of any Excavation or Demolition, as defined in the statute, required to perform work contained in this Project, and further said "Person" shall comply with all other requirements of this Statute relative to Excavator's Work.

3.2 PREPARATION

- A. Prevent movement or settlement of adjacent structures scheduled to remain.
- B. Provide bracing and shoring of adjacent structures scheduled to remain.
- C. Protect existing landscaping materials, appurtenances and structures which are not to be demolished.
- D. Disconnect, cap, and remove designated utility lines, including electrical, mechanical services within demolition areas.
- E. Cooperate and work with local utility company to provide removal or disconnection of designated electrical, mechanical services.
- F. Mark location of disconnected utilities. Identify utilities and indicate capping locations on Project Record Documents.
- G. Erect and maintain temporary partitions and closures to prevent spread of dust, fumes, noise, and smoke into adjacent areas to remain.

3.3 DEMOLITION AND REMOVAL

- A. Except where specified in other sections, all materials and equipment removed, and not reused or salvaged shall become property of the Contractor.
- B. Demolish designated structures, sheds, pavements, and appurtenances in accordance with removal procedure and schedule.

- C. Cease operations and notify Engineer/Architect, Owner's Representative or Construction Manager immediately if adjacent structures or landscape features appear to be endangered.
- D. Do not resume operations until corrective measures have been taken.
- E. Immediately remove demolished material from site unless approved demolition procedure and schedule submitted in accordance with this section provides otherwise.
- F. Relics, antiques, and similar objects remain property of Owner.
- G. Notify Engineer/Architect, Owner's Representative or Construction Manager prior to removal and obtain acceptance regarding method of removal.
- H. Remove materials to be re-installed or retained in manner to prevent damage.
 - 1. Store and protect under provisions of Section 01 60 00 – Product Requirements, Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework.
- I. Remove and promptly dispose of contaminated, vermin infested, or dangerous materials encountered.
- J. Do not burn or bury materials on site.
- K. Remove site structure and shed foundations and footings completely, within area of new construction.
- L. Demolish and remove designated concrete pavement completely which includes:
 - 1. Sidewalks.
 - 2. Stairway.
- M. Demolish and remove designated asphalt pavement completely which includes:
 - 1. Sidewalks.
 - 2. Driveways.
- N. Neatly saw cut pavement edges at right angle to surface to complete depth of pavement prior to shattering or mechanical removal.
- O. Keep work sprinkled to minimize dust. Provide hoses and water main or hydrant connections for this purpose. Obtain permits and pay for water usage as required by Local Water Utility.
- P. Backfill areas excavated, open pits, and holes caused as a result of demolition with Type S1 subsoil specified in Section 31 05 13 – Soils for Earthwork Type A 10 fill specified in 31 05 16 – Aggregates for Earthwork.
- Q. Rough grade and compact areas affected by building demolition to maintain and blend site grades and contours as indicated on Drawings.

END OF SECTION 024113

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements including cutting away, breaking out, and removing portions of existing paving.
3. Removal of designated equipment and fixtures.
4. Identification of utilities.
5. Legal offsite disposal of demolition materials.
6. Salvage of existing items to be reused or recycled.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.4 ACTION SUBMITTALS

- A. Schedule: Submit sequence of demolition operations to Owner for review prior to start of work to prevent interruption of onsite operations.
 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
 2. Coordinate shutoff, capping, and continuation of utility services as required and interruption of utility services.
 3. Details for dust and noise control protection.
 4. Coordinate with Owner's continuing occupation of portions of existing building.
 5. Use of elevator and stairs.
 6. Location of salvageable items.
 7. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
 8. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
 9. Locations of temporary partitions and means of egress.

- B. Shop Drawings: Indicate location and construction of temporary work.
- C. Concrete Cutting: Submit 3 copies of proposed cutting procedures and operations for each type of concrete demolition for review and approval prior to starting the work. Outline types of equipment proposed, protections to be installed, and cutting schedule.
- D. Roof Removal: Submit procedures indicating compliance with manufacturer's warranty (if required) and schedule for roof removal.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit copies of qualification data for refrigerant recovery technician.
- B. Engineering Survey: Submit engineering survey of condition of building.
- C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- D. Schedule of Selective Demolition Activities:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's and other tenants' on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Dust and noise control protection
 - 6. Location of salvageable items.
 - 7. Location of construction for temporary work
 - 8. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed work.
- E. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Division 01, General Requirements. Submit prior to commencement of the work.
- F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- G. Permits: Submit permits, notices and certificates authorizing demolition work, necessary for utility work, and for transportation and disposal of debris.
- H. Project Record Documents: Accurately record actual locations of capped utilities, subsurface obstructions, and hidden or concealed building elements which have been approved to be left in place.
- I. Warranties: Documentation indicating that existing warranties remain in effect after completion of selective demolition.
- J. Inventory: Submit a list of items for removal and salvage prior to start of demolition.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements:

1. Comply with applicable federal, state, and local codes for demolition work, dust and noise control, safety of structure, and debris removal.
 2. Obtain required permits from authorities having jurisdiction.
- B. Refrigerant Recovery Technician Qualifications: Certified by an EPA approved certification program.
- C. Predemolition Conference: Conduct conference at site.
1. Inspect and discuss condition of construction to be selectively demolished.
 2. Review structural load limitations of existing structure.
 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 5. Review areas where existing construction is to remain and requires protection.

1.7 FIELD CONDITIONS

- A. Occupancy: Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted. Provide minimum of 72 hours' notice to Owner of demolition activities that will affect Owner's operations including but not limited to:
1. Interruption of power.
 2. Interruption of utility services.
 3. Excessive noise.
- B. Condition of Structure: Conditions of the structure existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
1. Notify Architect of discrepancies between existing structural conditions and Drawings before proceeding with selective demolition of structural elements.
 2. Before commencing selective demolition, Owner may identify and remove items; contractor shall coordinate an on-site meeting and walk-through to identify such items.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not anticipated that hazardous materials will be encountered in the work.
1. Any known hazardous materials will be removed by Owner prior to the commencement of the work.
 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract. Work shall continue in other areas of project unaffected by hazardous materials.
- E. Storage or sale of removed items or materials on site is not permitted.
- F. Traffic: Conduct operations and debris removal to ensure minimum interference with roads, streets, drives, fire lanes, walks, accessible paths, and adjacent occupied or used facilities.
1. Do not close, block, or obstruct streets, drives, walks, or occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around obstructed traffic ways.
- G. Flame Cutting: Place and maintain portable fire suppression devices during flame cutting operations.

- H. Environmental Controls: Use water sprinkling, temporary enclosures, or other acceptable methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection. Do not use water when it may create hazardous or objectionable conditions.
- I. Utility Services: Maintain existing utilities and protect against damage during demolition operations.
 - 1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by the Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, acceptable to Owner and governing authorities.
 - 2. Maintain fire protection facilities in service during selective demolition operations.
- J. Protections: Provide temporary barriers to protect Owner's personnel and public from injury from work.
 - 1. Take protective measures to provide free and safe passage to occupied portions of building.
 - 2. Provide protection to ensure safe passage of the Owner's personnel and the public around demolition areas and to and from occupied portions of adjacent areas, buildings, and structures.
 - 3. Provide shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.
 - 4. Protect existing work which becomes exposed during demolition operations.
 - a. Protect existing improvements, appurtenances, and conditions to remain.
 - b. Protect adjacent floors with coverings.
 - c. Protect walls, openings, roofs, and adjacent exterior construction to remain and exposed to building demolition operations.
 - 5. Construct temporary acoustically insulated dustproof partitions to separate areas from noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks.
 - 6. Provide temporary weather protection when exposing exterior conditions to prevent water leakage or damage to structure or interior areas of existing building.
- K. Damages: Promptly repair damages caused to adjacent facilities by demolition work.
- L. Fire Arms and Explosives: Fire arms and explosives are not permitted at the site.

1.8 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.
- B. Coordinate selective demolition work with cutting and patching requirements.

1.9 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include, but are not limited to the following:
 - 1. Roofing assemblies.
 - 2. Waterproofing
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Demolition Standards: Comply with ASSE A10.6 and NFPA 241.

2.2 MATERIALS

- A. Repair Materials: Use repair materials identical to existing materials.
 - 1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials visually matching existing adjacent surfaces.
 - 2. Use materials whose installed performance equals or surpasses that of existing materials.
- B. Comply with material and installation requirements specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 - 1. Perform surveys as the work progresses to detect hazards resulting from selective demolition activities.
- D. Verify hazardous materials have been remediated before proceeding with building demolition operations.
- E. Survey of Existing Conditions: Record existing conditions by use of measured drawings or preconstruction photographs and video.
 - 1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.
- B. Pest Control: Employ certified, licensed exterminator to treat building and to control rodents and vermin before and during selective demolition operations.

- C. Site Access and Temporary Controls: Conduct selective demolition and debris removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities. Comply with requirements for access and protection.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Provide written notification to Owner 72-hours prior to scheduled shutting off utility services and/or any mechanical/plumbing/electrical services.
 - 2. Arrange to shut off utilities with utility companies.
 - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - a. Erect temporary pathways and means of egress necessary for ongoing operations compliant with building and accessibility regulations.
 - b. Provide temporary barricades and protection required to prevent injury and damage to adjacent buildings and facilities to remain.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - a. Protect existing work which becomes exposed during demolition operations.
 - b. Protect adjacent entrances from damage due to demolition activities.
 - c. Protect existing improvements, appurtenances, and conditions to remain.
 - d. Protect floors with covering.

- e. Protect walls, openings, roofs, and adjacent exterior construction to remain and exposed to building demolition operations.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling.
 - a. Construct temporary insulated dustproof partitions to separate areas from noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks.
 - b. Construct dustproof partitions of not less than 3-5/8-inch (92.075 mm) studs, 5/8-inch (16mm) gypsum wallboard with joints taped on occupied side, and 1/2 inch (13mm) fire retardant plywood on the demolition side.
 - c. Provide acoustical batt Insulation in all partitions adjacent to current or future occupied areas.
 - d. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
 - e. Protect air handling equipment.
 - f. Weatherstrip openings to prevent the spread of dust and intrusion of insects and vermin.
 6. Damage: Promptly repair damages to adjacent components cause by demolition activities.
- B. Furnishings and Equipment: Cover and protect furniture, equipment, and fixtures from spoilage or damage, as necessary.
- C. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 1. Strengthen or add new supports when required during progress of selective demolition.
- D. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION

- A. Conduct demolition to minimize interference with existing and adjacent building areas and to cause as little inconvenience to Owner and employees of occupied buildings as possible.
 1. Cease operations immediately if structure appears to be in danger and notify Architect. Do not resume operations until directed.
 2. Maintain protected egress and access to work.
 3. Do not burn or bury materials on site. No explosive or blasting will be allowed for demolition.
- B. Demolish and remove existing construction to the extent required by new construction and as indicated. Use methods required to complete the work within limitations of governing regulations and as follows:
 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before

- starting flame cutting operations. Maintain portable fire suppression devices during flame cutting operations.
5. Maintain fire watch during and for at least 24 hours after flame cutting operations.
 6. Maintain ventilation when using cutting torches.
 7. Remove decayed, vermin infested, and dangerous or unsuitable materials and promptly and legally dispose off site.
 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 10. Dispose of demolished items and materials promptly
- C. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities, and their operations.
- D. Removed and Salvaged Items: Remove items and equipment indicated for salvage. Photograph items with existing damage prior to removal. Submit list of damage items with supporting photographs and videos. Clean and pack or crate items after cleaning. Identify contents of containers. Store items in secure area until delivery to Owner.
- E. Removed and Reinstalled Items: Clean and repair items to functional condition adequate for intended reuse.
1. Pack or crate items after cleaning and repairing. Identify contents of containers.
 2. Protect items from damage during transport and storage.
 3. Store items in secure storage, off ground, and covered. Protect until items are reinstalled.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- F. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in original locations after selective demolition operations are complete.
- G. Patching and Repair: Repair damage to adjacent construction caused by selective demolition operations promptly.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power driven saw, and then remove masonry between saw cuts.
- C. Concrete Slabs on Grade: Saw cut perimeter of area to be demolished, and then break up and remove.
- D. Interior Slab-on-Grade: Use best practice removal methods to prevent cracking or structurally disturbing adjacent slabs or partitions. Use power saw where possible.

- E. Below Grade Voids: Completely fill below grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel, or sand, free of trash and debris, with no stones over 6 inches (150 mm) in diameter, roots, or organic matter.
- F. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI Recommended Work Practices for the Removal of Resilient Floor Coverings.
- G. Partitions: Completely remove indicated interior partitions and interior finishes indicated. Leave adjacent work scheduled to remain sound and ready for new finishes with minimal required repair.
- H. Doors and Frames: Remove doors, frames, and hardware where indicated. Remove anchors, shims, trim, and attachments. Leave opening ready to receive new work. Remove from site.
- I. Cut existing masonry walls for new openings where indicated. Leave openings ready to receive new work or patching. Coordinate opening structural requirements with building structural engineer; see engineering survey of condition of building for temporary shoring requirements.
- J. Windows: Remove existing windows where indicated. Remove associated anchors, shims, blocking, operating devices, sealant, and trim. Cut back interior finishes required for plumb surface for patching. Leave openings ready for installation of new materials and finishes or to be infilled.
- K. Mechanical, Electrical, and Structural Elements: Where unanticipated mechanical, electrical, or structural elements conflicting with intended function or design are encountered, investigate and measure both nature and extent of the conflict.
 - 1. Submit written report to Architect in accurate detail. Pending receipt of directive, arrange selective demolition schedule as necessary to continue overall job progress without undue delay.
 - 2. HVAC Equipment: Refrigerants shall be removed by technician certified by an EPA-approved certification program.

3.7 REMOVAL OF STRUCTURAL ELEMENTS

- A. Foundation: Demolish foundation walls to a minimum depth of 12 inches (300mm) below existing ground surface. Demolish and remove below grade wood or metal construction. Break up below grade concrete slabs.
 - 1. Interior Slabs on Grade: Employ removal methods to prevent cracking or structurally disturbing adjacent slabs or partitions. Use power saw where possible.
 - 2. Completely fill below grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel, or sand, free of trash and debris, stones over 6 (150mm) inches in diameter, roots, or other organic matter.
- B. Pneumatic Operated Hammers: When possible, reduce use of pneumatic operated hammers. When necessary to use pneumatic tools, locate compressors as remote from occupied areas as possible.
 - 1. To break large pieces of concrete, isolate concrete from floor slabs and building structure to prevent structure borne vibration.
- C. Saw Cutting: Locate compressors as remote as possible from occupied areas of facility.
 - 1. Use diamond tipped saw blades and related equipment.
 - 2. Saw cut portions of walls and slabs. Angle saw blade at floors and corners to cut as closely as possible to desired location.
 - 3. Control runoff water used with saw to prevent damage to existing materials.

3.8 PATCHING AND REPAIRS

- A. Promptly repair damage to adjacent construction caused by selective demolition operations. Refinish construction or item to a condition comparable or better than before selective demolition operations or replace with new.
- B. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction to eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 - 3. Floors and Walls: Where walls or partitions are removed, extend one finished area into another, patch and repair floor and wall surfaces in new space. Provide even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - 4. Painted Surfaces: Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 - 5. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.
 - 6. Mechanical, Electrical, and Plumbing: Fit work airtight to pipes, sleeves, ducts, conduit and penetrations through surfaces.
 - 7. Fire Resistive Separations and Penetrations: Where fire rated separations are penetrated, fill space around pipe or insert with material complying with fire resistance requirements of penetrated surface. Refer to fireproofing and fire stopping requirements.
 - 8. Exterior Building Enclosure: Patch components and restore enclosure to a weathertight condition.
- C. Repairs: When necessary to repair to existing surfaces, patch to produce surfaces suitable for new materials.
 - 1. Fill holes and depressions in existing masonry walls to remain with masonry patching material applied according to manufacturer's written recommendations.
- D. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.
- E. Floors and Partitions: Where walls or partitions are demolished, extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - 1. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
 - 2. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
 - 3. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

- F. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

3.9 DISPOSAL OF DEMOLISHED MATERIALS

- A. Legally remove demolition waste materials from site and dispose in an EPA approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.

3.10 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.
- B. Remove partitions and temporary work. Restore surfaces to match adjacent surfaces.

END OF SECTION

SECTION 033100 – STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural Concrete.
2. Admixtures.
3. Curing and Treatment Requirements.
4. Floor flatness and levelness.
5. Formwork, shoring, bracing, and anchorage.
6. Concrete reinforcement and accessories.
7. Preparation of existing floor slabs for concrete overlay.
8. Concrete overlay.

B. Work Installed But Furnished Under Other Sections:

1. Section 05 12 00 – Structural Steel Framing: Anchor bolts cast into concrete.

C. Related Sections:

1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.

1.2 REFERENCES

A. Incorporated Guides and References:

1. American Concrete Institute (ACI):
 - a. ACI 302.1R – Guide for Concrete Floor and Slab Construction.
 - b. ACI 304R – Guide for Measuring, Mixing, Transporting and Placing Concrete.
 - c. ACI 304.2R - Placing Concrete by Pumping Methods.
 - d. ACI 305R - Hot Weather Concreting.
 - e. ACI 309R – Guide for the Consolidation of Concrete.
 - f. ACI 347 – Guide to Formwork for Concrete.
 - g. ACI SP-66 – ACI Detailing Manual.

B. Specifications:

1. American Concrete Institute (ACI):
 - a. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials.
 - b. ACI 301 - Specifications for Structural Concrete.

- c. ACI 303.1 – Specification for Cast-In-Place Architectural Concrete.
 - d. ACI 308.1 – Specification for Curing Concrete.
 - e. ACI 315 - Details and Detailing of Concrete Reinforcement.
 - f. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
2. ASTM International (ASTM):
- a. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - b. ASTM A704 – Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
 - c. ASTM A706 – Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
 - d. ASTM C33 – Standard Specification for Concrete Aggregates.
 - e. ASTM C94 – Standard Specification for Ready-Mixed Concrete.
 - f. ASTM C150 – Standard Specification for Portland Cement.
 - g. ASTM C171 – Standard Specification for Sheet Materials for Curing Concrete.
 - h. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.
 - i. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - j. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.
 - k. ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use in Concrete.
 - l. ASTM C989 – Standard Specification for Slag Cement for Use in Concrete and Mortars.
 - m. ASTM C1059 – Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.
 - n. ASTM C1116 – Standard Specification for Fiber-Reinforced Concrete.
 - o. ASTM C1602 – Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
 - p. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
 - q. ASTM E1155 – Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers.
 - r. ASTM E1643 – Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

1.3 SUBMITTALS

- A. Submit proposed mix design of each class of concrete to Engineer/Architect not later than 10 days after Notice to Proceed or 15 days prior to the first concrete placement, whichever comes first.
- B. Submit shop drawings of reinforcing steel under provisions of Division 01 – General Requirements.
 - 1. Initial submittal of reinforcement shop drawings shall be complete. No partial submittals will be accepted.

2. Indicate reinforcement sizes, spacings, locations and quantities of reinforcing steel, bending and cutting schedules, splicing, supporting and spacing devices.
3. Reinforcement placement shop drawings for foundations and walls shall conform to ACI SP-66 providing full wall elevations.

C. Material Certificates: For each of the following, signed by the manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Bonding agents.
5. Vapor retarders.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates.

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with ACI 301, 305R, and 306.1.
- B. Maintain copy of ACI 301 on site.
- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of local, state and federal rules and regulations applicable to Work and Project location.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Hot Weather Concreting

1. Placement and curing of concrete subject to a combination of (1) rising air temperature (generally greater than 75 degrees F) and (2) wind and low relative humidity shall be in accordance with ACI 305R.
2. Contractor shall provide plan for minimizing exposure of concrete to adverse conditions due to combinations of high air temperature, direct sunlight, drying winds, and high concrete temperature.
3. Protect concrete from rapid temperature drop.
4. Pre-wet subgrade and forms.

1.7 SLAB PRE-CONSTRUCTION MEETING

- A. At least 20 days prior to placing first concrete floor slab, Contractor shall hold a meeting to review detailed requirements for preparing final concrete design mixes and to establish procedures for placing, finishing, curing, and protecting concrete to meet required quality under anticipated conditions.
- B. Contractor shall request responsible representatives of each party concerned with concrete work to attend a meeting, including but not limited to the following:
 - 1. Contractor's Superintendent.
 - 2. Structural Engineer.
 - 3. Testing Laboratory responsible for field quality control.
 - 4. Concrete Subcontractor's Project Manager.
 - 5. Ready-mix Concrete Supplier.
 - 6. Concrete Pumping Equipment Supplier.
 - 7. Resident Project Representative.
 - 8. Architect.
- C. Minutes of the meeting shall be recorded, typed, reproduced and distributed by Contractor to all parties concerned within five working days of meeting.
- D. Minutes shall include a statement by admixture manufacturer(s) indicating that proposed mix design and placing can produce concrete quality required by this Section.
- E. Contractor shall notify Structural Engineer and Architect at least 10 days prior to scheduled date of meeting.

PART 2 – PRODUCTS

2.1 FORM MATERIALS

- A. Plywood Forms: Douglas Fir or Spruce-Pine-Fir species: Sound, undamaged sheets with clean true edges, exterior glue, facing material to provide finish specified.
- B. Lumber: Douglas Fir or Spruce species; construction grade or better; with grade stamp clearly visible.
- C. Preformed Steel Wall Forms: Minimum 16 gage thick, Vertically and horizontally matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and surface appearance.
- D. Tubular Column Type: Round, spirally wound laminated fiber material; inside surface treated with release agent.

- E. Form Ties For Exposed Surfaces: Plastic cone snap ties with 1-inch outside diameter by 1-inch (nominal) long cones, with no metal within 1-inch of concrete face after removal;
 - 1. Manufacturers:
 - a. Advance Concrete Formwork, Inc.
 - b. Dayton Superior.
 - c. Symons - A Dayton Superior Company.
 - d. Williams Form Engineering Corporation.
 - e. Substitutions: As approved by Engineer/Architect.

- F. Form Ties For Hidden Surfaces: Metal spreader type, removable to a depth of 1-inch from concrete face;
 - 1. Manufacturers:
 - a. Advance Concrete Formwork, Inc.
 - b. Dayton Superior.
 - c. Williams Form Engineering Corporation.
 - d. Substitutions: As approved by Engineer/Architect.
 - e. Contractor shall use formwork, form components and accessories provided by a single manufacturer. Intermixing of formwork, components and accessories shall not be allowed.

2.2 REINFORCING STEEL

- A. Reinforcing Steel: ASTM A615, 60 ksi yield grade carbon steel deformed bars; uncoated finish.
- B. Reinforcement Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire fabric, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete.

2.3 CONCRETE MATERIALS

- A. Cementitious Materials
 - 1. Portland Cement: ASTM C150, gray color, Type I except as specified below.
 - 2. Fly Ash: ASTM C618, Class C or F.
 - 3. Ground Granulated Blast Furnace Slag: ASTM C989, Grade 100 or 120.
- B. Fine and Coarse Aggregates: ASTM C33.
- C. Water: ASTM C1602, clean and not detrimental to concrete.

2.4 ADMIXTURES

- A. Admixtures to be used in the concrete mixture shall be submitted to the Engineer for approval as part of the mixture design.

- B. Chemical admixtures shall be in accordance with ASTM C494.
- C. Admixtures shall be used in accordance with manufacturer's written recommendations.
- D. Admixtures containing chlorides, sulfides, or nitrides are not permitted.
- E. Admixtures permitted shall be supplied by a single manufacturer for project.
- F. Air Entrainment Admixture: ASTM C260;
 - 1. Manufacturers:
 - a. Axim Italcementi Group.
 - b. BASF Admixtures, Inc.
 - c. Grace Construction Products.
 - d. The Euclid Chemical Company.
 - e. Substitutions: As approved by Engineer/Architect.
- G. Corrosion Inhibiting Admixtures:
 - 1. Manufacturers:
 - a. BASF – Master Builders – MasterLife C1222.
 - b. W. R. Grace & Co. – DCI S.
 - c. Sika Corporation – Sika Ferro Guard 901.
 - d. Substitutions: As approved by Engineer/Architect.

2.5 ACCESSORIES

- A. Vapor Retarder: ASTM E1745; Class C, 10 mil minimum thickness, water vapor permeance rating of 0.050 perms or less;
- B. Manufacturers:
 - a. Americover - Vapor Block VB 10.
 - b. Fortifiber - Moistop Ultra 10.
 - c. Stego Industries - Stego Wrap 10-mil.
 - d. W.R. Meadows - Perminator.
 - e. Substitutions: As approved by Engineer/Architect.
- C. Non-Shrink Grout: Premixed compound with non-metallic aggregate, cement, water reducing and plasticizing agents; capable of minimum compressive strength of 2400 psi.
- D. Joint Filler: ASTM D1751, Bituminous fiber, 1/2-inch wide by depth of concrete less 1/8-inch.
- E. Form Release Agent: Colorless material which will not stain concrete, absorb moisture or impair natural bonding or color characteristics of coating, intended for use on concrete;
 - 1. Manufacturers:
 - a. BASF Construction Chemicals, LLC - Building Systems: Castoff.
 - b. Dayton Superior - Clean Strip Ultra (J-3).
 - c. W.R. Meadows - Duogard.
 - d. Substitutions: As approved by Engineer/Architect.

- F. Concrete Surface Cleaning Compound;
 - 1. Manufacturers:
 - a. Dayton Superior – Citrus Cleaner J48.
 - b. Conspec – Conclean 5000.
 - c. Substitutions: As approved by Engineer/Architect.

- G. Bonding Agent: Concsive Liquid LPL as manufactured by Master Builders or Equal.

2.6 CURING AND TREATMENT MATERIALS

- A. Water: Potable and clean.

- B. Evaporation Reducer: Thin monomolecular film to reduce rapid moisture loss from the concrete surfaces prior to curing;
 - 1. Manufacturers:
 - a. BASF Admixtures, Inc. - Master Builders - Confilm.
 - b. Dayton Superior - Sure Film J-74.
 - c. W.R. Meadows - Evapre.
 - d. Substitutions: As approved by Engineer/Architect.

- C. Curing Compound (Dissipating Type): ASTM C309, Type I, free of oil, wax, or grease;
 - 1. Manufacturers:
 - a. Dayton Superior - Day-Chem Rez Cure (J-11-W).
 - b. The Euclid Chemical Company - Kurez DR VOX.
 - c. W.R. Meadows -Sealtight 1100 - Clear.
 - d. Substitutions: As approved by Engineer/Architect.

- D. Curing and Sealing Compound: ASTM C309; Type I free of oil, wax, or grease;
 - 1. Manufacturers:
 - a. BASF Building Systems, Inc. - Sonneborn Kure-N-Seal WB.
 - b. Dayton Superior - Safe Cure & Seal (J-18).
 - c. The Euclid Chemical Company - Aqua-Cure VOX.
 - d. W. R. Meadows - Sealtight - VOCOMP-20.
 - e. Substitutions: As approved by Engineer/Architect.

- E. Curing Compound (Exterior Use Only): ASTM C309; Type II white pigmented;
 - 1. Manufacturers:
 - a. ChemMasters - SafeCure 3000.
 - b. Dayton Superior - Day-Chem City White Cure (J-8).
 - c. W. R. Meadows - 1200 White Series.
 - d. Substitutions: As approved by Engineer/Architect.

- F. Liquid Hardener and Densifiers:
 - 1. Manufacturers:

- a. BASF Building Systems, Inc. - Sonneborn Kure-N-Harden.
 - b. Dayton Superior - Day-Chem Sure Hard (J-17).
 - c. The Euclid Chemical Company - Euco Diamond Hard.
 - d. W.R. Meadows - Liqui-Hard.
 - e. Substitutions: As approved by Engineer/Architect.
2. Hardeners and sealer used shall be of same manufacturer.
- G. Polyethylene Film: ASTM C171, 6 mil thick, clear.
- H. Curing Paper: ASTM C171;
1. Manufacturers:
 - a. Fortifiber - Orange Label Sisalkraft 280.
 - b. Substitutions: As approved by Engineer/Architect.
- I. Burlap shall be clean, evenly woven, free of encrusted concrete or other contaminating materials, and shall be reasonably free of cuts, tears, broken or missing areas.

2.7 CONCRETE MIXTURE

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture of field test data, or both, according to ACI 301.
- B. Mix concrete in accordance with ASTM C94.
- C. Concrete mix designs shall be designed and submitted in accordance with Division 01 and included as part of cost of this Work.
- D. Mix designs shall be prepared by a qualified agency acceptable to Engineer/Architect. Six (6) copies of mix designs shall be submitted for Engineer/Architect's review prior to placing any concrete.
- E. Mix design shall indicate brands, types, and quantities of admixtures included, compressive strength, slump, sieve analysis for fine and coarse aggregate, quantities of all ingredients, type and brand of cement, source of aggregate, whether fine aggregate is natural or manufactured.
- F. Design of mix shall assure placing and finishing characteristics that meet Project requirements.
- G. Mix designs contained in the Schedule of Mixes may be modified and submitted to Engineer for approval, by use of mid or high range water reducing admixtures to control slumps required for pumping of concrete. Strength, placing and finishing requirements shall be maintained.
- H. Concrete mixtures placed directly over vapor retarders shall be designed to have low shrinkage characteristics and designed to minimize slab curling.
- I. Initial and final set times of concrete mix designs shall be coordinated between the contractor and concrete supplier.

2.8 SCHEDULE OF MIXES

- A. Footings: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 4000 psi.
 2. Maximum Aggregate Size: 1-1/2 inches.
 3. Maximum Water-Cement Ratio: 0.50.
- B. Columns: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 4000 psi.
 2. Maximum Aggregate Size: 3/4 - inch.
 3. Corrosion Inhibiting Admixture: Include for exterior exposed columns.
- C. Beams, Joists, Structural Slabs: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 4000 psi.
 2. Maximum Aggregate Size: 3/4 - inch.
 3. Air Entrainment: A minimum of 4 percent air content is required with an acceptable range of air content being plus or minus 1.5 percent for exterior exposed walls.
 4. Corrosion Inhibiting Admixture: Include for exterior exposed beams, joists, and slabs.
- D. Foundation Walls, Grade Beams: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 4000 psi.
 2. Maximum Aggregate Size: 3/4 - inch.
 3. Air Entrainment: 6 percent air content is required with an acceptable air content of plus or minus 1.5 percent.
- E. Interior Slab-on-Ground, Equipment Pads: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 4000 psi.
 2. Maximum Aggregate Size: 3/4 - inch.
 3. Air Entrainment: A minimum of 4 percent air content is required with an acceptable range of air content of plus or minus 1.5 percent.
- F. Exterior Slab-on-Ground, Walks, Paving, Curbs, Equipment Pads: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 4000 psi.
 2. Maximum Aggregate Size: 3/4 - inch.
 3. Maximum Slump (Inch): 3
 4. Maximum Water-Cement Ratio: 0.50.
 5. Air Entrainment: A minimum of 4 percent air content is required with an acceptable range of air content of plus or minus 1.5 percent.

- G. Tapered Overlay Fill Slab 3-Inch and Thicker: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 4000 psi.
 2. Maximum Aggregate Size: 3/8 - inch.
 3. Maximum Slump (Inch): 3
 4. Maximum Water-Cement Ratio: 0.50.

PART 3 – EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits stated below.
- C. Verify lines, levels, and measurement before proceeding with formwork.
- D. Earth forms are not permitted.
- E. Align form joints.
- F. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.
- G. Provide chamfer strips for all exposed concrete corners of formwork.

3.2 REINFORCEMENT

- A. Place, support, and secure reinforcement against displacement.
- B. Locate reinforcing splices as shown on Drawings.

3.3 VAPOR RETARDERS

- A. Vapor retarders shall be provided where slabs will receive vapor-sensitive floor coverings or in humidity-controlled areas or as indicated on drawings.
 1. Install vapor retarders directly under concrete slab-on-ground at areas with vapor-sensitive floor coverings and where subgrade granular material is subject to future moisture infiltration.
 2. Where subgrade material is dry and will not be subject to future moisture infiltration and where humidity will be controlled, place the vapor retarder beneath the dry granular material and the concrete slab-on-ground directly on the dry granular material.

- B. Installation of Water Vapor Retarders shall be in accordance with ASTM E1643.
- C. Edges shall be lapped six (6) inches and sealed.
- D. Contractor is responsible for maintaining conditions to provide a dry subgrade material where the slab is cast on top of granular material.
- E. Contractor is responsible for maintaining a puncture free vapor retarder. Any punctures shall be sealed appropriately to prevent vapor transmission.
- F. Do not disturb vapor retarder while placing reinforcement.

3.4 PLACING CONCRETE

- A. Notify Engineer/Architect a minimum of 48 hours prior to commencement of concreting operations.
- B. Failure to notify Engineer/Architect may result in rejection of concrete placed without observation.
- C. Place concrete in accordance with ACI 301.
- D. Place pumped concrete in accordance with ACI 304.2R. Line coating mix to initiate pumping shall not be used in pour but shall be wasted.
- E. Ensure reinforcement and embedded items are not disturbed during concrete placement.
- F. Concrete with excessive honeycomb or embedded debris shall be rejected and replaced at no cost to OWNER.
- G. Application of surface retarders and sawcutting of joints shall be planned in advance.
- H. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures and mechanical injury.
- I. Placing During Hot Weather:
 - 1. Place concrete during hot weather conditions in accordance with ACI 305R.
- J. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.5 FLOOR SLABS

- A. Place floor slabs-on-ground with contraction and construction joints as indicated on Drawings.
- B. Saw cut contraction joints as soon as possible, without raveling, after placement of concrete, but within 24 hours.
- C. Cut slabs with 3/16-inch thick blade, cutting one-fourth depth of slab thickness.

- D. Separate slabs on fill from vertical surfaces with a joint filler.
- E. Extend joint filler from bottom of slab to within 1/8-inch of finished slab surface.
- F. Floor Finishes shall be in accordance with ACI 302.1R. Immediately after finishing, begin curing. See Finish and Cure Schedule.

3.6 FLOOR CURING AND TREATMENT

- A. Curing shall begin promptly to prevent drying of concrete. Curing shall continue for seven (7) days after placing.
- B. Curing methods shall not be changed until after the third day, and then only with written approval of the Engineer.
- C. Do not allow concrete to cool rapidly.
- D. Keep forms covered and moist during the first three (3) days of the curing period.
- E. Verify compatibility of floor treatment materials with mastics and finish materials to be applied to floor.
- F. Where floors are to be covered, apply one coat of dissipating curing compound, applied immediately after finishing.
- G. Where floors are not scheduled to be covered, apply two coats of curing and sealing compound, with first coat applied immediately after finishing and second coat just before final acceptance of building except where floor covering materials are to be applied.
- H. Provide a moist cure for a full seven (7) days through the use of burlap or curing paper kept continuously moist. Material shall completely cover the concrete surface and shall be weighted down to prevent shifting due to wind or other factors.
- I. Apply a non-slip aggregate to stair treads and landings, and ramps not scheduled to receive floor covering, in accordance with manufacturer's instructions, trowel to a hard finish, and treat surface with liquid hardener without sealer.

3.7 REPAIR OF VERTICAL SURFACE DEFECTS

- A. Upon stripping of forms, vertical surfaces shall be inspected for defects caused by surface air voids, honeycombing, form tie holes, peeling, and fins.
- B. Surface air voids shall be repaired with a unit packaged mixture of sand and cement mixed on job site with water and a unit of acrylic. Mixture shall be brushed uniformly on to surface and into voids. Where surface is to be exposed, surface finish of repair shall match adjacent surface.
- C. Honeycombed and other defective concrete shall be removed down to sound concrete and patched to match adjacent surfaces.

3.8 FINISHING OF FORMED SURFACES

- A. After removal of forms and repair of defects, surfaces of concrete shall be given finishes specified below.
- B. Rough Form Finish: Surface left with texture imparted by forms; form facing material not specified; tie holes and defects shall be patched; fins exceeding 1/4-inch shall be chipped or rubbed off.
- C. Tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed and shall be floated to a texture reasonably consistent with that of formed surface.
- D. Final finish on formed surfaces shall continue uniformly across unformed surfaces.

3.9 TOLERANCES

- A. All tolerances for concrete work shall be in accordance with ACI 117.
- B. Contractor shall employ construction techniques to provide the following tolerances:

	<u>Overall</u>		<u>Local Minimum</u>	
	FF	FL	FF	FL
Slab on Grade	25	17	20	15

- C. Contractor shall set forms consistent with and is solely responsible for meeting requirements of F-numbers specified above.
- D. Testing:
 - 1. Floor tolerances will be tested by an independent testing agency paid for by Owner. Testing will be performed under provisions of Division 01.
 - 2. Contractor shall conduct its own F-number tests within 24 hours of placing each slab section to determine adequacy of placing operations.
 - 3. F-Number testing for elevated slabs shall be conducted prior to removal of forms.
 - 4. All tests performed shall conform to ASTM E1155. Equipment to be used for testing shall be dipstick.
- E. All floors not conforming to these requirements shall be corrected by replacement or other methods approved by Engineer/Architect.

3.10 FIELD QUALITY CONTROL

- A. Testing and analysis of concrete shall be performed under provisions of Division 01.
- B. Testing firm will cast test cylinders and perform slump and air entrainment tests in accordance with ACI 301.

- C. Three concrete test cylinders shall be cast from each increment of 100 cubic yards of each class of concrete placed each day or from each placement of each class if less than 100 cubic yards.
- D. During hot or cold weather, as defined in Section 1.6, one additional test cylinder shall be cast from each increment of 100 cubic yards of each class of concrete placed each day or from each pour of each class if less than 100 cubic yards and be cured on site under same conditions as concrete it represents.
- E. One slump test, air entrainment test, and temperature record are to be taken for each set of tests cylinders cast and additional slump tests are to be taken whenever consistency of concrete appears to vary.
- F. No water may be added to the concrete at the site unless pre-approved in writing by the Engineer for that specific mix. If pre-approved, the mix ticket must state how much water may be added.

3.11 PREPARATION OF EXISTING WORK

- A. Drill holes in existing concrete, insert steel dowels and pack with non-shrink grout where new concrete is doweled to existing concrete work.
- B. Prior to placement of new concrete clean with steel brush and apply bonding agent in accordance with manufacturer's instructions.

3.12 PREPARATION FOR TOPPING SLAB

- A. For Areas to Receive Concrete Overlay:
 - 1. Power wash and clean using degreaser.
 - 2. Scarify existing floor slab to 1/2 inch below existing surface by Hydro-demolition method where overlay is to be 1/2 inch or less above existing surfaces.
- B. Shotblast concrete floor slab to a 1/8-inch minimum profile.
- C. Perform testing for oil/chemical contamination.
 - 1. Sprinkle water on slab surface and observe absorption rate. Contaminated surfaces will not absorb the water.
 - 2. If water testing is not conclusive, apply small drops of diluted muriatic acid (7 percent to 10 percent solution). If acid does not immediately etch the slab, then surface is contaminated.
 - 3. All contaminated surfaces and dark colored questionable areas will receive additional bonding treatment and an additional treatment of bonding agent as specified in Article 3.12 below.
- D. Perform the following steps in all contaminated and dark colored, questionable areas:
 - 1. Shotblast these areas a second time.

2. Apply bonding agent (20 mils + 4 mils) within 24 hours of shotblasting or before oil has migrated to surface of the slab.
3. Broadcast oven-dried coarse silica sand into the bond coat to rejection.
4. Remove excess sand.
5. Vacuum up any concrete dust or dirt from anchoring procedure.

3.13 CONCRETE TOPPING PLACEMENT

- A. Notify Engineer a minimum of 24 hours prior to placing concrete.
- B. Verify floor is clean and ready to accept bonding agent. Areas not clean shall be reshotblasted.
- C. For areas thicker than 3 inches, apply 20 mils + 4 mils of bonding agent over entire areas that will receive concrete topping. This final application of bonding agent must be installed within 24 hours after the contaminated area bonding agent application (see Article 3.11, paragraph C.3 above).
- D. For areas less than 3 inches, apply a scrub coat of SikaTop 122 Plus in accordance with manufacturer's recommendations.
- E. Install concrete topping slab within 2-1/2 hours of the final bonding agent application. For areas 3 inches and thicker, use Mix H, for areas less than 3 inches, use Mix I in accordance with manufacturer's instructions.
- F. Use square tipped shovels or come-alongs to move concrete into place. Do not use insertion type vibrators to move concrete horizontally.
- G. Use a vibratory screed for striking off topping slab.
- H. Level and consolidate with wood bull floats or with a highway straight edge before bleed water rises to the surface.
- I. Use evaporative reducer on freshly screeded surface when environmental conditions dictate.

3.14 FINISH AND CURE SCHEDULE

CLASS	TYPE OF FINISH	AREA DESIGNATION	TYPE OF CURE
2	Single troweling; non-slip finish where required	Stair Treads; Interior Slabs-on-Grade: Office	Curing Compound
3	Float, trowel or broom finish	Exterior Slabs-on-Grade Footings-on-Grade	Curing Compound
4	Normal steel trowel finish	Interior Slabs-on-Grade: Screening room	Curing Compound

END OF SECTION 033100

SECTION 03 39 00 - CONCRETE SEALER

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Application of curing, sealing, and hardening compounds to concrete flooring.

1.2 ACTION SUBMITTALS

- A. Product Data: Submit technical data including manufacturer's specifications, application instructions, and recommendations. Include data substantiating product complies with requirements of the contract documents.

1.3 QUALITY ASSURANCE

- A. Applicator Qualifications: Entity having minimum 5 years documented experience who is acceptable to manufacturer and employs applicators trained in the specified system.
- B. Mockups: Build mockups to verify selections and to demonstrate typical joints, surface finish, tolerances, and standard of workmanship.
1. Existing Concrete: Build mockups approximately 100 sq. ft. (9.3 sq. m) in the location directed by Architect.
 2. If Architect determines that mockups do not meet requirements, demolish, and remove them from the site and cast others until mockups are approved.
 3. Apply curing compound and allow to dry completely. Perform peel test in presence of Architect and manufacturer's representative to determine bond strength.
 4. If bond fails, determine cause of failure, correct deficiency, and repeat peel test until recommended bond is attained.
- C. Preinstallation Conference: Conduct conference at site.

1.4 COORDINATION

- A. Coordinate work with concrete curing. Do not use combination curing and hardening materials.
1. Use curing and sealing compounds for finish applications.
 2. Do not use curing and sealing compounds for concrete curing.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with concrete sealer manufacturer's written instructions for substrate temperature, ambient temperature, humidity, ventilation, and conditions affecting application.
- Apply concrete sealer when substrate temperature and surrounding air temperatures are between 50 degrees F and 95 degrees F (10 degrees F and 35 degrees C).
1. Do not apply concrete sealer in rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original, unopened packages. Protect from freezing, direct sun exposure and exposure to moisture.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. VOC Content: Provide products that comply with the following limits, when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Concrete Curing Compounds: VOC content of not more than 350 g/L.
 2. Concrete and Masonry Sealers: VOC content of not more than 700 g/L.
- B. Curing Compound - Type 1: Clear, Waterborne, Membrane Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
1. Subject to compliance with requirements, provide one of the following:
 - a. Euclid Chemical Company (The), an RPM company; Kurez DR VOX.
 - b. Laticrete.; L&M Cure R.
 - c. Meadows, W. R., Inc.; 1100.
 - d. NoxCrete; Res-Cure.
- C. Curing and Sealing Compound - Type 2:
1. Clear, Solvent Borne, Membrane Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
 - a. Subject to compliance with requirements, provide one of the following:
 - 1) BASF Construction Chemicals - Building Systems; MasterKure CC 250 SB.
 - 2) Euclid Chemical Company (The), an RPM company; Super Diamond Clear.
 - 3) Laticrete International; L&M Lumiseal Plus.
 - 4) Meadows, W. R., Inc.; CS-309-30.
- D. Hardener and Sealer - Type 3: Clear, inorganic silicate or silicate materials or magnesium siliofluoride and proprietary components that chemically reacts with alkaline; odorless; that penetrates, hardens, and densifies concrete surfaces.
1. Subject to compliance with requirements, provide one of the following:
 - a. BASF Construction Chemicals - Building Systems; MasterKure HD 300WB.
 - b. Euclid Chemical Company (The), an RPM company; Surfhard.
 - c. Laticrete International; L&M Lion Hard.
 - d. Meadows, W.R., Inc.; Liqui-Hard.
 - e. NoxCrete; Duro-Nox LSC.
- E. Hardener and Sealer - Type 4:
1. Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
 2. Subject to compliance with requirements, provide one of the following:
 - a. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
 - b. Laticrete International, L&M Chem Hard.
 - c. NoxCrete; Duro-Nox LSC.

- F. Polyurethane Sealer - Type 5: Nonpenetrating, nonyellowing, two component aliphatic polyurethane sealer, providing a glossy, durable surface with abrasion and chemical resistant properties.
 - 1. Subject to compliance with requirements, provide the following:
 - a. Euclid Chemical Company (The), an RPM company; Euco Tammoshield
- G. Grout: Nonshrink, nonmetallic grout recommended by sealer manufacturer.
- H. Concrete Cleaner: Recommended by compound manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for conditions affecting performance and conditions of floor treatment.
 - 1. Verify new concrete has obtained achieve strength required by Section 03 30 00.
 - 2. Verify compatibility with and suitability of substrates, including existing finishes or primers.
 - 3. Verify plasticizers in existing concrete substrate will not impair bond.
 - 4. Proceed with installation after correcting unsatisfactory conditions

3.2 PREPARATION

- A. Clean substrate, removing projections and substances detrimental to the work; comply with recommendations of manufacturer of products to be installed for proper preparation procedures. Mask off or protect adjacent surfaces not scheduled to receive sealer.
- B. Remove residue and curing compounds with cleaner recommended by sealer manufacturer with a bristle brush or broom or mechanically abrade concrete surface to a uniform profile complying with ASTM D 4259. Do not acid etch.
- C. Patch holes in existing concrete slabs with grout recommended by sealer manufacturer.
- D. Protect adjacent surface from splatter in accordance with sealer manufacturer's written instructions.

3.3 APPLICATION

- A. Curing Compound: Apply uniformly in continuous operation by power spray or roller complying with manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - 1. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
- B. Curing and Sealing Compounds: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller complying with manufacturer's written instructions. Repeat process 24 hours later and apply a second coat.

- C. Penetrating Sealer: Spray apply sealer to comply with manufacturer's instructions except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.
 - 1. Apply sealer to produce surface without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or surface imperfections. Produce sharp glass lines and color breaks. Do not permit sealer to pond and dry on concrete surface. Squeegee ponding sealer to spread.

3.4 CLEANING

- A. After completing application, clean spattered surfaces. Remove spattered sealer by washing or other appropriate methods for coating. Do not scratch or damage adjacent finished surfaces.
- B. Clean Up: Remove rubbish, empty cans, rags, and discarded materials from site daily. Rinse and recycle or legally dispose of sealer and coating containers.

3.5 PROTECTION

- A. Institute protective procedures and install protective materials as required to ensure that work of this section will be without damage or deterioration at substantial completion.

3.6 FLOOR SEALER SCHEDULE

- A. Curing Compound, Type 1: Provide at new concrete floor slabs, unless moisture curing is specified in Section 03 30 00.
- B. Curing and Sealing Compound, Type 2: Provide at existing exposed floor slabs in rooms where no other finished flooring products are scheduled such as storage rooms, closets, mechanical/electrical/plumbing closets, and similar spaces.
- C. Penetrating Sealer and Hardener, Type 3: Provide at janitor closets, mechanical/electrical rooms, under access floors at baggage handling area floors, industrial floors, commercial garages, and similar spaces.
- D. Chemically Reactive Hardener and Sealer - Type 4:

END OF SECTION

SECTION 042200 – CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Section Includes: Concrete masonry units, accessories, and cleaning agents.
- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
- C. Products Installed But Not Furnished Under This Section: Pre-fabricated items to be built into concrete unit masonry construction.

1.2 REFERENCES

- A. American Concrete Institute; American Society of Civil Engineers; The Masonry Society:
 - 1. ACI 530/ASCE 5/TMS 402: Building Code Requirements for Masonry Structures.
 - 2. ACI 530.1/ASCE 6/TMS 602: Specifications for Masonry Structures.
- B. American Society for Testing and Materials:
 - 1. ASTM C 33 - Concrete Aggregates.
 - 2. ASTM C 90 - Hollow Load-Bearing Concrete Masonry Units.
 - 3. ASTM C 129 - Non-Load-Bearing Concrete Masonry Units.
 - 4. ASTM C 150 - Portland Cement.
- C. International Masonry Institute All-Weather Council: Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.
- D. Masonry Advisory Council: Hot and Cold Weather Construction.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's descriptive literature, specifications, installation instructions and application procedures.
- B. Certificates: Submit manufacturer's certificates and acceptable laboratory test reports attesting that materials furnished meet specified requirements.
- C. Reinforcing: Submit placement drawings and bar lists for vertical and horizontal reinforcing bars for load bearing masonry.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 530 Building Code Requirements for Masonry Structures and ACI 530.1 Specification for Masonry Structures.
- B. Fire Resistance Rated Masonry: UL listed and certified that fire-rated masonry materials have been manufactured in compliance with the governing codes in regard to face shell and aggregate for the rating shown on the drawings

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver masonry materials to project in undamaged condition.
- B. Store and handle masonry units off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes; segregate various fire-rated units from each other and from other non-rated units. Maintain clear indication of rating of the stored units for easy identification and selection. If units become wet, do not place until units are in an air-dried condition.

1.6 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. Cold Weather Protection: When temperature of outside air is below 40 degrees F, pre-condition material and finish work in accordance with "Recommended Practices and Guide Specifications for Cold Weather Masonry Construction", as published by International Masonry Industry All-Weather Council.
 - 2. Hot Weather Protection: Protect masonry construction from direct exposure to wind and sun when erected in ambient air temperature of 99 degrees F in shade with relative humidity less than 50 percent in accordance with Hot and Cold Weather Construction as published by Masonry Advisory Council.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide square-edged units for outside corners unless otherwise indicated.
- B. CMUs: ASTM C 90.
 - 1. Provide lightweight, medium weight, or normal weight units at Contractor's option.
 - 2. Nominal face dimensions: 4", 6", and 8" high x 16" long, unless otherwise noted.
 - 3. Provide standard and fire-rated units.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine foundation to ensure surfaces to support masonry are proper grade and elevation, and free from dirt or other deleterious matter.
- B. Verify items built-in by other trades are properly located and sized.
- C. Verify items to be built-in under this Section are fabricated correctly and readily available at project site.

3.2 PREPARATION

- A. Concrete Masonry Units:
 - 1. Lay only dry units, free of paint, oil, efflorescence or foreign matter.
 - 2. Remove laitance, loose aggregate or anything that prevents bonding to foundation.
- B. Use masonry saws to cut concrete masonry units.
- C. Establish lines, levels and coursing. Protect layout aids from disturbance.

3.3 INSTALLATION

- A. Pattern Bond: Running bond with vertical joints located at centerline of masonry units in alternate courses.
- B. General Requirements:
 - 1. Set units plumb, true to line and with level courses accurately spaced within allowed
 - 2. tolerances.
 - 3. Do not install cracked, broken or chipped masonry units exceeding ASTM C 90 allowable
 - 4. requirements.
 - 5. Adjust masonry unit to final position while mortar is soft and plastic.
 - 6. Where adjustment must be made or if units are displaced after mortar has stiffened, remove units, clean joints and units of mortar, and replace with fresh mortar.
 - 7. Do not pound corners and jambs to fit stretcher units after they are set in position.
 - 8. Adjust shelf angles to keep masonry level and at proper elevation.
 - 9. Provide pressure relieving joints by placing continuous 1/8" foam pad under shelf angle.
- C. Mortar Beds:
 - 1. Hollow units:
 - a. Lay with full mortar coverage on horizontal and vertical face shells.
 - b. Provide full mortar coverage on horizontal and vertical face shells and webs where adjacent to cells or cavities to be filled with grout.
 - c. Use concrete block for fill-in material.
 - 2. Solid units:
 - a. Lay with completely filled mortar joints.
 - b. Do not furrow bed joints.

- c. Butter ends of solid units with sufficient mortar to fill head joints.
 - d. Rock closures into place with head joints thrown against two adjacent units in place.
- D. Horizontal and Vertical Face Joints:
- 1. Construct uniform joints, 3/8" nominal thickness.
 - 2. Tool concave joints in exposed surfaces when thumb-print hard with round jointed slightly larger than width of joint.
 - 3. Flush cut joints not exposed.
 - 4. Remove mortar protruding into cells of cavities to be filled with grout.
 - 5. Fill horizontal joints between top of non-loadbearing masonry partitions and underside of beams or slabs with flexible material.
- E. Control Joints:
- 1. Keep clean of mortar and debris.
 - 2. Install where indicated and at following exterior and interior locations:
 - a. Changes in thickness, height or direction.
 - b. Within 4'-0" of corners or offsets.
 - c. At control or expansion joints in structure.
 - d. Place control joints at foundation walls, shelf angles, setbacks and materials expanding at different ratios.
 - e. Space joints at 30'-0" on center maximum in uninterrupted walls.
 - f. Offset control joints to ends of lintels.
- F. Collar Joints:
- 1. Keep cavity within cavity walls clean.
 - 2. Remove protruding mortar fins in cavity to be grouted.
- G. Joining of Work:
- 1. When joining fresh masonry to set or partially set masonry construction, remove loose units and mortar, and clean exposed surface of set masonry prior to laying fresh masonry.
 - 2. If necessary to stop off horizontal runs of masonry, rack back one-half block length in each course.
 - 3. DO not use toothing to join new masonry to set or partially set masonry.
- H. Bond Beams:
- 1. Provide CMU bond beams at top of CMU walls and lintels above door openings.
 - 2. Reinforce bond beams with minimum two bars and grout.
 - 3. Discontinue bond beams at expansion joints; maintain minimum 8" bearing each side of opening.
 - 4. Place and consolidate concrete without disturbing reinforcing.
 - 5. Allow lintels to reach maximum strength before removing temporary supports.
 - 6. Bond beam shall be trough tile blocks, "Knock Out" bond beams are not acceptable.
- I. Built-In Work:
- 1. Install built-in items including bolts, anchors, expansion joints, inserts, frames, flashing and other items as masonry work progresses.
 - 2. Apply compatible sealant or self-adhered sheet membrane strip, as recommended by air barrier manufacturer, behind masonry anchors to seal penetrations made by fasteners through sheathing.
 - 3. Avoid cutting and patching.
 - 4. Solidly grout spaces around built-in items.

5. Build chases in; do not cut in.
6. Built-in items to be plumb to planes of wall.
7. Grout solid hollow metal door frames.

J. Reinforced Masonry Grouting:

1. Do not place mortar under block cores at first course to allow grout to come in contact with slabs.
2. Stack wall not more than 5'-0" for each lift.
3. Grout cores.
4. If grouting is to be stopped for more than one hour, stop grout 1-1/2" from top block.
5. Build second lift and grout.
6. Filling cores with mortar as work progresses is not permitted.

K. Pointing:

1. At completion of conventional masonry unit work, fill holes in joints and tool.
2. Cut out and repoint defective joints.
3. Dry brush masonry surface after mortar has set at end of each days work and after final pointing.

3.4 ALLOWABLE TOLERANCES

A. Maximum Variation from Plumb:

1. Vertical lines and surfaces of columns and walls: 1/4" in 10'-0"; 3/8" in any story or 20'-0" maximum and 1/2" in 40'-0".
2. External corners or control joints: 1/4" in any one story or 20'-0" maximum; 1/2" in 40'-0".

B. Maximum Variation from Level or Grades for Exposed Lintels, Sill, Parapets, or Horizontal Grooves: 1/4" on any bay or 20'-0"; 1/2" in 40'-0".

C. Maximum Variation from Plan Location of Linear Building Line or Related Portions of Columns, Walls and Partitions: 1/2" in any bay or 20'-0"; 3/4" in 40'-0".

D. Maximum Variation in Cross-Sectional Dimensions of Columns and Thicknesses of Walls: 1/4", +1/2".

3.5 FIELD QUALITY CONTROL

A. Reinforced Masonry Testing and Inspections - A qualified independent testing agency shall provide testing and inspection of structural masonry construction as follows:

1. Certificates for materials.
 - a. Submit certificates for mortar, grout, and masonry units indicating compliance with minimum material requirements.
2. Testing
 - a. Test grout for compressive strength per ASTM C 1019.
 - 1) Prior to start of construction, build and test three grout prisms in accordance with ASTM C 1019.
 - 2) with ASTM C 1019.
 - 3) Prepare additional sets of three prisms for each 5,000 square feet of wall area and test in accordance with ASTM C 1019.

- b. Test prism assemblies for determining the combined compressive strength of masonry walls in accordance with ASTM C 1314.
 - 1) Prior to start of construction, build and test three masonry prisms in accordance with ASTM C 1314.
 - 2) Prepare additional sets of three prisms for each 5,000 square feet of wall area and test in accordance with ASTM C 1314. Not required at locations of standard
 - 3) inspection.
- 3. Inspections
 - a. Structural Inspection
 - 1) Structural inspection is required at locations of load bearing walls taller than 20 feet. Inspection shall occur prior to placing grout in reinforced or unreinforced cells and continuously during grouting operations. Inspections shall include reinforcing size and layout, lapped splices of reinforcement, condition of cells prior to grouting, grout placement procedures, and construction of mortar joints.
 - b. Standard Inspection
 - 1) At locations other than those requiring structural inspection, the testing agency shall observe and report on placement of masonry units, placement of reinforcing, condition of grout space, immediately prior to closing of cleanouts and during grouting operations.
 - 2) Standard Inspection shall occur prior to the first grouting operation and continue at random grouting operations. A minimum of 25% of the grouting operations shall have standard inspection.
- 4. Retesting of materials and components failing to meet specified requirements shall be done at no cost to the Owner.
- 5. See Section 01 45 29, Testing Laboratory Services, for additional requirements.

3.6 CLEANING

- A. Clean initially with stiff brushes and clean water.
- B. When cleaning agent is required, apply cleaning agent to sample wall area of 20 square feet.
 - 1. Do not proceed with cleaning until sample area is reviewed by Engineer.
 - 2. Scrub with acceptable cleaning agent and immediately rinse with clear water.
 - 3. Do small sections at a time, working from top to bottom.
 - 4. Protect sash, metal lintels and other corrosive parts when masonry is cleaned with acidic solution.
- C. Leave area and surfaces clean and free of mortar spots, droppings and broken masonry.

3.7 PROTECTION OF SURFACES

- A. Cover partially completed walls when work is not in progress with nonstaining waterproof covering.
- B. Extend cover minimum 24" down both sides and securely anchor in place.
- C. After masonry work is complete, protect top of wall until cap or coping and flashing is in place.

- D. Load Application:
 - 1. Do not apply uniform floor or roof loading for at least 12 hours after building masonry columns or walls.
 - 2. Do not apply concentrated loads for at least three days after building columns or walls.
- E. Protect door jambs and corners from damage during construction.
- F. Prevent grout or mortar from staining face of masonry to be left exposed or painted.
- G. Protect sills, ledges and projections from droppings of mortar or other damage during construction.
- H. Remove misplaced grout or mortar immediately.

END OF SECTION 042200

SECTION 04 72 00 - CAST STONE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cast stone trim.
 - a. Pilaster caps.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data to indicate performance, fabrication procedures, product variations, and each type of accessories, including construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.
 - 1. Include building elevations showing layout of units and locations of joints and anchors.
- C. Samples: Submit for each color and texture of cast stone required, 10 inches (250 mm) square in size.
 - 1. Make samples available for Architect's review at project site.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit data for manufacturer.
 - 1. Submit copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C1364.
- B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C1364, including test for resistance to freezing and thawing.
 - 1. Provide test reports based on testing within previous two years.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer of cast stone units having minimum 10 years documented experience, that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute, the Architectural Precast Association, or the Precast/Prestressed Concrete Institute for Group A, Category AT.
- B. Source Limitations for Cast Stone: Obtain cast stone units from single source from single manufacturer.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.
- D. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.
- E. Preinstallation Conference: Conduct conference at site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Coordinate delivery of cast stone to avoid delaying the work.
- B. Pack, handle, and ship cast stone units in suitable packs or pallets.
 - 1. Lift with wide belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units if required, using dollies with wood supports.
 - 2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store mortar aggregates where grading and required characteristics are maintained and contamination is avoided.

1.6 FIELD CONDITIONS

- A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed stone masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.
- B. Stain Prevention: Immediately remove mortar and soil to prevent from staining stone masonry face.
 - 1. Protect base of walls from rain splashed mud and mortar splatter using coverings spread on the ground and over the wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at end of each day to prevent rain from splashing mortar and dirt on completed stone masonry.
- C. Hot Weather Requirements: Comply with hot weather construction requirements in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 CAST STONE MATERIALS

- A. Cast Stone: Comply with ASTM C1364.
- B. Portland Cement: ASTM C150/C150M, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C114. Provide natural color or white cement as required to produce cast-stone color indicated.
- C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C33/C33M; gradation and colors as needed to produce required cast stone textures and colors.
- D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C33/C33M, gradation and colors as needed to produce required cast-stone textures and colors.

- E. Color Pigment: ASTM C979/C979M, synthetic mineral oxide pigments or colored water reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
- F. Admixtures: Use admixtures specified or approved in writing by Architect.
 - 1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
 - 2. Use admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
 - 3. Water Reducing Admixture: ASTM C494/C494M, Type A.
 - 4. Water Reducing, Retarding Admixture: ASTM C494/C494M, Type D.
 - 5. Water Reducing, Accelerating Admixture: ASTM C494/C494M, Type E.
- G. Reinforcement: Deformed steel bars complying with ASTM A615/A615M, Grade 60 (Grade 420). Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches (38 mm) of cast-stone material.
 - 1. Epoxy Coating: ASTM A775/A775M.

2.2 CAST STONE UNITS

- A. Cast Stone Units: Comply with ASTM C1364.
 - 1. Manufacture Method: Vibrant dry tamp method.
 - 2. Compressive Strength: ASTM C1194; Minimum 6500 psi at 28 days.
 - 3. Absorption Strength: ASTM C 1195, Less than 6 percent at 29 days.
- B. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
 - 1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
 - 2. Provide drips on projecting elements unless otherwise indicated.
- C. Fabrication Tolerances:
 - 1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch (3 mm).
 - 2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch (3 mm), whichever is greater, but in no case by more than 1/4 inch (6 mm).
 - 3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch (3 mm), whichever is greater.
 - 4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch (3 mm) on formed surfaces of units and 3/8 inch (10 mm) on unformed surfaces.
- D. Curing Units:
 - 1. Cure units in enclosed, moist curing room at 95 percent to 100 percent relative humidity and temperature of 100 degrees F (38 degrees C) for 12 hours or 70 degrees F (21 degrees C) for 16 hours.
 - 2. Keep units damp and continue curing to comply with one of the following:
 - a. No fewer than five days at mean daily temperature of 70 degrees F (21 degrees C) or above.
 - b. No fewer than six days at mean daily temperature of 60 degrees F (16 degrees C) or above.
 - c. No fewer than seven days at mean daily temperature of 50 degrees F (10 degrees C) or above.

- d. No fewer than eight days at mean daily temperature of 45 degrees F (7 degrees C) or above.
 - E. Acid etch units after curing to remove cement film from surfaces to be exposed to view.
 - F. Colors and Textures: Selected by Architect, to match existing.
- 2.3 MORTAR MATERIALS
- A. Provide mortar materials that comply with Section 04 22 00.
 - B. Water: Potable.
- 2.4 ACCESSORIES
- A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A240/A240M, ASTM A276, or ASTM A666.
 - B. Dowels: 1/2-inch (12 mm) diameter round bars, fabricated from Type 304 stainless steel complying with ASTM A240/A240M, ASTM A276, or ASTM A666.
 - C. Proprietary Acidic Cleaner: Standard strength cleaner designed for removing mortar/grout stains, efflorescence, and new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cast stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Diedrich Technologies, Inc.; a Hohmann & Barnard company.
 - b. EaCo Chem, Inc.
 - c. PROSOCO, Inc.
- 2.5 MORTAR MIXES
- A. Comply with requirements in Section 04 22 00 for mortar mixes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and conditions affecting performance of the work.
- B. Proceed with installation after correcting unsatisfactory conditions.

3.2 SETTING CAST STONE IN MORTAR

- A. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.
 - 1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
 - 2. Coordinate installation of cast stone with installation of flashing specified.
- B. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

- C. Set units in full bed of mortar with full head joints unless otherwise indicated.
 - 1. Set units with joints to match width of existing.
 - 2. Build anchors and ties into mortar joints as units are set.
 - 3. Fill dowel holes and anchor slots with mortar.
 - 4. Build concealed flashing into mortar joints as units are set.
 - 5. Keep head joints in copings and between other units with exposed horizontal surfaces open to receive sealant.
- D. Rake out joints for pointing with mortar to depths of not less than 3/4 inch (19 mm). Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.
- E. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch (10 mm). Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
- F. Tool exposed joints slightly concave when thumbprint hard. Use a smooth plastic jointer larger than joint thickness.
- G. Rake out joints for pointing with sealant to depths of not less than 3/4 inch (19 mm). Scrub faces of units to remove excess mortar as joints are raked.
- H. Point joints with sealant to comply with applicable requirements in Section 07 92 00.
 - 1. Prime cast-stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

3.3 SETTING ANCHORED CAST STONE WITH SEALANT FILLED JOINTS

- A. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.
 - 1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
 - 2. Shim and adjust anchors, supports, and accessories to set cast stone in locations indicated with uniform joints.
- B. Keep cavities open where unfilled space is indicated between back of cast stone units and backup wall; do not fill cavities with mortar or grout.
- C. Keep joints free of mortar and other rigid materials. Remove temporary shims and spacers from joints after anchors and supports are secured in place and cast-stone units are anchored. Do not begin sealant installation until temporary shims and spacers are removed.
 - 1. Form open joint of width indicated, but not less than 3/8 inch (10 mm).
- D. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
- E. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200.

3.4 INSTALLATION TOLERANCES

- A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12 mm) maximum.

- B. Variation from Level: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12 mm) maximum.
- C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches (3 mm in 900 mm) or one-fourth of nominal joint width, whichever is less.
- D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch (1.5 mm), except where variation is due to warpage of units within tolerances specified.

3.5 ADJUSTING AND CLEANING

- A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.
- B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean cast stone as work progresses.
 - 1. Remove mortar fins and smears before tooling joints.
 - 2. Remove excess sealant immediately, including spills, smears, and spatter.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
 - 3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
 - 5. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION

SECTION 051200 – STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
1. Record Drawings.
 2. Record Product Data.

1.2 SUMMARY

- A. Section Includes:
1. Fabrication, transportation, delivery, and erection of structural steel.
 2. Structural steel, framing members, support members, struts, bracing, sag rods, purlins, welds, and fasteners.
 3. Base plates, anchor rods, bearing plates, and weld plates.
 4. Inserts for steel work.
 5. Non-shrink grout under base plates.
 6. Cutting, fitting, removal, and revision to existing structural framing and connections in order to fit new work to existing.
- B. Products Supplied But Not Installed Under This Section:
1. Section 03 31 00 – Structural Concrete: Non-shrink grout under base plates and anchors for casting into concrete.
- C. Related Sections:
1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
 2. Section 05 31 13 - Steel Floor Decking: Support framing for small openings in floor deck.
 3. Section 05 31 23 - Steel Roof Decking: Support framing for small openings in roof deck.
 4. Division 07 - Thermal and Moisture Protection and Section 07 81 00 – Applied Fireproofing: Fireproofing.

1.3 REFERENCES

- A. ASTM International (ASTM):
1. ASTM A36 - Standard Specification for Carbon Structural Steel.
 2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 3. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
 4. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.

5. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
6. ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
7. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
8. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
9. ASTM A563 – Standard Specification for Carbons and Alloy Steel Nuts.
10. ASTM A673 – Standard Specification for Sampling Procedure for Impact Testing of Structural Steel.
11. ASTM A992 - Standard Specification for Structural Steel Shapes.
12. ASTM F436 – Standard Specification for Hardened Steel Washers.
13. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

B. American Welding Society (AWS):

1. AWS A2.0 - Standard Welding Symbols.
2. AWS D1.1 - Structural Welding Code.

C. American Institute of Steel Construction, Inc (AISC):

1. AISC – Steel Construction Manual, Current Edition.
2. AISC - Code of Standard Practice for Steel Buildings and Bridges.
3. AISC - Specification for Architectural Exposed Structural Steel.

D. Research Council on Structural Connections (RCSC):

1. RCSC - Specification for Structural Joints Using ASTM A325 or A490 Bolts.

E. The Society for Protective Coatings (SSPC):

1. Volume 1 – Good Painting Practices, Current Edition.
2. Volume 2 – Systems and Specifications.

1.4 SUBMITTALS

A. Division 01 – General Requirements: Submittal Procedures.

B. Shop and Erection Drawings:

1. Indicate profiles, sizes, spacing, and locations of structural members, openings, attachments, and fasteners.

C. Show all connections. Connections shall be designed and drawings and calculations shall be Stamped/Sealed by the Professional Engineer, registered in State of Florida, who is responsible for connection design.

1. Show cambers and loads.
2. Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths.
3. Indicate cleaning and painting specifications.
4. Assume responsibility for dimensional errors.
5. Field verify dimensions affected by existing construction prior to submitting Shop Drawings and so note verified dimensions on shop drawings.

6. Field verify existing anchor bolt placements and modify base plates to accommodate field conditions.
 7. Fabricator shall check shop drawings before Submittal.
- D. Shop drawings which include the following shall have been prepared under supervision of a Professional Engineer registered in the State of Florida:
1. Calculations, connection drawings, job standards, and any other items that are performance specified or designed by Contractor's engineer.
 2. Provide holes for installation of other work.
 3. Any omission from shop drawings of any materials required by Contract Documents shall not relieve Contractor of responsibility of furnishing and installing such materials, even though shop drawings may have been reviewed and approved.
- E. Manufacturer's Mill Certificate: Submit under provisions of Division 01 – General Requirements certifying that products meet or exceed specified requirements.
- F. Mill Test Reports: Submit under provisions of Division 01 – General Requirements Manufacturer's Certificates, indicating structural strength, destructive and non-destructive test analysis.
- G. Welders Certificates: Submit under provisions of Division 01 – General Requirements Manufacturer's Certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.5 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC -Specifications and the AISC Code of Standard Practice for Steel Buildings and Bridges.
- B. Special inspections shall be performed in accordance with the International Building Code (IBC) 2009 Edition as follows:
1. Chapter 17: Structural Tests and Special Inspections:
 2. Section 1704.3: Steel Construction Table.
 3. Table 1704.3: Required Verification and Inspection of Steel Construction.

1.6 QUALIFICATIONS

- A. Fabricator: Company specializing in performing the work of this Section with minimum ten years documented experience and AISC Certified.
- B. Erector: Company specializing in performing the work of this Section with minimum ten years documented experience.

1.7 FIELD MEASUREMENTS

- A. Verify that field measurements are as shown on Drawings and shop drawings.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Structural Steel W-Shape Members: ASTM A992, $F_y = 50$ ksi.
- B. Structural Steel Angles, Plates, Channels and Other Rolled Members: ASTM A36, $F_y = 36$ ksi.
- C. Rectangular or Square (HSS) Hollow Structural Sections: ASTM A500, Grade B, $F_y = 46$ ksi.
- D. Round (HSS) Hollow Structural Sections: ASTM A500, Grade B, $F_y = 42$ ksi.
- E. Steel Pipe: ASTM A53, Grade B, $F_y = 35$ ksi.
- F. Shear Stud Connectors: ASTM A108 Grade 1015, $F_u = 60$ ksi Forged Steel, headed and uncoated.
- G. Bolts, Nuts, and Washers: ASTM A325 High-Strength Bolts, Type 1 – Medium Carbon, Carbon Boron or Medium Carbon Alloy Steel finish; with ASTM A563 heavy hex nuts and ASTM F436 washers, head markings on bolts, fully traceable;
 - 1. Manufacturers:
 - a. Nucor Fastener.
 - b. St. Louis Screw & Bolt Co.
 - c. Hayden Bolts.
 - d. Approved equal.
- H. Threaded Anchor Bolts (Anchor Rods): ASTM F1554, Class 2A threads; Grade 55; straight; headless with ASTM A563 heavy hex nuts, and ASTM F436, Type 1 washers.
- I. Welding Electrodes: E70XX and shall comply with AWS D1.1; type required for materials being welded.
- J. Non-Shrink Grout: Pre-mixed compound with non-metallic aggregate, cement, water reducing and plasticizing agents; capable of minimum compressive strength of 7,000 psi.
- K. Shop Primer: Interior steel receiving no additional Coatings: Universal Metal Primer for Structural Steel grey.
- L. Shop Primer: Exposed Interior and Exterior Steel Receiving Additional Coatings: Primer shall be Universal Metal Primer for Structural Steel compatible with subsequent finish coats specified in Division 09 - Finishes.

2.2 FABRICATION

- A. Fabricate items of structural steel in accordance with AISC specifications, and as shown on approved shop drawings.
- B. Field connections are to be bolted unless welded, or other types of connections are indicated.
- C. Bolted connections shall be made with ASTM A325 high strength bolts, unless otherwise noted.

- D. Connections shall support a minimum of one-half the total uniform load capacity shown in the AISC ASD tables for allowable loads on beams for the given shape, span, and steel specified, unless otherwise noted.
- E. Connections shall be made with standard double angles unless otherwise shown.
- F. Install high strength threaded fasteners in accordance with RCSC - "Specifications for Structural Joints Using ASTM A325 or A490 bolts".
- G. Welding shall comply with AISC and AWS Codes for procedures, appearance, quality of welds, and for methods used in correcting welding work.
- H. All welds shall be made by AWS pre-qualified welders, certified for welds made.
- I. Minimum size of fillet welds shall be as specified in TABLE J2.4 of AISC Manual of Steel Construction.
- J. Minimum Strength of Welded Connections: Unless noted otherwise on drawings, all shop and field welds shall develop full tensile strength of member of element joined.
- K. All members with moment connections, noted on drawings, shall be welded to develop full flexural capacity of member, unless noted otherwise on drawings.
- L. Provide holes required for securing other work to structural steel framing and for passage of other work through steel members, as shown on approved shop drawings.
- M. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.
- N. Verify or supplement dimensions shown on Drawings by field measurements to assure fit of new work.
- O. Jointed members shall be sealed with continuous welds unless otherwise noted.
- P. Struts and Braces:
 - 1. Connections for all struts hangers, and braces shall have connection designed to develop full allowable tensile strength of member unless design force is indicated on drawings.

2.3 FINISH

- A. Prepare interior structural component surfaces for general work in accordance with SSPC - SP1 and SP3 as a minimum.
- B. Prepare structural component surfaces of exterior steel in accordance with SSPC - SP1 and SP6 as a minimum.
- C. Coated surfaces, interior or exterior, shall be prepared in accordance with coating manufacturer's SSPC requirements if more stringent than listed above.

- D. Shop Primed Structural Steel Members: Minimum one coat for interior steel, minimum two coats for exterior steel. Prime coats shall be a minimum of 2.4 mils dry thickness unless manufacturer has more stringent requirements.
- E. Do not prime surfaces that will be fireproofed, in contact with concrete. Do not prime surfaces that will be field welded unless coated with a weldable primer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that field conditions are acceptable and are ready to receive work in accordance with Drawings and shop drawings.
- B. Verify anchors and anchor rods have been preset into connection work in accordance with Drawings and shop drawings.
- C. Beginning of installation and erection means that existing conditions have been checked and found acceptable.
- D. Cost of corrections shall be borne by this Section if variances are not identified prior to start of installation.

3.2 ERECTION

- A. Erect structural steel in accordance with AISC Specifications.
- B. Store steel on site on substantial shores or blocking to keep free of ground and to prevent bending, buckling, or twisting.
- C. Prevent water collection on members.
- D. Provide for erection loads, wind, and dead loads, and provide sufficient temporary bracing to maintain structure in safe, plumb, and true alignment until completion of erection and installation of permanent bracing.
- E. Do no final bolting or welding until structure has been properly aligned and plumbed.
- F. Do not field cut or alter structural members without prior approval of Structural Engineer of Record.
- G. Field weld components indicated on Drawings and shop drawings.
- H. All bolted joints may be installed as Snug Tightened joints as specified and permitted in the RCSC - Specification, unless otherwise noted.
- I. Pretension all high strength bolts for Pretension or Slip-Critical (S.C.) Joints to minimum bolt pretension specified in Table 8.1 of RCSC - Specification for Structural Joints Using ASTM

A325 or A490 Bolts, Current Edition. Tension shall be achieved using twist-off type tension-control bolt assemblies.

- J. Clean and prime welds, bolt and rivet heads, abrasions of prime coat, and surfaces not previously shop primed, except surfaces to be in contact with concrete after erection.
- K. Grout solid under base plates and bearing plates in accordance with AISC - Code of Standard Practice for Steel Buildings and Bridges.
- L. Contact surfaces of field connections shall be free from dust, oil, loose scale, burrs, pits, and other defects that prevent solid seating of parts.
- M. Clean all surfaces of dirt, mud, oil, or grease that would impair bonding of fireproofing or concrete.
- N. Reaming is not allowed if reaming weakens or makes it impossible to fill holes or adjust accurately after being reamed.

3.3 ERECTION TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

3.4 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 01 – General Requirements.
- B. Field welding to be inspected per the International Building Code (IBC) 2009 Chapter 17 at the following frequency:
 - 1. Full and Partial Penetration Welds – 100 percent ultrasonic.
 - 2. Fillet Welds: 100 percent visual, 10 percent non-destructive (mag-particle dye penetrant).
 - 3. All Repaired Welds: Inspected 100 percent, non-destructive.

END OF SECTION 051200

SECTION 053123 - STEEL ROOF DECKING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel roof deck and accessories.
2. Formed steel closure plates.
3. Framing for openings up to and including 18-inches.
4. Bearing plates and anchors.
5. Roof drain sump pans.

B. Related Sections:

1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
2. Section 05 12 00 - Structural Steel Framing.
3. Section 05 31 13 - Steel Floor Decking.
4. Section 07 81 00 - Applied Fireproofing.

1.2 REFERENCES

A. ASTM International (ASTM):

1. ASTM A36 - Structural Steel.
2. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
3. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic Coated by the Hot-Dip Process.
4. ASTM A992 - Steel for Structural Shapes For Use in Building Framing.
5. ASTM A1008 – Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

B. American Welding Society (AWS):

1. AWS D1.1 - Structural Welding Code.
2. AWS D1.3 - Structural Welding Code: Sheet Steel.

C. Factory Mutual (FM):

1. FM - Roof Assembly Classifications.

D. Steel Deck Institute (SDI):

1. SDI - Design Manual for Composite Decks, Form decks, Roof Decks, Cellular Metal Floor Deck with Electrical Distribution.

E. The Society for Protective Coatings (SSPC):

1. SSPC - Painting Manual. SSPC Paint No. 15, Steel Joist Shop Paint Type 1, red oxide; SSPC - 20 Type I Inorganic; and SSPC - 20, Type II - Organic.

1.3 PERFORMANCE REQUIREMENTS

- A. Design metal deck in accordance with SDI Design Manual.

1.4 SUBMITTALS

- A. Division 01 – General Requirements: Submittal requirements.
- B. Shop Drawings: Indicate deck plan, support locations, projections, openings, pertinent details and accessories, fasteners and fastener pattern diagram.
- C. Product Data: Submit deck profile characteristics and dimensions, structural properties, and finishes.
- D. Manufacturer’s Installation Instructions: Submit manufacturer’s installation instructions.
- E. Manufacturer’s Certificates: Certify products meet or exceed specified requirements.
- F. Welders Certificates: Certify welders employed on Work verifying AWS qualification within previous twelve months.

1.5 QUALIFICATIONS

- A. Installer: Company specializing in performing work of this Section with minimum five (5) years documented experience.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Division 01 – General Requirements: Product Storage and handling requirements.
- B. Cut plastic wrap to encourage ventilation.
- C. Site Storage: Store off ground on dry wood sleepers with one end elevated to provide positive drainage. Protect from elements with a waterproof covering, ventilated to avoid condensation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Epic Metals Corp.
- B. United Steel Deck, Inc.
- C. Vulcraft Steel Deck, Division of Nucor Corp.
- D. Wheeling Corrugating Co.
- E. No Substitutions permitted.

2.2 MATERIALS

- A. Sheet Steel: ASTM A653, Grade A Structural Quality; with G90 galvanized coating conforming to ASTM A653 and A924.

- B. Angles, Plates, and Channels: ASTM A36.
- C. Welding Materials: AWS D1.1.
- D. Fasteners: Carbon steel, self-tapping screws. Framing connections - #12 minimum; deck stitch connections - #10 minimum.
- E. Welding Materials: AWS D1.1 and D1.3.
- F. Touch-Up Primer for Galvanized Surfaces: SSPC 20 Type I - Inorganic.
- G. Framed Openings: ASTM A36 Structural Steel; $F_y = 36$ ksi.

2.3 FABRICATION

- A. Metal Deck: Sheet Steel, configured as follows:
 - 1. Span Design: Triple span where possible.
 - 2. Minimum Metal Thickness Excluding Finish: 20 gage.
 - 3. Nominal Height: 1-1/2 inch, fluted profile to SDI WR.
 - 4. Formed Sheet Width: 36 inches.
 - 5. Side Joints: Lapped.
 - 6. Flute Sides: Plain vertical face.
 - 7. Flute Bottoms: Factory punched vent tabs, 6 inches c-c projecting upward, staggered flute to flute.
- B. Roof Sump Pan: Fabricate of 14 gage thick sheet steel, flat bottom, sloped sides, bearing flange 3 inches wide, sealed watertight.
- C. Fasteners: Stainless steel, self tapping.

2.4 FLORIDA PRODUCT APPROVAL

- A. Roof deck shall be an approved product per the State of Florida Product Approval System.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Coordination and project conditions.
- B. Verify that field conditions are acceptable and are ready to receive work.
- C. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

- A. Erect metal deck in accordance with SDI Design Manual.
- B. Bear deck on steel supports with 1-1/2 inch minimum bearing. Align and level.

- C. Fasten ribbed deck to steel support members at ends and intermediate supports with welds as indicated on the Drawings.
- D. Welded connections shall be in accordance with AWS D1.1 and D1.3.
- E. Mechanically fasten male/female side laps as noted on the Drawings.
- F. Stitch fastening of deck shall be made with minimum #10 self-tapping screws.
- G. Reinforce steel deck openings from 6 to 18 inches in size with 2-inch x 2-inch x 1/4 inch steel angles. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and fusion weld to deck at each flute.
- H. Install six (6) inch minimum wide sheet steel cover plates, of same thickness as deck, where deck changes direction. Mechanically fasten 12 inches on center maximum.
- I. Position roof sump pans with flange bearing on top surface of deck. Mechanically attach at each deck flute.
- J. Immediately after any welding of deck and other metal components in position, clean and coat welds, burned areas, and damaged surface coating, with touch-up prime paint.

END OF SECTION 053123

SECTION 05 40 00 - COLD FORMED STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Exterior nonload bearing wall framing.
 2. Interior nonload bearing wall framing, exceeding height limitations of standard, nonstructural metal framing.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data for cold formed steel framing components, including framing, clips, track, anchors, and gaskets, and to verify section properties of studs shown on the drawings and instructions for securing studs to tracks and other framing connections and for accessories including factory applied primers.
- B. Shop Drawings: Include detailed stud layout, spacing, size, thickness, and types of cold formed steel framing; fabrication; and fastening and anchorage details; include mechanical fasteners, bracing, welds and related accessories.
1. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- C. Delegated Design Submittal: For cold formed steel framing, to verify compliance with performance requirements and design criteria, including structural analysis data. Submittal shall be signed and sealed by the qualified Professional Engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Product Certificates: For each type of code compliance certification for studs and tracks.
- C. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic coating thickness. Submit reports for:
1. Steel sheet.
 2. Expansion anchors.
 3. Power actuated anchors.
 4. Mechanical fasteners.
 5. Vertical deflection clips.
 6. Horizontal drift deflection clips
 7. Miscellaneous structural clips and accessories.
- D. Research Reports: Submit ICC-ES evaluation report for:
1. Nonstandard cold formed steel framing post installed anchors and power actuated fasteners, from ICC-ES or qualified testing agency acceptable to authorities having jurisdiction.
 2. Sill sealer gasket/termite barrier showing compliance with ICC-ES AC380.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with the IBC as adopted and amended by the AHJ including special inspections.
 - a. Code Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified in accordance with the product certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, or the Steel Stud Manufacturers Association.
- B. Professional Engineer Qualifications: A Professional Engineer who is legally qualified to practice in the State of Florida and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold formed metal framing similar to those indicated in material, design, and extent.
 - 1. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and structural data.
- C. Welding Qualifications: Qualify procedures and personnel in accordance with:
 - 1. AWS D1.1/D1.1M Structural Welding Code - Steel.
 - 2. AWS D1.3/D1.3M Structural Welding Code - Sheet Steel.
- D. Preinstallation Conference: Conduct conference at the site.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Protect cold formed steel framing members from weather exposure and damage. Deliver to site in bundles, fully identified with name, type and grade. Store off ground in dry, ventilated space or protect with suitable, venting waterproof coverings.
- B. Inspect cold formed steel framing upon delivery for corrosion and damage to temporary primer. Remove corrosion and repair temporary primer.
- C. Protect cold formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design cold formed steel framing complying with requirements.
- B. Structural Performance: Provide cold formed steel framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: Indicated on Drawings.
 - 2. Seismic Loads: Indicated on Drawings.
 - 3. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. For exterior stud behind masonry veneer: L/500 for stud by itself and L/660 for the complete wall system.
 - b. For exterior stud behind plaster and EIFS: L/460 for stud by itself.
 - c. For exterior stud behind metal panel: L/240 for stud by itself.
 - 4. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection

- failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 degrees F (67 degrees C).
5. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 3/4 inch (19 mm).
 6. Design exterior nonload bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- C. Cold Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200:
1. Floor and Roof Systems: AISI S210.
 2. Wall Studs: AISI S211.
 3. Headers: AISI S212.
 4. Lateral Design: AISI S213.
- D. Fire Resistance Ratings: Comply with ASTM E 119; testing by UL. Identify products with appropriate markings.
1. Indicate design designations from the UL Fire Resistance Directory.
- E. AISI Specifications and Standards: Comply with AISI North American Specification for the Design of Cold Formed Steel Structural Members and Standard for Cold Formed Steel Framing - General Provisions.
1. Comply with AISI S100 and AISI S200 unless more stringent requirements are indicated.

2.2 COLD FORMED STEEL FRAMING MATERIALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Allied Studco.
 2. AllSteel & Gypsum Products, Inc.
 3. CEMCO; California Expanded Metal Products Co.
 4. ClarkDietrich Building Systems.
 5. Formetal Co. Inc. (The).
 6. MarinoWARE.
 7. Quail Run Building Materials, Inc.
 8. SCAFCO Corporation.
 9. Southeastern Stud & Components, Inc.
 10. Steel Network, Inc. (The).
 11. United Steel Manufacturing.
- B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating designation:
1. Grade: ST50H (ST340H).
 2. Coating: G60 (Z180), A60 (ZF180), AZ50 (AZM150), or GF30 (ZGF90).
- C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating:
1. Grade: 50 (340), Class 1.
 2. Coating: G60 (Z180).
- D. Framing Accessories: Fabricate steel framing accessories from ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

1. Provide accessories in standard thickness and configuration, unless otherwise indicated:
 - a. Supplementary framing.
 - b. Bracing, bridging, and solid blocking.
 - c. Web stiffeners.
 - d. Anchor clips.
 - e. End clips.
 - f. Foundation clips.
 - g. Gusset plates.
 - h. Stud kickers and knee braces.
 - i. Joist hangers and end closures.
 - j. Hole reinforcing plates.
 - k. Backer plates.

- E. Anchors, Clips, and Fasteners:
 1. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot dip process in accordance with ASTM A 123/A 123M.
 2. Post Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 as appropriate for the substrate.
 - a. Uses: Securing cold formed steel framing to structure.
 3. Power Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
 4. Mechanical Fasteners: ASTM C 1513, corrosion resistant coated, self-drilling, self-tapping, steel drill screws.
 - a. Head Type: Low profile head beneath sheathing.
 5. Welding Electrodes: Comply with AWS standards.

- F. Miscellaneous Materials:
 1. Galvanizing Repair Paint: High zinc dust content galvanizing repair paint ASTM A 780/A 780M or SSPC-Paint 20.
 2. Nonmetallic, Nonshrink Grout: Factory packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C 1107/C 1107M, and with a fluid consistency and 30-minute working time.
 3. Shims: Load bearing, high density, multimonomer, nonleaching plastic; or cold formed steel of same grade and metallic coating as framing members supported by shims.

- G. Sill Sealer Gasket/Termite Barrier: Minimum 68-mil (1.7-mm) nominal thickness, self-adhering sheet consisting of 64 mils (1.6 mm) of rubberized asphalt laminated on one side to a 4-mil- (0.10-mm-) thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
 1. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
 - a. Polygard Products.
 2. Physical Properties:
 - a. Peel Adhesion: 17.0 lb/in of width (2.9 N/mm of width) when tested in accordance with ASTM D412.
 - b. Low Temperature Flexibility: Pass at minus 25 degrees F (minus 32 degrees C) when tested in accordance with ASTM D146/D146M.
 - c. Water Vapor Permeance: 0.05 perm (0.44 ng/Pa x s x sq. m) maximum when tested in accordance with ASTM E96/E96M, Method B.
 - d. Resistance to Termite Penetration: Comply with ICC-ES AC380.

2.3 EXTERIOR NONLOAD BEARING WALL FRAMING

- A. Steel Studs: C shaped steel studs, of web depths indicated, punched, with stiffened flanges:
 - 1. Minimum Base Metal Thickness: 0.0538 inch (1.37 mm).
 - 2. Flange Width: 1-5/8 inches (41 mm).
- B. Steel Track: U shaped steel track, of web depths indicated, unpunched, with unstiffened flanges:
 - 1. Minimum Base Metal Thickness: 0.0538 inch (1.37 mm).
 - 2. Flange Width: 1-1/4 inches (32 mm).
- C. Vertical Deflection Clips: Bypass and/or Head clips (as required), capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
 - 1. Products: Subject to compliance with requirements, provide products of one of the following:
 - a. AllSteel & Gypsum Products, Inc.
 - b. ClarkDietrich Building Systems.
 - c. Marino\WARE.
 - d. SCAFCO Corporation.
 - e. Simpson Strong-Tie Co., Inc.
 - f. Steel Network, Inc. (The).
 - g. Steeler, Inc.
- D. Drift Clips: Bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.
- E. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
 - 2. Flange Width: 1-5/8 inches (41 mm).

2.4 INTERIOR NONLOAD BEARING WALL FRAMING

- A. Steel Studs: C-shaped steel studs, of web depths indicated, punched, with stiffened flanges:
 - 1. Minimum Base Metal Thickness: 0.0538 inch (1.37 mm).
 - 2. Flange Width: 1-5/8 inches (41 mm).
- B. Steel Track: U shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base Metal Thickness: 0.0538 inch (1.37 mm).
 - 2. Flange Width: 1-1/4 inches (32 mm).
- C. Vertical Deflection Clips: Head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
 - 1. Manufacturers: Subject to compliance with requirements, provide products for framing manufacturer or compatible products by one of the following:
 - a. AllSteel & Gypsum Products, Inc.
 - b. ClarkDietrich Building Systems.
 - c. Marino\WARE.
 - d. SCAFCO Corporation.
 - e. Simpson Strong-Tie Co., Inc.
 - f. Steel Network, Inc. (The).
 - g. Steeler, Inc.

- D. Single Deflection Track: Single, deep leg, U shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure:
 - 1. Minimum Base Metal Thickness: 0.0538 inch (1.37 mm).
 - 2. Flange Width: 1 inch (25 mm) plus the design gap for one story structures.
- E. Drift Clips: Bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 FABRICATION

- A. Fabricate cold formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, in accordance with referenced AISI specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install in accordance with Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
 - 4. Fasten other materials to cold formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, in accordance with approved Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies' level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960):
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and conditions affecting performance of the work. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire resistive materials.
- B. After applying sprayed fire resistive materials, remove only as much of the material as necessary to complete installation of cold formed framing without reducing thickness of fire resistive

materials below that required to obtain fire resistance ratings indicated. Protect remaining fire resistive materials from damage.

- C. Install load bearing shims or grout between the underside of load bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION

- A. Cold formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop or field fabricated, cold formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true to line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install in accordance with approved Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
 - 1) Make connection to concrete with self-tapping screws designed specifically for concrete connections.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 07 21 00, in framing assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 LOAD BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings:
 - 1. Anchor Spacing: Indicated on Shop Drawings.
- B. Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8 inch (3 mm) between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
 - 1. Stud Spacing: Indicated on Shop Drawings, 16 inches (406 mm), maximum.
- C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs in accordance with AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
 - 2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced vertically as indicated on approved Shop Drawings. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.
- J. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall framing system.

3.5 EXTERIOR NONLOAD BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to bottom track unless otherwise indicated.

1. Stud Spacing: Indicated on Shop Drawings, 16 inches (406 mm), maximum.
- C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
- D. Isolate nonload bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 1. Install single deep leg deflection tracks and anchor to building structure.
 2. Install double deep leg deflection tracks and anchor outer track to building structure.
 3. Connect vertical deflection clips to infill studs and anchor to building structure.
 4. Connect drift clips to cold-formed steel framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on approved Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
 1. Channel Bridging: Cold rolled steel channel, welded or mechanically fastened to webs of punched studs.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm) of single deflection track. Install a combination of bridging and stud or stud track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 1. Install solid blocking at centers indicated on approved Shop Drawings, 96-inch (2440 mm) centers, maximum.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall framing system.

3.6 INTERIOR NONLOAD BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to bottom track unless otherwise indicated.
 1. Stud Spacing: Indicated on Shop Drawings, 16 inches (406 mm), maximum.
- C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
- D. Isolate nonload bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 1. Install single deep leg deflection tracks and anchor to building structure.
 2. Connect vertical deflection clips to studs and anchor to building structure.
 3. Connect drift clips to cold formed steel metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings, but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
 1. Channel Bridging: Cold rolled steel channel, welded or mechanically fastened to webs of punched studs.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm) of single deflection track. Install a combination of bridging and stud or stud track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 1. Install solid blocking at centers indicated on approved Shop Drawings, 96-inch (2440 mm) centers, maximum.

- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall framing system.

3.7 ERECTION TOLERANCES

- A. Install cold formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960):
 - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.8 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Cold formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold formed steel framing with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Provide final protection and maintain conditions ensuring cold formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 50 00 - MISCELLANEOUS METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Requirements including but not limited to:
1. Steel framing and supports for:
 - a. Applications where framing and supports not specified elsewhere.
 - b. Miscellaneous framing and supports.
 2. Shelf angles.
 3. Metal ladders.
 4. Miscellaneous steel trim.
 5. Metal bollards.
 - a. Bollard caps.
 6. Vehicular steel channel barriers.
 7. Abrasive metal stair nosings.
 8. Loose bearing and leveling plates.
 9. Loose steel lintels.
 10. Anchor bolts, steel pipe sleeves, slotted channel inserts, and wedge type inserts indicated to be cast into concrete or built into unit masonry.
 11. Steel weld plates and angles for casting into concrete for applications.

1.2 ACTION SUBMITTALS

- A. Product Data: Submit technical data for each miscellaneous metal fabrications and paint, coatings, and grout accessories.
- B. Shop Drawings: Submit shop drawings detailing the fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
1. Steel framing and supports for mechanical and electrical equipment.
 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 3. Metal ladders.
 4. Miscellaneous steel trim.
 5. Metal bollards.
 6. Loose steel lintels.
 7. Vehicular steel channel barriers.

1.3 INFORMATIONAL SUBMITTALS

- A. Certificates and Reports:
1. Welding certificates.
 2. Mill certificates.
 3. Paint Compatibility Certificates: Submit manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
 4. Research/Evaluation Reports: ICC-ES reports for post installed anchors.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Welding: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M Structural Welding Code - Steel.
 - b. AWS D1.2/D1.2 M Structural Welding Code - Aluminum.
 - c. AWS D1.6/D1.6M Structural Welding Code - Sheet Steel.
 - d. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- B. Fabricator/Installer Qualifications: A firm having minimum 5 years documented experience in producing metal fabrications similar to those indicated.

1.5 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 - 2. Provide allowance for trimming and fitting at site.

1.7 STORAGE, DELIVERY AND HANDLING

- A. Store metal fabrications in a dry, well ventilated, weathertight place. Deliver and handle to prevent type of damage to the fabricated work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

2.2 MATERIALS

- A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Ferrous Metal:
1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 2. Stainless Steel Bars and Shapes: ASTM A 276, Type 304.
 3. Rolled Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
 4. Steel Tubing: ASTM A 500/A 500M, cold formed steel tubing.
 5. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
 6. Slotted Channel Framing: Cold formed metal box channels (struts) complying with MFMA-4.
 - a. Size of Channels: 1-5/8 inches by 1-5/8 inches (41 mm by 41 mm).
 - b. Exterior Material: Galvanized steel, ASTM A 653/A 653M, structural steel, Grade 33 (Grade 230), with G90 (Z275) coating; 0.064 inch (1.6 mm) nominal thickness.
 - c. Interior Material: Cold rolled steel, ASTM A 1008/A 1008M, structural steel, Grade 33 (Grade 230); 0.0677 inch (1.7 mm) minimum thickness; hot dip galvanized after fabrication.
 7. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
- C. Fasteners: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- D. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- E. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- F. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- G. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

- H. Miscellaneous Materials:
1. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 2. Shop Primer for Ferrous Metal: Universal primer, organic zinc rich primer, complying with SSPC-Paint 20 and compatible with topcoat. Use primer containing pigments that make it easily distinguishable from zinc rich primer.
 - a. Product: Provide Series 10-99 (red) or 10-09 (gray) by Tnemec Company.
 3. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc coated metal and compatible with finish paint systems indicated.
 4. Galvanizing Repair Paint: High zinc dust content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.
 - a. Product: Provide Series 90-97 Tneme-Zinc by Tnemec Company.
 5. Bituminous Paint: Cold applied asphalt emulsion complying with SSPC-Paint 12, containing no asbestos fibers, or cold applied asphalt emulsion complying with ASTM D 1187 ASTM D 1187/D 1187M.
 6. Nonshrink, Nonmetallic Grout: Factory packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
 7. Concrete Materials and Properties: Composed of ASTM C150 Type I Portland cement, ASTM C33 sand and coarse aggregates and potable water to produce a low slump mix suitable for placement. Grade coarse aggregate from 1/8 inch (3 mm) with at least 95 percent passing a 3/8" sieve and not more than 10 percent passing a No. 8 sieve. Proportion fill to provide a minimum 28-day compressive strength of 3000 psi (20 MPa).
 8. Bollard Caps: Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, manufactured to meet ASTM D1784, sized to slip over steel pipe, with concrete core, to match existing. As manufactured by Lasco, or an approved equivalent.
 - a. Location: Service areas only.
- I. Concrete Materials and Properties: Composed of ASTM C150 Type I Portland cement, ASTM C33 sand and coarse aggregates and potable water to produce a low slump mix suitable for placement. Grade coarse aggregate from 1/8-inch (3 mm) with at least 95 % passing a 3/8-inch (9 mm) sieve and not more than 10% passing a No. 8 sieve. Proportion fill to provide a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.3 FABRICATION

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
1. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
 2. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
 3. Form exposed work with accurate angles and surfaces and straight edges.
 4. Weld corners and seams continuously to comply with the following:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

5. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
6. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
7. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
8. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - a. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 inch by 1-1/2 inches (3.2 mm by 38 mm), with minimum 6 inch (150 mm) embedment and 2 inch (50 mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.4 METAL LADDERS

A. General:

1. Comply with ANSI A14.3.

B. Steel Ladders:

1. Space siderails 16 inches (406 mm) apart unless otherwise indicated.
2. Siderails: Continuous, 3/8-by-2-1/2-inch (9.5-by-64-mm) steel flat bars, with eased edges.
3. Rungs: 3/4-inch- (19-mm-) diameter, steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
6. Provide nonslip surfaces on top of each rung by coating with abrasive material metallicly bonded to rung.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Harsco Industrial IKG, a division of Harsco Corporation.
 - 2) Ross Technology Corporation.
 - 3) W.S. Molnar Company.
7. Source Limitations: Obtain nonslip surfaces from single source from single manufacturer.
8. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.
9. Galvanize and prime ladders, including brackets.

2.5 MISCELLANEOUS FRAMING AND SUPPORTS

A. Provide steel framing and supports necessary to complete the work and which are not a part of the structural framework, including but not limited to framing and supports for countertops, and tube framing for partial height walls, CMU partition head supports, mechanical and electrical equipment.

1. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - a. Fabricate units from slotted channel framing where indicated.

b. Furnish inserts for units installed after concrete is placed.

- B. Countertop Framing: Custom fabricate countertop framing, using steel shapes and plates, and cold finished mild steel bars at exposed conditions, for support framing and plywood, to the thickness, sizes and shapes shown, and necessary to produce work of adequate strength and durability, without objectionable deflections. Use proven details of fabrication, as required, to achieve proper assembly and alignment of the various components of the work.
- C. CMU Partition Head Supports: Fabricate supports from 4" x 4" x 1/4" x 36" (100 mm by 100 mm by 6 mm by 900 mm) long structural steel angles. Drill supports a maximum of 12 inches (300 mm) o.c. to receive expansion bolts.
1. Galvanize miscellaneous framing and supports at exterior locations; prime paint miscellaneous framing and supports at interior locations.

2.6 METAL ANGLES AND PLATES

- A. Shelf Angles: Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19 mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.
1. Provide mitered and welded units at corners.
 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.
 3. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
 - a. Galvanize and prime shelf angles located in exterior walls.
 - b. Prime shelf angles located in exterior walls with zinc rich primer.
 - c. Furnish wedge type concrete inserts, complete with fasteners, to attach shelf angles to cast in place concrete.
- B. Loose Bearing and Leveling Plate: Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
1. Galvanize plates.
- C. Loose Steel Lintels: Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
1. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches (200 mm) unless otherwise indicated.
 2. Galvanize and prime loose steel lintels located in exterior walls.
- D. Steel Weld Plates and Angles: Provide steel weld plates and angles not specified elsewhere for items supported from concrete construction as necessary to complete the work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.7 MISCELLANEOUS STEEL TRIM

- A. Steel Trim: Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
1. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

- a. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction, spaced not more than 6 inches (150 mm) from each end, 6 inches (150 mm) from corners, and 24 inches (600 mm) o.c.
 2. Cast in Pit Angles and Edge Angles: Provide edge angles, and pit angles, fabricated from angles of size as shown, or required, with welded on stud anchors spaced 24 inches (600 mm) on center. Provide pit and edge angles in as long lengths as possible. Miter and weld corners and provide splice plates for alignment between sections.
 3. Galvanize miscellaneous steel trim.
- B. Pipe Bollards: Fabricate bollards from Schedule 40 steel pipe or 1/4-inch (6.4 mm) wall thickness rectangular steel tubing.
1. See Section 03 30 00, for concrete for setting bollards into ground, and filling bollard with concrete.
 2. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
 3. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.
 4. Prime bollards with zinc rich primer.

2.8 VEHICULAR GUARD RAIL CHANNELS

- A. Vehicular Guard Rail Channels: Provide steel guard rail channels complete with supporting posts.
1. Steel channels shall be hot-dipped galvanized.
 2. Weld channels to supporting posts, as indicated on drawings, in accordance with American Welding Society's (AWS) specification D-19.0, Welding Zinc Coated Steel).
 3. Repair galvanized surfaces in areas of welding in accordance with ASTM A780, Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

2.9 ABRASIVE METAL NOSINGS

- A. Extruded Units: Aluminum, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Safety Tread Co., Inc.
 - b. Amstep Products.
 - c. Balco; a CSW Industrials Company.
 - d. Nystrom.
 2. Source Limitations: Obtain units from single source from single manufacturer.
 3. Provide ribbed units, with abrasive filler strips projecting 1/16 inch (1.5 mm) above aluminum extrusion.
 4. Provide solid-abrasive-type units without ribs.
- B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- C. Drill for mechanical anchors and countersink. Locate holes not more than 4 inches (100 mm) from ends and not more than 12 inches (300 mm) o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.
1. Provide two rows of holes for units more than 5 inches (125 mm) wide, with two holes aligned at ends and intermediate holes staggered.

- D. Apply bituminous paint to concealed surfaces of cast-metal units.
- E. Apply clear lacquer to concealed surfaces of extruded units.

2.10 MISCELLANEOUS FABRICATIONS

- A. Abrasive Metal Stair Nosings:
 - 1. Cast Metal Units: Cast iron, with an integral abrasive, as cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Poured Concrete Stair:
 - a) Style 3511 by American Safety Tread, Inc.
 - b) Type S25-C by Armstrong Products Inc.
 - c) Type 231BF by Wooster Products, Inc.
 - b. Nosings: Cross hatched units, 1-1/2 by 1-1/2 inches (38 by 38 mm), for casting into concrete.
 - 2. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
 - 3. Apply bituminous paint to concealed surfaces of cast metal units.

2.11 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch (3mm) maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch (1.5mm).
- C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5mm).
- D. Maximum Bow: 1/8 inch (3mm) in 48 inches (1.2m).
- E. Maximum Deviation From Plane: 1/16 inch (1.5mm) in 48 inches (1.2m).

2.12 FINISH

- A. Finish metal fabrications after assembly. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.
- B. Steel and Iron Finishes:
 - 1. Galvanizing: Hot dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - a. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 - 2. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean vehicular guard railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
 - 3. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 4. Preparation for Shop Priming: Prepare surfaces to comply with **requirements**:
 - a. Exterior Items: SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning.
 - b. Items Indicated to Receive Zinc Rich Primer: SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning.

- c. Items Indicated to receive primers specified for high performance Coatings: SSPC-SP 6/NACE No. 3 "Commercial Blast Cleaning.
- d. Other Items: SSPC-SP 3"Power Tool Cleaning.
5. Shop Priming: Apply shop primer to comply with SSPC-PA 1 Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel for shop painting.
6. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Framing and Supports: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
 1. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 - a. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified.
- G. Installing Nosings: Center nosings on tread widths unless otherwise indicated.
 1. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

- H. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

- I. Leveling Plate: Clean concrete and masonry bearing surfaces of bond reducing materials and roughen to improve bond to surfaces. Clean bottom surface of plates.
 - 1. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.2 ERECTION TOLERANCES

- A. Maximum Variation from Plumb: 1/4 inch (6mm) per story, noncumulative.
- B. Maximum Offset from True Alignment: 1/4 inch (6mm).
- C. Maximum Out of Position: 1/4 inch (6mm).

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0 mil (0.05 mm) dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 90 00.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION

SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel pipe and tube railings attached to walls, and/or floor supported.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data including rail manufacturer's welded railing components, including railing brackets, and accessory materials including but not limited to grout, anchoring cement, and paint products.
- B. Shop Drawings: Submit plans, elevations, sections, details, and attachments to other work.
- C. Delegated Design Submittal: Submit analysis data including structural design calculations for specified load requirements signed and sealed by the qualified professional engineer responsible for preparation.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding Certificates: Submit current certificates for each welder certifying it had passed AWS qualifications testing for welding process.
- B. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
- D. Product Test Reports: Submit test reports performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935 for handrails and railings.
- E. Evaluation Reports: Submit ICC-ES report for post installed anchors, from ICC-ES.

1.4 QUALITY ASSURANCE

- A. Professional Engineer Qualifications: Licensed to practice in state where project is located and is experienced in providing engineering services of the kind indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M Structural Welding Code - Steel.
- C. Source Limitations: Obtain each type of railing from single source from single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer experienced in the design of railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
- C. Pipe Railing Standard: Comply with applicable provisions of ANSI/NAAMM AMP 521 Pipe and Railing Systems Manual.
- D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: [120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C, material surfaces).

2.2 METALS

- A. Metal Surfaces: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch (38 mm) clearance from inside face of handrail to finished wall surface.
- C. Steel and Iron:
1. Tubing: ASTM A 500 (cold formed) or ASTM A 513.
 2. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads. Provide galvanized finish for exterior installations and where indicated.
 3. Plates, Shapes, and Bars: ASTM A 36/A 36M.
 4. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- D. Fasteners:
1. Ungalvanized Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 for zinc coating.
 2. Hot Dip Galvanized Railings: Type 304 stainless steel or hot dip zinc coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
 3. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.
- E. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- F. Post Installed Anchors: Torque controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
1. Material for Interior Locations: Carbon steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- G. Miscellaneous Materials:
1. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 2. Etching Cleaner for Galvanized Metal: Solution of acid and detergents designed to remove grease and oil residue from metal surfaces resulting in clean, lightly etched surface promoting adhesion of coating system.
 3. Galvanizing Repair Paint: High zinc dust content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
 4. Universal Shop Primer: Fast curing, lead and chromate free, universal modified alkyd primer and compatible with topcoat. Use primer containing pigments that make it easily distinguishable from zinc rich primer.
 5. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc coated metal and compatible with finish paint systems indicated.
 - a. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
 6. Epoxy Zinc Rich Primer: Zinc rich primer compatible with topcoat.
 7. Bituminous Paint: Cold applied asphalt emulsion complying with ASTM D 1187/D 1187M.

8. Nonshrink, Nonmetallic Grout: Factory packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.3 FABRICATION

- A. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove flux immediately.
 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Nonwelded Connections: Not permitted.
- J. Form Changes in Direction: By radius bends of radius indicated on drawings or by inserting prefabricated elbow fittings of radius indicated.
 1. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- K. Close exposed ends of railing members with prefabricated end fittings.
- L. Provide wall returns at ends of wall mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
- M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- N. Provide inserts and anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- O. Toe Boards: Where indicated, or required by authority having jurisdiction, provide toe boards at railings around openings and at edge of open sided floors and platforms. Fabricate to dimensions and details indicated.

2.4 FINISHES

A. Steel and Iron:

1. Galvanized Railings:
 - a. Hot dip galvanize exterior and where indicated steel railings, including hardware, after fabrication.
 - b. Comply with ASTM A 123/A 123M for hot dip galvanized railings.
 - c. Comply with ASTM A 153/A 153M for hot dip galvanized hardware.
 - d. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 - e. Fill vent and drain holes that are exposed in the finished work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
 - f. For galvanized railings, provide hot dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
 - g. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
2. Nongalvanized Steel Railings: Provide nongalvanized ferrous metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry.
3. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning or SSPC-SP 3 Power Tool Cleaning requirements based on exposure and conditions of use:
 - a. Exterior Railings: SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning.
 - b. Railings Indicated to Receive Zinc Rich Primer: SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning.
 - c. Railings Indicated to Receive Field Applied Primers: SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning.
 - d. Other Railings: SSPC-SP 3 Power Tool Cleaning.
4. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 Shop, Field, and Maintenance Painting of Steel for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 - a. Shop prime uncoated railings with universal shop primer.
 - b. Do not apply primer to galvanized surfaces, if paint finish is not specified.
5. Shop Painted Finish: Comply with Section 09 91 13 Exterior Painting.
 - a. Color: Selected by Architect.
6. High Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1 Shop, Field, and Maintenance Painting of Steel for shop painting. Apply at spreading rates recommended by coating manufacturer.
 - a. Color: Selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine field conditions for acceptability and ready to receive work.
- B. Attached Railings: Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.
- C. Beginning of installation means erector accepts existing conditions.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Furnish items necessary to cast into concrete, embedded in masonry, or placed in partitions with setting templates.

3.3 INSTALLATION

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
 - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- D. Anchor posts in concrete by inserting into formed or core-drilled holes and grouting annular space.
- E. Anchor railing ends at walls with round flanges anchored to wall construction.
- F. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For steel-framed partitions, use hanger or lag bolts set into concealed steel reinforcements. Coordinate with stud installation to locate backing members.
- G. Adjust railings before anchoring to ensure alignments to required horizontal position and heights.
- H. Fastening to In Place Construction: Use devices and fasteners necessary for securing railings and for properly transferring loads to in place construction.

3.4 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections whether welding is performed in the shop or in the field.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) of post.

3.5 ANCHORING POSTS

- A. Form or core drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Leave anchorage joint exposed with anchoring material flush with adjacent surface.
- C. Anchor posts to metal surfaces with welded connections as necessary for conditions, connected to posts and to metal supporting members:

3.6 ATTACHING RAILINGS

- A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.
- C. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- D. Secure wall brackets and railing end flanges to building construction:
 - 1. For concrete and solid masonry anchorage, use drilled in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For steel framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.7 ADJUSTING AND CLEANING

- A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0 mil (0.05 mm) dry film thickness.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

3.8 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION

SECTION 05 75 00 - DECORATIVE FORMED METAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exterior formed metal shaped panels at ticket counters.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data for each type of product including finishing materials.
- B. Shop Drawings: Show fabrication and installation details for decorative formed metal.
 - 1. Include plans, elevations, component details, and attachment details.
 - 2. Indicate materials and profiles of each decorative formed metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.
- C. Samples: Submit samples for each type of exposed finish required, prepared on 6 inch (150 mm) square Samples of metal of same thickness and material indicated for the work.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For decorative formed metal elements that house items specified elsewhere. Show dimensions of housed items, including locations of housing penetrations and attachments, and necessary clearances.
- B. Qualification Data: Submit data for Installer.
- C. Mill Certificates: Signed by manufacturers of stainless-steel products certifying products furnished comply with requirements.
- D. Evaluation Reports: Submit ICC-ES reports for post installed anchors.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Entity having minimum 5 years documented experienced in producing decorative formed metal similar and sufficient production capacity to produce required units.
- B. Installer Qualifications: Fabricator of products.
- C. Mockups: Build mockups to verify selections, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockups for the following types of decorative formed metal: One Ticket Counter.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- D. Preinstallation Conference: Conduct conference at site.

1.5 COORDINATION

- A. Coordinate installation of anchorages for decorative formed metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Ensure delivery to site in time for installation.
- B. Coordinate installation of decorative formed metal with adjacent construction to ensure that wall assemblies, flashings, trim, and joint sealants, are protected against damage from the effects of weather, age, corrosion, and other causes of deterioration.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver decorative formed metal products wrapped in protective coverings and strapped together in suitable packs or in heavy duty cartons. Remove protective coverings before staining occurs or bonding to finished surfaces.
- B. Store products on elevated platforms in a dry location.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, columns, beams, and construction contiguous with decorative formed metal by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SHEET METAL

- A. Fabricate products from sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.
- B. Stainless Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, stretcher leveled standard of flatness.
- C. Miscellaneous Materials:
 - 1. Sealants, Interior: Nonsag, paintable sealant complying with Section 079200 and as recommended in writing by decorative formed metal manufacturer.
 - 2. Filler Metal and Electrodes: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded or brazed and as necessary for strength, corrosion resistance, and compatibility in fabricated items.
 - a. Use filler metals matching color of metal being joined and will not cause discoloration.
 - 3. Fasteners: Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated. Do not use metals that are incompatible with materials joined.
 - a. Provide concealed fasteners for interconnecting decorative formed metal items and for attaching them to other work unless otherwise indicated.
 - b. Provide square or hex socket flat head machine screws for exposed fasteners unless otherwise indicated.
 - 4. Nonstructural Anchors: For applications not indicated to comply with design loads, provide fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
 - 5. Anchor Materials:

- a. Material for Interior Locations: Carbon steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
6. Sound Deadening Materials:
 - a. Insulation: Unfaced, mineral fiber blanket insulation complying with ASTM C 665, Type I, and passing ASTM E 136 test.
 - b. Mastic: Cold applied asphalt emulsion complying with ASTM D 1187/D 1187M.
7. Backing Materials: Provided or recommended by decorative formed metal manufacturer.
8. Laminating Adhesive: Adhesive recommended by metal fabricator that fully bonds metal to metal, will prevent telegraphing and oil canning, and is compatible with substrate and noncombustible after curing.
9. Isolation Coating: bituminous paint.

2.2 FABRICATION

- A. Shop Assembly: Preassemble decorative formed metal items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Coordinate dimensions and attachment methods of decorative formed metal items with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.
- C. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch- (12-mm-) wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch (1 mm) and support with concealed stiffeners.
- D. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness equivalent to stretcher leveled standard of flatness and sufficient strength for indicated use.
 1. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.
- E. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce decorative formed metal items as needed to attach and support other construction.
- F. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install decorative formed metal items.
- G. Where welding or brazing is indicated, weld or braze joints and seams continuously. Grind, fill, and dress to produce smooth, flush, exposed surfaces in which joints are not visible after finishing is completed.
 1. Use welding and brazing procedures that will blend with and not cause discoloration of metal being joined.

2.3 FINISH REQUIREMENTS

- A. Complete mechanical finishes of flat sheet metal surfaces before fabrication where possible. After fabrication, finish all joints, bends, abrasions, and other surface blemishes to match sheet finish.

- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Apply organic finishes to formed metal after fabrication unless otherwise indicated.
- D. Finish items indicated on Drawings after assembly.
- E. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- F. Stainless Steel Finishes: To match existing, and as noted below.
 - 1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 - 2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - 3. Directional Satin Finish: No. 4.
 - 4. Dull Satin Finish: No. 6.
 - 5. Satin, Reflective, Directional Polish: No. 7.
 - 6. Mirrorlike Reflective, Nondirectional Polish: No. 8.
 - 7. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 8. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and conditions affecting performance of decorative formed metal. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

- A. Locate and place decorative formed metal items level and plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install decorative formed metal.
 - 1. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where needed to protect metal surfaces and to make a weathertight connection.
- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.
- D. Install concealed gaskets, joint fillers, insulation, sealants, and flashings, as the work progresses, to make exterior decorative formed metal items weatherproof.

- E. Install concealed gaskets, joint fillers, sealants, and insulation, as the work progresses, to make interior decorative formed metal items soundproof or lightproof as applicable to type of fabrication indicated.
- F. Corrosion Protection: Apply bituminous paint or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.

3.3 ADJUSTING AND CLEANING

- A. Unless otherwise indicated, clean metals by washing thoroughly with water and soap, rinsing with clean water, and drying with soft cloths.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

3.4 PROTECTION

- A. Protect finishes of decorative formed metal items from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION

SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Wood blocking, cants, and nailers.
 2. Plywood backing panels.

1.2 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater size but less than 5 inches nominal (114 mm actual) size in least dimension.

1.3 ACTION SUBMITTALS

- A. Product Data: Technical data for each type of process and factory fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Wood Preservative Treatment: Submit data from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 2. Fire Retardant Treatment: Submit data from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - a. Include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 3. Waterborne Treatment: Submit statement that moisture content of treated materials was reduced to levels specified before shipment to site.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: Submit ICC-ES reports for:
1. Preservative treated wood.
 2. Fire retardant treated wood.
 3. Power driven fasteners.
 4. Post installed anchors.
 5. Metal framing anchors.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

2.2 WOOD PRESERVATIVE TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWWA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- B. Kiln dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
 - 2. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE RETARDANT TREATED MATERIALS

- A. General: Where fire retardant treated materials are indicated, materials shall comply with requirements, are acceptable to authorities having jurisdiction, and with fire test response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire Retardant Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
 - 1. Treatment shall not promote corrosion of metal fasteners.

2. Exterior Type: Treated materials shall comply with requirements specified above for fire retardant treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln dry lumber after treatment to a maximum moisture content of 19 percent. Kiln dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire retardant treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat all miscellaneous carpentry unless otherwise indicated, including the following:
1. Concealed blocking.
 2. Roof framing and blocking.
 3. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
 4. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

- A. For items of dimension lumber size, provide Construction or No. 2 grade lumber
- B. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- C. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 PLYWOOD PANELS

- A. Equipment Backing Panels: DOC PS 1, Exterior, C-C Plugged, fire-retardant treated, made with adhesive containing no urea formaldehyde, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.
- B. Plywood Wall Sheathing: DOC PS 1, Exterior, Structural I, fire-retardant treated sheathing, made with adhesive containing no urea formaldehyde.
 1. Span Rating: Not less than 16/0.
 2. Nominal Thickness: Not less than 5/8 inch.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements for material and manufacture.
 1. Where carpentry is exposed to weather, in ground contact, pressure preservative treated, or in area of high relative humidity, provide fasteners of Type 316 stainless steel.

- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Metal Framing: ASTM C 1002 and ASTM C 954 as appropriate, with length as recommended by screw manufacturer for material being fastened.
- F. Lag Bolts: ASME B18.2.1.
- G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

2.7 METAL FRAMING ANCHORS

- A. Hot Dip, Heavy Galvanized Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high strength low alloy steel Type A (HSLAS Type A), or high strength low alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.
 - 1. Use for wood preservative treated lumber and where indicated.

2.8 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).
 - 1. Primer: Product recommended by manufacturer of flexible flashing for substrate.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- B. Framing Standard: Comply with AF&PA's WCD 1 Details for Conventional Wood Frame Construction unless otherwise indicated.
- C. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.
- E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- F. Do not splice structural members between supports unless otherwise indicated.
- G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.
 - H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
 - I. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 1. Use inorganic boron for items that are continuously protected from liquid water.
 2. Use copper naphthenate for items not continuously protected from liquid water.
 - J. Where wood preservative treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
 - K. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 1. Table 2304.9.1 Fastening Schedule in ICC's Florida Building Code.
 2. ICC-ES evaluation report NER 272, for power driven fasteners.
 - L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.
 - M. Flexible Flashing Installation: Install self-adhering flexible flashing membrane as a separator sheet between preservative-treated wood and metals such as aluminum, carbon steel, and galvanized metal to avoid potential corrosion induced by contact with chemicals commonly found in preservative-treated wood materials.
 - N. Wood Blocking and Nailer: Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
 1. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
 2. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
 3. Provide permanent grounds of dressed, pressure preservative treated, key beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.
- 3.2 PROTECTION
- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron treated wood becomes wet, apply EPA registered borate treatment. Apply borate solution by spraying to comply with EPA registered label.
 - B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA registered borate treatment. Apply borate solution by spraying to comply with EPA registered label.

END OF SECTION

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wall sheathing.
 - 2. Parapet sheathing.
 - 3. Sheathing joint and penetration treatment.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. For water-resistant glass-mat gypsum sheathing, include manufacturer's technical data and tested physical and performance properties of products.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Certificates: From air-barrier and water-resistant glass-mat gypsum sheathing manufacturer, certifying compatibility of sheathing accessory materials with Project materials that connect to or that come in contact with the sheathing.
- B. Product Test Reports: For water-resistant glass-mat gypsum sheathing assembly, indicating compliance with specified requirements, for tests performed by a qualified testing agency.
- C. Evaluation Reports: Submit ICC-ES reports for:
 - 1. Sheathing materials.
 - 2. Joint and penetration treatment.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.
- B. Deliver gypsum sheathing board and related materials in original packages bearing brand name and identification of manufacturer.
- C. Handle gypsum sheathing board to prevent damage to edges, ends, and surfaces.

1.5 COORDINATION

- A. Sequence and Scheduling: Sequence installation of gypsum sheathing board with exterior cladding so that sheathing board is not exposed to weather for longer than one month. If sheathing board will be exposed to the weather for longer than one month, protect cutouts, corners, and joints in sheathing by filling with flexible sealant at time sheathing is applied, but do not leave exposed for more than four months.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire Test Response Characteristics: For assemblies with fire resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire Resistance Ratings: Indicated by design designations from UL *Fire Resistance Directory* or GA-600 *Fire Resistance Design Manual*.

2.2 WALL SHEATHING

- A. Glass Mat Gypsum Sheathing: ASTM C 1177/1177M.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. GlasRoc by CertainTeed Corporation.
 - b. Dens-Glass Exterior Sheathing by Georgia-Pacific Building Products.
 - c. EXP Fire-Shield Sheathing by National Gypsum Company.
 - d. Securock by United States Gypsum Company.
 - 2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.
 - 3. Size: 48 inches by 96 inches (1219 mm by 2438 mm) for vertical installation.

2.3 PARAPET SHEATHING

- A. Cementitious Backer Units: ASTM C 1325, Type A.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C-Cure.
 - b. Custom Building Products.
 - c. FinPan, Inc.
 - d. United States Gypsum Company.
 - 2. Thickness: 1/2 inch (12.7 mm) or 5/8 inch (15.9 mm).

2.4 FASTENERS

- A. Provide fasteners of size and type indicated that comply with requirements for material and manufacture.
- B. Screws for cementitious backer unit sheathing: Steel screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating, designed to resist 1500 hours of salt spray testing before developing 5-percent rust in accordance with ASTM B 117.
- C. Screws for Fastening Gypsum Sheathing to Cold Formed Metal Framing: Screws: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
 - 1. For steel framing less than 0.0329 inch (0.835 mm) thick, use screws that comply with ASTM C 1002.
 - 2. For steel framing from 0.033 inch to 0.112 inch (0.84 mm to 2.84 mm) thick, use screws that comply with ASTM C 954.

2.5 SHEATHING JOINT AND PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass fiber sheathing tape and for covering exposed fasteners.
 - 1. Sheathing Tape: Self adhering glass fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.9.1 Fastening Schedule in the ICC Florida Building Code.
 - 2. ICC-ES evaluation report for fastener.
- D. Coordinate wall and parapet sheathing installation with flashing and joint sealant installation, so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to cold formed metal framing with screws.
 - 2. Install panels with a 3/8-inch (9.5 mm) gap where nonload bearing construction abuts structural elements.
 - 3. Install panels with a 1/4-inch (6.4 mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
 - 1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.
 - 2. Provide blocking for support wherever end joints do not bear against stud framing.

- D. Seal sheathing joints in accordance with sheathing manufacturer's written instructions.
 - 1. Apply glass fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.3 CEMENTITIOUS BACKER UNIT INSTALLATION

- A. Install panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

END OF SECTION

SECTION 06 20 00 - FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Interior trim.

1.2 DEFINITIONS

- A. MDF: Medium density fiberboard.

1.3 ACTION SUBMITTALS

- A. Product Data: Technical data for each type of process and factory fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.
1. Include data for wood preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
- B. Samples:
1. For each trim profile, 12 inches (300 mm) in length.
 2. For each finish system and color with factory applied finish.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.
1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
 2. Provide for air circulation around stacks and under coverings.
- B. Deliver interior finish carpentry materials when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.
 1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. For exposed lumber, mark grade stamp on end or back of each piece.
- B. MDF: ANSI A208.2, Grade 130.

2.2 INTERIOR TRIM

- A. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish):
 1. Species: As indicated on Drawings.
 2. Grade: Clear NHLA
 3. Maximum Moisture Content: 10.
- B. Hardwood Lumber Trim for Opaque Finish (Painted Finish):
 1. Species: Aspen, basswood, cottonwood, sap gum, sycamore, white maple, or yellow poplar; A Finish.
 2. Grade: Clear NHLA
 3. Maximum Moisture Content: 10.
- C. Hardwood Moldings for Transparent Finish (Stain or Clear Finish): MMPA WM 4, N-grade wood moldings made to patterns included in MMPA HWM/Series Hardwood Molding Patterns.
 1. Species: As indicated on Drawings.
 2. Maximum Moisture Content: 9 percent.
 3. Finger Jointing: Not allowed.
 4. Matching: Selected for compatible grain and color.
- D. Moldings for Opaque Finish (Painted Finish): Made to patterns included in MMPA WM/Series Softwood Molding Patterns.
 1. Hardwood Moldings: MMPA WM 4, P-grade.
 - a. Species: Aspen, basswood, cottonwood, sap gum, sycamore, white maple, or yellow poplar.
 - b. Maximum Moisture Content: 9 percent.
 2. Finger Jointing: Not allowed.
 3. Optional Material: Primed MDF.
- E. Molding patterns and finishes: As indicated on Drawings.

2.3 MISCELLANEOUS MATERIALS

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

- B. Glue: Aliphatic resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
- C. Multipurpose Construction Adhesive: Formulation, complying with ASTM D 3498, that is recommended for indicated use by adhesive manufacturer.

2.4 FABRICATION

- A. Back out or kerf backs of the following members, except those with ends exposed in finished work:
 - 1. Interior standing and running trim, except shoe and crown molds.
- B. Ease edges of lumber less than 1-inch (25 mm) in nominal thickness to 1/16-inch (1.5 mm) radius and edges of lumber 1-inch (25 mm) or more in nominal thickness to 1/8-inch (3 mm) radius.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, for compliance with requirements for installation tolerances and other conditions affecting performance of the work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION

- A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.
- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.
 - 1. Use concealed shims where necessary for alignment.
 - 2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 - 3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
 - 4. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining interior finish carpentry with 1/32 inch (0.8 mm) maximum offset for flush installation and 1/16 inch (1.5 mm) maximum offset for reveal installation.
 - 5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install trim with minimum number of joints as is practical, using full length pieces from maximum lengths of lumber available.
 - 1. Do not use pieces less than 24 inches (610 mm) long, except where necessary.
 - 2. Stagger joints in adjacent and related standing and running trim.
 - 3. Cope at returns, miter at outside corners, and cope at inside corners to produce tight fitting joints with full surface contact throughout length of joint.
 - 4. Use scarf joints for end to end joints.
 - 5. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
 - 6. Install trim after gypsum-board joint finishing operations are completed.
 - 7. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting.
 - 8. Fasten to prevent movement or warping.
 - 9. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 ADJUSTING

- A. Replace interior finish carpentry that is damaged or does not comply with requirements.
 - 1. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.
- B. Adjust joinery for uniform appearance.

3.6 CLEANING

- A. Clean interior finish carpentry on exposed and semi-exposed surfaces.
- B. Restore damaged or soiled areas and touch up factory applied finishes if any.

3.7 PROTECTION

- A. Protect installed products from damage from weather and destructive causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 - 1. Indications that materials are wet, or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or blotchy surface contamination and discoloration.

END OF SECTION

SECTION 06 41 16 - PLASTIC LAMINATE CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plastic laminate clad architectural cabinets.
 - 2. Wood furring, blocking, shims, and hanging strips for installing plastic laminate clad architectural cabinets that are not concealed within other construction.
- B. See Section 05 75 00, for Decorative Formed Metals, at ticket counters.

1.2 DEFINITIONS

- A. Exposed Surfaces:
 - 1. Surfaces visible when doors and drawers are closed.
 - 2. Bottoms of cases more than 4 feet above finish floor.
 - 3. Back and edges of hinged doors exposed when opened.
- B. Semi-exposed Surfaces:
 - 1. Surfaces that becomes visible when drawers and doors are open.
 - 2. Tops of cases 6 feet or higher above finish floor.
- C. Concealed Surfaces: Surfaces not visible after installation.

1.3 ACTION SUBMITTALS

- A. Product Data: Technical data for each type of product, including data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show large scale details. Draw profiles, sections, and views of items specifically manufactured for this work, at scale large enough to permit checking for design conformity.
 - 3. Show sizes, quantities, markings, materials, wood species, finishes and accessories.
 - 4. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 5. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets, including cutouts to be either shop and field cut or drilled – identify all field cut/drilled penetrations.
 - 6. Include assembly and installation drawings to show methods of fastening, bracing, jointing and connecting to work of other trades.
- C. Samples: Submit samples for:
 - 1. Plastic Laminates: 12 inches by 12 inches (300 mm by 300 mm)], for each type, color, pattern, and surface finish required.
 - a. Provide one sample applied to core material with specified edge material applied to one edge.
 - 2. Thermoset Decorative Panels: 12 inches by 12 inches (300 mm by 300 mm), for each color, pattern, and surface finish.

- a. Provide edge banding on one edge.
3. Corner Pieces:
 - a. Cabinet front frame joints between stiles and rails and at exposed end pieces, 18 inches (450 mm) high by 18 inches (450 mm) wide by 6 inches (150 mm) deep.
 - b. Miter joints for standing trim.
4. Exposed Cabinet Hardware and Accessories: One full size unit for each type and finish.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit data for manufacturer and Installer.
- B. Product Certificates: Submit certificates for:
 1. Composite wood products.
 2. Thermoset decorative panels.
 3. High pressure decorative laminate.
 4. Adhesives.
- C. Evaluation Reports: Submit ICC-ES reports for fire retardant treated materials.
- D. Field quality control reports.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Entity having minimum 5 years documented experience and that employs skilled workers who custom fabricate products similar-to those required.
- B. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers.
- C. Architectural Woodwork Standards (AWS) Catalog: Catalog numbers indicated on the drawings and in the specifications are for the convenience of identifying specific cabinet types. Unless modified by notation on the drawings or otherwise specified, current description for indicated number, together with indicated or specified options or accessories, constitutes requirements for each cabinet.
 1. Catalog numbers and specific requirements indicated on the drawings and in the specification are given for the purpose of establishing standard design and quality of materials, construction, and workmanship.
 2. Catalog numbers noted on the drawings are based upon AWS, Appendix A.
- D. Installer Qualifications: Manufacturer of products.
- E. Preinstallation Conference: Conduct conference at site.

1.6 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements.

- B. Protect cabinets during delivery, storage and handling to prevent damage, soilage, and deterioration.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Performance Requirements: Provide millwork in accordance with Architectural Woodwork Standards (AWS), Second Edition; including but not limited to:
 - 1. Submittals: Section 1.
 - 2. Care and Storage: Section 2.
 - 3. Lumber: Section 3.
 - 4. Sheet Products: Section 4.
 - 5. Finishing: Section 5.
 - 6. Millwork (Miscellaneous Work): AWS Section 6.
 - 7. Casework: AWS Section 10.
 - 8. Countertops: AWS Section 11.
- B. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. The Contract Documents may contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.
 - 2. Casework Integrity: The use of Scientific Equipment and Fixture Association (SEFA) 8-1999 standard, as referenced in the AWS, will not be accepted as a method to modify (or reduce) the minimum requirements of the AWS.

2.2 PLASTIC LAMINATE CLAD ARCHITECTURAL CABINETS

- A. Architectural Woodwork Standards Grade: Premium.
- B. Type of Construction: Frameless.

- C. Door and Drawer Front Style: Flush overlay.
 - 1. Reveal Dimension: As indicated.

 - D. High Pressure Decorative Laminate: NEMA LD 3, grades as indicated or as required by quality standard.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Wilsonart International; Basis-of-Design.
 - b. Abet Laminati Inc.
 - c. ArpaUSA.
 - d. Formica Corporation.
 - e. Lamin-Art, Inc.
 - f. Panolam Industries International, Inc. brand.
 - 2. Color/Finish: See drawings for finish schedule

 - E. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Vertical Surfaces: Grade HGS.
 - 3. Edges: Grade HGS, matching horizontal laminate in color, pattern, and finish.
 - 4. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels, unless indicated otherwise on the Drawings.

 - F. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: High pressure decorative laminate, NEMA LD 3, Grade VGS.
 - a. For semiexposed backs of panels with exposed plastic laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
 - 2. Drawer Sides and Backs: Solid hardwood lumber.
 - 3. Drawer Bottoms: Hardwood plywood

 - G. Dust Panels: 1/4-inch (6.4 mm) plywood or tempered hardboard above compartments and drawers which are noted to be locked, unless located directly under tops.

 - H. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High pressure decorative laminate, NEMA LD 3, Grade BKL.

 - I. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.

 - J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces as indicated on Drawings.
- 2.3 PLATIC-LAMINATE COUNTERTOPS
- A. Quality Standard: Unless otherwise indicated, comply with the “Architectural Woodwork Standards, 2nd Edition,” for grades indicated for construction, installation, and other requirements.

 - B. Grade: Premium.

 - C. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS.
 - 1. Manufacturers: As indicated on Drawings.

- D. Colors, Patterns and Finishes: As indicated on Drawings.
- E. Edge Treatment: Same as laminate cladding for horizontal surfaces, unless indicated otherwise.
- F. Core Material at Sinks: Particleboard made with exterior glue.
- G. Core Thickness 3/4-inches (19 mm).
 - 1. Build up countertop thickness to 1-1/2-inches (38 mm) at front, back, and ends with additional layers of core material laminated to top.
- H. Backer Sheet: Provide plastic-laminate backer sheet , NEMA LD 3, Grade BKL, on underside of countertop substrate.

2.4 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
 - 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
 - 1. Medium Density Fiberboard (MDF): ANSI A208.2, Grade 130.
 - 2. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.
 - 3. Softwood Plywood: DOC PS 1.
 - 4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

2.5 FIRE RETARDANT TREATED MATERIALS

- A. Fire Retardant Treated Materials: Where fire retardant treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire test response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
 - 1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
 - 2. Use fire retardant treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 - 3. Identify fire retardant treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
- B. Fire Retardant Treated Lumber and Plywood: Products with a flame spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
 - 1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
 - 2. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
 - 3. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying

sticks or other causes, marring, and other defects affecting appearance of architectural cabinets.

- C. Fire Retardant Particleboard: Made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame spread index of 25 or less and smoke developed index of 25 or less per ASTM E 84.
1. For panels 3/4 inch (19 mm) thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: modulus of rupture, 1600 psi (11 MPa); modulus of elasticity, 300,000 psi (2070 MPa); internal bond, 80 psi (550 kPa); and screw holding capacity on face and edge, 250 and 225 lbf (1100 and 1000 N), respectively.
 2. For panels 13/16 to 1-1/4 inches (20 to 32 mm) thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties: modulus of rupture, 1300 psi (9 MPa); modulus of elasticity, 250,000 psi (1720 MPa); linear expansion, 0.50 percent; and screw holding capacity on face and edge, 250 and 175 lbf (1100 and 780 N), respectively.
 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arauco North America.
 - b. Timber Products Company.

2.6 CABINET HARDWARE AND ACCESSORIES

- A. Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 08 71 00 "Door Hardware."
- B. Pulls: As indicated on Drawings.
- C. Frameless Concealed Hinges (European Type) (type 1): BHMA A156.9, B01602, 165 degrees of opening, self-closing, for full-overlay.
1. Product: Subject to compliance with requirements, provide one of the following:
 - a. Salice No. C2PFA99; Hafele 329.07.609.
 - b. No. 3903 by Grass America, Inc.
- D. Back Mounted Pulls: BHMA A156.9, B02011.
1. Drawer and Cabinet Pulls: 3-1/2-inch (89 mm) aluminum pull.
 - a. Product: Subject to compliance with requirements, provide No. 4483-1/2 by Stanley Security Solutions, Inc.
 2. Wire Pulls: Back mounted, solid, 5 inches (127 mm) long, 2-1/2 inches (63.5 mm) deep, and 5/16 inch (8 mm) in diameter.
- E. Catches: Push in magnetic catches, BHMA A156.9, B03131.
1. Product: Subject to compliance with requirements, provide V713 Magnecatch by National Hardware.
- F. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081, typical, unless otherwise indicated); BHMA A156.9, B04102; with shelf brackets, B04112 (knife-type brackets for mounting at rear of shelves, where indicated).
- G. Shelf Rests: BHMA A156.9, B04013; two pin plastic with shelf hold down clip.
- H. Drawer Slides: BHMA A156.9.
1. Grade 1: Side mounted extending under bottom edge of drawer.
 - a. Type: Full extension.
 - b. Material: Zinc plated steel with polymer rollers.

2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full extension type; zinc plated steel ball bearing slides.
 3. For drawers not more than 3 inches (75 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1.
 4. For drawers more than 3 inches (75 mm) high, but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1HD-100.
 5. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD-200.
 6. For trash bins not more than 20 inches (500 mm) high and 16 inches (400 mm) wide, provide Grade 1HD-200.
- I. Door Locks: BHMA A156.11, E07121.
- J. Drawer Locks: BHMA A156.11, E07041.
1. Drawer Locks: Six pin tumbler controlling three drawers, US26D chrome plated, master-keyed and keyed alike. Provide locks where shown on casework elevations.
 - a. Product: Subject to compliance with requirements, provide one of the following:
 - 1) No. 986 by Knape and Vogt.
 - 2) National Lock.
- K. Door and Drawer Silencers: BHMA A156.16, L03011.
- L. Countertop Grommets: EDP Grommet, EDP Series, 2-1/2 inches (63mm) hole for 3-1/2 inches (88mm) o.d. grommet, color: black, by Doug Mockett, Inc.
- M. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Stainless Steel: BHMA 630, typical unless indicated otherwise on Drawings.
- N. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
- 2.7 OTHER ACCESSOREIS
- A. Keyboard Slides: Grade 1HD-100; for computer keyboard.
1. Acceptable product, for slides only, 16-inches (400 mm) wide and less: Accuride 2109, adjustable height, 75-pound load rating.
 2. Acceptable products for slides and tray: Accuride "Cbergo-Tray 200," fixed-tilt, adjustable height.
 3. Acceptable product for slides, tray, and accessories: Accuride "Cbergo-Tray 300," adjustable tilt, adjustable-height, cable management, palm-rest, and mouse pad.
- B. Work Surface Support Bracket:
1. Material: Stamped metal.
 2. Size: 24-1/4-inches by 24-1/2-inches.
 3. Capacity: 400-pound capacity-per-pair.
 4. Finish: Powder coat, color as selected by Architect.
 5. Acceptable Product: SWS4 by Doug Mockett & Co., Inc.
- C. Coat Hooks:
1. Finish: Burnished cast-aluminum double-hook.
 2. Acceptable Product: Ives No. 580.

- D. Hanging Rods:
 - 1. Closet Shelf and Rod Supports:
 - a. Material: Steel
 - b. Color: White.
 - c. Dimensions: 11-inches long by 10-inches high.
 - d. Acceptable Product: 1195 by Knape & Vogt.
 - 2. Hanging Supported Rod: Acceptable manufacturer: Knape & Vogt 660 series.
 - a. Material: Steel
 - b. Finish: Stainless Steel.
 - c. Tubing Flange: 1-1/16-inch o.d. mounted with two 5 mm pins; KV 632.
 - d. End Cap: KV 630.
 - e. Center Support: KV 760.

2.8 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire retardant treated softwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post installed anchors. Use nonferrous metal or hot dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesive for Bonding Plastic Laminate: Adhesive which do not contain urea formaldehyde.

2.9 FABRICATION

- A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.
 - 1. Countertops shall be provided with front and end overhangs of 1-inch (25 mm) from vertical faces of base cabinet.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Prepare countertop edges to be assembled in field, in the shop, to the maximum extent possible.
- C. Shop cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

- A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
 - 1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
 - 2. Seal edges of cutouts by saturating with varnish.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.
- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) using concealed shims.
 - 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 - 2. Install cabinets without distortion so doors and drawers' fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
- E. Field-Assembled Countertops: Complete fabrication assembly of countertops for those impracticable to assemble in shop.
 - 1. Secure field-joints with concealed clamping devices located within 6-inches (150 mm) of front and back edges and at intervals not exceeding 24-inches (600 mm). Tighten clamps according to fabricator's instructions to exert a constant, heavy-clamping pressure at joints.
- F. Install countertops anchoring securely by screwing through corner blocks of base cabinets or other supports into underside of countertops.
 - 1. Install countertops with no more than 1/8-inch in 96-inch (3 mm in 2400 mm) sag, bow, or other variation from a straight line.
 - 2. Secure backsplashes to tops with concealed metal brackets at 16-inches (400 mm) o.c. and to walls with adhesive.
 - 3. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semi-exposed surfaces.

END OF SECTION

SECTION 07 01 50 - ROOF MAINTENANCE AND REPAIR

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Repair of existing membrane roofing system in conjunction with new penetrations.
 2. Determine and Contact manufacturer of original roofing system and provide matching materials for repair.
 - a. Determine if existing roof system has an existing warranty in place.

1.2 SYSTEM DESCRIPTION

- A. Design Requirements: Determine, in conjunction with Architect and manufacturer's representative, extent of roofing repair required by new roof penetrations.

1.3 ACTION SUBMITTALS

- A. Product Data: Submit copies of specifications, installation instructions and general recommendations for roof repair by manufacturers of original roofing system.

1.4 QUALITY ASSURANCE

- A. Qualifications: Installer's shall have five years documented experience as certified installer of manufacturer of original roofing system.
- B. A complete copy of manufacturers latest specification manual and project Drawings must be kept on job site at all times.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection:
1. Store roofing repair materials in acceptable staging areas on site. Store under environmental conditions acceptable to manufacturer of roofing materials.
 2. Store materials on roof surfaces as necessary, placed on plywood or other type materials to protect roof surfaces.
 3. Maintain adequate protection of materials from damage. Protect Owner's and adjacent property from injury or loss arising from this contract. Furnish necessary danger signs, guards, and obstructions necessary to protect public and workmen from any dangers inherent with or created by work in progress.

1.6 PROJECT CONDITIONS

- A. Environmental Requirements:
1. Do not apply roofing membrane during inclement weather or when ambient temperatures are below 40 degrees F. unless approved in writing by manufacturer of primary roofing materials.
 2. Do not apply roofing membrane to damp or frozen deck surface.
 3. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during the same day.

1.7 WARRANTY

A. Special Warranty:

1. Contractor to execute roofing repairs in manner acceptable to original roofing system manufacturer and in manner so as to not void any existing roofing system warranties.
2. Should Contractor, through any of his actions, void part of Owner's existing roofing system warranty, Contractor shall undertake repairs at his own expense to reinstate roofing warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by original roof manufacturer, or acceptable to the original roof manufacturer, to maintain existing warranty.

2.2 MATERIALS

- A. Roof Materials: Obtain roofing membranes, insulation and membrane flashings only from manufacturer of original system.
- B. Traffic Pads: Ceramic granule surfaced protection pads acceptable to manufacturer of roofing system.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to be repaired with Architect to determine when conditions are satisfactory for installation of specified materials.
1. If existing roof assembly is still under warranty, a manufacturer's representative shall also be present.
- B. Examine surfaces for inadequate anchorage, foreign material, moisture, and unevenness which would prevent execution and quality of application of roofing system repairs.
- C. Verify penetrations for work of other trades must be in place.
- D. Ensure necessary wood blocking has been placed at proper elevations around entire perimeter of new penetration. Verify that required wood blocking is pressure treated with water borne preservative. Do not apply roofing over Creosote or oil borne preservatives.
- E. Verify roof deck surfaces are dry, sound and rigidly anchored in place.

3.2 PREPARATION

- A. Thoroughly clean roof deck surfaces.
- B. Test substrate each day for moisture before work starts. Do not apply hot bitumen to substrates when foaming occurs. If bitumen foams or can be cleanly stripped by hand after cooling, substrate contains excessive moisture. Do not proceed until moisture level permits proper application.

3.3 INSTALLATION

- A. Perform roofing repair work in accordance with manufacturer's general requirements, installation information selections and detail specifications.
- B. Install traffic walk pads in manner acceptable to manufacturer of roofing system.

3.4 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for original roofing system manufacturer's technical personnel to inspect roofing installation repairs upon completion.
 - 1. Notify Architect and Owner 48 hours in advance of date and time of inspection.
- B. Roofing system will be considered defective if it does not pass tests and inspections.
 - 1. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 ADJUSTING AND CLEANING

- A. Remove debris, scraps, containers, and other rubbish and trash resulting from installation from job site each day.
- B. Clean faces of gravel stops, fascias, and walls of smears or drippings of adhesives or similar materials.

3.6 DAMAGE TO WORK OF OTHERS

- A. Repair, refinish, or replace damage to building including damage to interior tile work, wall covering, paint, ceilings, floors, or any other finished work.

END OF SECTION

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Extruded polystyrene foam plastic board.
 2. Polyisocyanurate foam plastic board.
 3. Glass fiber blanket.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data and installation instructions for each type of insulation product specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.
1. For blown in or sprayed fiberglass and cellulosic fiber loose fill insulation, indicate initial installed thickness, settled thickness, settled R-value, installed density, coverage area, and number of bags installed.
 2. Sign, date, and post the certification in a conspicuous location on Project site.
- B. Product Test Reports: Submit test report for tests performed by a qualified testing agency. based on tests performed by a qualified independent testing agency evidencing compliance of insulation products including thermal resistance, fire test response characteristics, water vapor transmission, water absorption, and other properties, based on comprehensive testing of current products.
- C. Evaluation Reports: Submit current ICC-ES report for foam plastic insulation.

1.4 QUALITY ASSURANCE

- A. Single Source Responsibility for Insulation Products: Obtain each type of building insulation from single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam plastic board insulation:
1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 2. Protect against ignition at all times. Do not deliver foam plastic board materials to Project site until just before installation time.
 3. Quickly complete installation and concealment of foam plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire Performance Characteristics: Identify products with appropriate markings of applicable testing and inspecting organization.
 - 1. Surface Burning Characteristic: ASTM E 84.
 - a. Flame Spread Index: Maximum 25.
 - b. Smoke Developed Index: Maximum 450.
 - 2. Fire Resistance Ratings: ASTM E 119.
 - 3. Combustion Characteristics: ASTM E 136.
- B. National Fire Prevention Association (NFPA) 255 Test of Surface Burning Characteristics of Building Materials.
- C. Underwriter's Laboratories (UL) 723 Tests for Surface Burning Characteristics of Building Materials.

2.2 EXTRUDED POLYSTYRENE FOAM PLASTIC BOARD

- A. Extruded Polystyrene Board, Type VII: ASTM C 578, Type VII, 60-psi (414-kPa) minimum compressive strength.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DiversiFoam Products.
 - b. Styrofoam Series, Dow Chemical Company (The).
 - c. Foamular 600; Owens Corning.

2.3 POLYISOCYANURATE FOAM PLASTIC BOARD

- A. Polyisocyanurate Board; Foil Faced: ASTM C 1289, foil faced, Type I, Class 1 or 2.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Atlas Roofing Corporation; EnergyShield Pro.
 - b. Hunter XCI; Carlisle Coatings & Waterproofing Inc.; Hunter Xci Foil (Class A).
 - c. Dow Chemical Company; Thermax Series (ci).
 - d. Rmax, Inc.; TSX-8500.
 - 2. Flame Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 - 3. Smoke Developed Index: Not more than 450 when tested in accordance with ASTM E84.
 - 4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - 5. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.
 - 6. Thermal resistivity: Minimum aged R value of 6.0/in; R of <insert value> total thickness.
 - 7. Water Absorption: Less than 1-1/2 percent by volume maximum in accordance with ASTM D 2842.

2.4 GLASS FIBER BLANKET

- A. Glass Fiber Blanket, Unfaced: ASTM C 665, Type I; passing ASTM E 136 for combustion characteristics.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.

- b. Guardian Building Products, Inc.
- c. Johns Manville; a Berkshire Hathaway company.
- d. Knauf Insulation.
- e. Owens Corning.
2. Flame Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke Developed Index: Not more than 50 when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

2.5 INSULATION FASTENERS

- A. Adhesively Attached, Spindle Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 1. Plate: Perforated, galvanized carbon steel sheet, 0.030-inch (0.762 mm) thick by 2 inches (50 mm) square.
 2. Spindle: Copper coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation.
- B. Adhesively Attached, Angle Shaped, Spindle Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 1. Angle: Formed from 0.030-inch (0.762 mm) thick, perforated, galvanized carbon steel sheet with each leg 2 inches (50 mm) square.
 2. Spindle: Copper coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation.
- C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

2.6 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 1. Glass Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame spread and smoke developed indexes of 5, per ASTM E 84.
 2. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame spread and smoke developed indexes of 75 and 450, respectively, per ASTM E 84.
- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.

- B. Board and Batt Insulation: Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thickness, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 PERIMETER AND UNDERSLAB INSULATION

- A. On vertical slab edge and extending horizontal under slab, set insulation units according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of 12 inches (305 mm) below exterior grade line.
 - 2. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) in from exterior walls.
- B. Butt panels together for tight fit.

3.4 CAVITY WALL INSULATION

- A. Foam Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face and as recommended by manufacturer.
 - 1. Coordinate courses of insulation with metal wall panel sub-framing and other obstructions, with edges butted tightly in both directions. Press units firmly against substrates.
 - 2. Expanding Foam Sealant: For joints, gaps, and openings greater than 1/2-inch (13 mm) wide, install sealant in a continuous ribbon between adjacent board edges, working sealant in to joint for a full depth bead of sealant.
 - 3. Butt board edges together tightly, and carefully fit around openings and penetrations.
 - 4. Tape all seams, edge and end joints, and thru-wall penetrations with manufacturer's recommended flashing tape

3.5 FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch (76 mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Glass Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
 - 2. Spray Applied Polyurethane Insulation: Apply spray applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes,

ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

3.6 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07 26 16 - BONDING SHEET MEMBRANE VAPOR RETARDER

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Underslab vapor retarder that forms an integral bond to poured concrete.
 - 2. Seaming and sealant materials.

1.2 DEFINITIONS

- A. Vapor Barrier: A Class I vapor retarder.
- B. Vapor Retarder: Material or assembly of materials that resists water vapor diffusion through it when tested in accordance with ASTM E 96, Test Method A.
 - 1. Class I: 0.1 perm or less; vapor impermeable.
 - 2. Class II: 1.0 perms or less and greater than 1.0 perm; vapor semi-impermeable.
 - 3. Class III: 10 perms or less and greater than 1.0 perm; vapor semipermeable.
- C. Vapor Permeable: Greater than 10 perms.

1.3 ACTION SUBMITTALS

- A. Product Data: Technical data indicating material characteristics, performance criteria, limitations; including installation instructions, treatment of each substrate; and tested physical and performance properties.
- B. Shop Drawings: Show locations and extent of vapor retarder and details of substrate joints and cracks, expansion joints, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and termination conditions.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit data for Installer.
- B. Product Test Reports: Submit test reports for tests performed by a qualified testing agency.
- C. Field quality control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Entity having minimum 5 years documented experience that employs installers and supervisors who are trained and approved by vapor retarder manufacturer.
- B. Source Limitations: Obtain primary air barrier materials and air barrier accessories from single source from single manufacturer.

- C. Preinstallation Conference: Conduct conference at site.
 - 1. Review air barrier requirements and installation, special details, mockups, air leakage and bond testing, air barrier protection, and work scheduling that covers air barriers.

1.6 COORDINATION

- A. Coordinate work to permit installation of materials with other vapor barrier materials and seals.
- B. Do not install vapor retarder until items penetrating it are in place.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. VBC-350 Composite Vapor Retarder; Barrier-Bac Inteplast Group, Ltd.
 - 2. Underseal Underslab; Polyguard Products, Inc.
 - 3. Florprufe 120 Membrane; GCP Applied Technologies.
- B. Bonded Vapor Retarder: Monolithic, nonwoven polyolefin film and synthetic adhesive layers that form an integral and permanent bond to poured concrete to prevent vapor migration at the interface of the membrane and structural concrete.
 - 1. Sheet Membrane Thickness: 15 mils, minimum. Added reinforcing films or backing adhesives cannot be included in minimum sheet membrane thickness.
 - 2. Total Membrane Thickness: 0.21 inch (0.5 mm).
 - 3. Performance Characteristics:
 - a. Water Vapor Permeance: ASTM E96, Method B (ASTM E1745); 0.03 perms.
 - b. Tensile Strength: ASTM E154; 65 lb/in.
 - c. Puncture Resistance: ASTM D1709; 3300 grams.
 - d. Elongation: ASTM D412; 300%.
 - 4. Life Expectancy: ASTM E 154; indefinite.
 - 5. Chemical Resistance: ASTM E 154, unaffected.
 - 6. Peel Adhesion to Concrete: ASTM D903; >4 lb/in.
- C. Auxiliary Materials: Furnish auxiliary materials recommended by vapor retarder manufacturer for intended use and compatible with vapor retarder.
 - 1. Seam Tape: Recommended by sheet membrane manufacturer.
 - 2. Liquid Adhesive and Penetration Sealer: Recommended by sheet manufacturer, compatible with vapor retarder, trowel or roller grade as required.
 - 3. Penetration Boots: Premanufactured or field fabricated from seam tape and liquid penetration sealer recommended by sheet membrane manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements and conditions affecting performance of vapor retarder.

1. Verify that void carton substrate is flat, smooth, and ready to receive sheet membranes.
- B. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

- A. Remove loose or foreign matter which might impair adhesion.
- B. Clean and prime substrate surfaces to receive adhesive and sealants in accordance with manufacturer's instructions.
- C. Layout sheet membrane parallel to direction of placement of concrete.

3.3 INSTALLATION

- A. Comply with ASTM E 1643 for materials and installation. Install materials in accordance with manufacturer's written instructions.
- B. Bonded Vapor Retarders under Concrete Slab:
 1. Install membrane with the HDPE film facing the prepared substrate. Remove release liner as the membrane is applied. Overlap succeeding sheets with minimum 2-inch (50 mm) overlaps along marked lap line. Stagger end laps to avoid a buildup of layers.
 2. Fasten membrane using mechanical fastening or taped lap methods to prevent gaps and openings and the membrane from moving.
 - a. Mechanical Fastening: Fastened laps together at maximum 39 inches (1 m) centers. Fix through the center of lap area using 1/2 inch (13 mm) long washer head self-tapping galvanized screws or similar allowing the head of the screw to bed into the adhesive compound to self-seal. Ensure membrane lays flat and no openings occur. Install additional fasteners at corners.
 - b. Taped Laps: Use manufacturer recommended tape to secure and seal the overlaps. Over-band the lap with the 4 inch (100mm) wide tape using the lap line for alignment. Remove plastic release liner to ensure bond to concrete.
 3. Where new slab is installation adjacent to existing slab, secure vapor barrier membrane to existing slab edge with manufacturers recommended adhesive or tape.
 4. Side Laps: Lap membrane not less than 4 inches (100 mm). Remove release liner from self-adhering seam edge. Align edges and press together. Roll edges with roller and pressure recommended by manufacturer to obtain full adhesion at seams.
 5. End Laps: Stagger end laps a minimum of 12 inches (305 mm). Lap membrane not less than 6 inches (150 mm). Use a combination of seam tape and liquid adhesive as recommended by manufacturer. Roll edges with roller and pressure recommended by manufacturer to obtain full adhesion at seams.
 6. Seal penetrations to form a tight seal with liquid flashing membrane and/or pressure sensitive seam tape per manufacturer's recommendations.
 7. Repair damaged bonded vapor retarder membrane prior to pouring concrete in accordance with manufacturer's recommended method.
- C. Seal side laps and end laps within recommended application temperature ranges.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a site representative qualified by vapor retarder manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection; and to furnish daily reports to Architect.
 - 1. Inspections may include the following:
 - a. Continuity of bonded vapor retarder system has been achieved.
 - b. Continuous support of bonded vapor retarder system has been provided.
 - c. Laps in membrane materials have complied with the minimum requirements with no fishmouths.
 - d. Compatible materials have been used.
 - e. Penetrations have been sealed.
 - f. Perimeter of bonded vapor retarder system has been properly terminated and sealed.

END OF SECTION

SECTION 07 27 26 - FLUID APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Vapor retarding, fluid applied air barriers.

1.2 DEFINITIONS

- A. Air Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air Barrier Assembly: The collection of air barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.3 ACTION SUBMITTALS

- A. Product Data: Technical data for each type of product including manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.
- B. Shop Drawings: Submit plans and details for air barrier assemblies.
 - 1. Show locations and extent of air barrier materials, accessories, and assemblies specific to conditions.
 - 2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie ins with adjoining construction.
 - 3. Include details of interfaces with other materials that form part of air barrier.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit data for Installer.
- B. Product Certificates: From air barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
- C. Product Test Reports: Submit report for each air barrier assembly for tests performed by a qualified testing agency.
- D. Field quality control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Entity having minimum 5 years documented experience that employs installers and supervisors who are trained and approved by manufacturer.
- B. Source Limitations: Obtain primary air-barrier materials and air barrier accessories from single source from single manufacturer.

- C. Preinstallation Conference: Conduct conference at site.
 - 1. Review air barrier requirements and installation, special details, mockups, air leakage and bond testing, air barrier protection, and work scheduling that covers air barriers.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect air barrier performance.
 - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Air Barrier Performance: Air barrier assembly and seals with adjacent construction shall be capable of performing as continuous air barrier. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa) when tested according to ASTM E 2357.

2.2 HIGH BUILD AIR BARRIERS, VAPOR RETARDING

- A. High Build, Vapor Retarding Air Barrier: Modified bituminous or synthetic polymer membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils (0.9 mm) or thicker over smooth, void free substrates.
 - 1. Modified Bituminous Type:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Carlisle Coatings & Waterproofing Inc.
 - 2) Henry Company.
 - 3) W.R. Meadows, Inc.
 - 2. Synthetic Polymer Type:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Carlisle Coatings & Waterproofing Inc.
 - 2) GCP Applied Technologies Inc.
 - 3) Henry Company.
 - 4) Hohmann & Barnard, Inc.

- 5) Rubber Polymer Corporation, Inc.
 - 6) Sto Corp.
 - 7) W.R. Meadows, Inc.
3. Physical and Performance Properties:
- a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.
 - b. Vapor Permeance: Maximum 0.1 perm (5.8 ng/Pa x s x sq. m); ASTM E 96/E 96M, Desiccant Method.
 - c. Ultimate Elongation: Minimum 500 percent; ASTM D 412, Die C.
 - d. Adhesion to Substrate: Minimum 16 lbf/sq. in. (110 kPa) when tested according to ASTM D 4541.
 - e. UV Resistance: Can be exposed to sunlight for 30 days according to manufacturer's written instructions.

2.3 ACCESSORY MATERIALS

- A. Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and accessory materials recommended in writing by air barrier manufacturer to produce a complete air barrier assembly and compatible with primary air barrier material and adjacent construction to which they may seal.
- B. Primer: Liquid waterborne primer recommended for substrate by air barrier material manufacturer.
- C. Stainless Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0250 inch (0.64 mm) thick, and Series 300 stainless steel fasteners.
- D. Preformed Silicone Extrusion: System consisting of cured low modulus silicone extrusion, sized to fit opening widths, with single component, neutral curing, Class 100/50 (low modulus) silicone sealant for bonding extrusions to substrates.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dow Corning Corporation.
 - b. GE Construction Sealants; Momentive Performance Materials Inc.
 - c. Pecora Corporation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements and conditions affecting performance of the work.
 1. Verify substrates are sound and free of oil, grease, dirt, excess mortar, or contaminants.
 2. Verify substrates have cured and aged for minimum time recommended in writing by air barrier manufacturer.
 3. Verify substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D 4263.
 4. Verify that masonry joints are flush and filled with mortar.
- B. Proceed with installation after correcting unsatisfactory conditions.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust free, and dry substrate for air barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form release agents, paints, curing compounds, and penetrating contaminants or film forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and voids in concrete with substrate patching material.
- E. Remove excess mortar from masonry ties, shelf angles, and obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
- H. Bridge isolation joints, expansion joints, and discontinuous wall to wall, deck to wall, and deck to deck joints with air barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 ACCESSORIES INSTALLATION

- A. Install accessory materials according to air barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.
 - 3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 - 4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Connect and seal wall air barrier material continuously floor construction, exterior g window systems, exterior louvers, exterior door framing, and other construction used in penetrating membrane material, using accessory materials.
- C. At end of each day, seal top edge of strips and transition strips to substrate with termination mastic.
- D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

- E. Wall Openings: Prime concealed, perimeter frame surfaces of all wall penetrations. Apply transition strip so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames, with not less than 1 inch (25 mm) of full contact.
 - 1. Transition Strip: Roll firmly to enhance adhesion.
- F. Flash all membrane penetrations per manufacturer's instructions with sheet and liquid membrane flashing material to achieve seal.
- G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- H. Seal top of through wall flashings to air barrier with an additional 6 inch (150 mm) wide, transition strip.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.4 PRIMARY AIR BARRIER MATERIAL INSTALLATION

- A. Apply air barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air barrier manufacturer's written instructions and details. Apply air barrier material within manufacturer's recommended application temperature ranges.
 - 1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 - 2. Limit priming to areas that will be covered by air barrier material on same day. Reprime areas exposed for more than 24 hours.
 - 3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.
- B. High Build Air Barriers: Apply continuous unbroken air barrier material to substrates according to the following thickness. Apply air barrier material in full contact around protrusions such as masonry ties.
 - 1. Vapor Retarding, High Build Air Barrier: Total dry film thickness recommended in writing by manufacturer to comply with performance requirements, but not less than 35 mils (0.9 mm), applied in one or more equal coats.
- C. Do not cover air barrier until it has been tested and inspected by testing agency.
- D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Inspections: Air barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
 - 1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
 - 2. Air barrier dry film thickness.

3. Continuous structural support of air barrier system has been provided.
 4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 5. Site conditions for application temperature and dryness of substrates have been maintained.
 6. Maximum exposure time of materials to UV deterioration has not been exceeded.
 7. Surfaces have been primed, if applicable.
 8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 9. Termination mastic has been applied on cut edges.
 10. Strips and transition strips have been firmly adhered to substrate.
 11. Compatible materials have been used.
 12. Transitions at changes in direction and structural support at gaps have been provided.
 13. Connections between assemblies (air barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 14. All penetrations have been sealed.
- C. Tests: Determined by testing agency from among the following tests:
1. Air Leakage Location Testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
 2. Air Leakage Volume Testing: Air barrier assemblies will be tested for air leakage rate according to ASTM E 783.
 3. Adhesion Testing: Air barrier assemblies will be tested for required adhesion to substrate according to ASTM D 4541 for each 600 sq. ft. (56 sq. m) of installed air barrier or part thereof.
- D. Air barriers are considered defective if they do not pass tests and inspections.
1. Apply additional air barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 2. Remove and replace deficient air barrier components for retesting as specified above.
- E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- F. Prepare test and inspection reports.
- 3.6 CLEANING AND PROTECTION
- A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove, and replace air barrier or install additional, full thickness, air barrier application after repairing and preparing the overexposed materials according to air barrier manufacturer's written instructions.
 2. Protect air barrier from contact with incompatible materials and sealants not approved by air barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION

SECTION 07 42 16 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Metal composite material (MCM) wall panels.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data including construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
1. Include fabrication and installation layouts of metal composite material panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
 2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 3 inches per 12 inches (1:4).
- C. Delegated Design Submittal: Submit for metal composite material wall panel systems indicated to comply with performance requirements and design criteria, analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Samples for Color and Finish Approval: For each type of metal panel color and finish, to match existing, prepare panel samples 24-inches (610 mm) long by typical panel width.
1. Samples shall be temporarily be erected on-site adjacent to existing metal wall panels for Architect's review and approval.
- E. Samples for Verification: Submit each type of approved exposed finish required, 12 inches (305 mm) long by actual panel width. Include fasteners, closures, joints, and other metal composite material panel accessories.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit qualifying data for Installer.
- B. Product Test Reports: Submit tests performed by a qualified testing agency.
- C. Florida Product Approval (FL#) or Miami-Dade County Product Notice of Acceptance (NOA): For metal-composite material panel system.
1. Impact Resistance Data: Manufacturer's current Product Approval Notice indicating product acceptance in accordance with requirements of the Florida Building Code TAS 201, TAS 202, and TAS 203 or Miami-Dade PA 201, PA 202, PA203, and High Velocity Hurricane Zone. Notice of Approval shall indicate a minimum product control number, expiration date of approval, and the specific conditions governing the approval.
 2. Impact Resistance Requirements: Meet impact tests as outlined in the Florida Building Code.
 - a. Large missile impact test (up to and including 30 feet in height).
 - b. Small missile impact test (above 30 feet in height).

- D. Field quality control reports.
- E. Sample Warranties: Submit proposed warranties for review.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Submit metal composite material panels data to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Entity having minimum 5 years documented experience that employs skilled workers who shop fabricate products similar to those required and member of the Metal Construction Association.
- B. Installer Qualifications: Entity having minimum 5 years documented experience that employs installers and supervisors who are trained and approved by manufacturer.
- C. Source Limitations: Obtain each type of metal faced composite wall panel from single source from single manufacturer.
- D. Mockups: Build mockups to verify selections and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. Preinstallation Conference: Conduct conference at site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal composite material panels, and other manufactured items so as not to be damaged or deformed. Package metal composite material panels for protection during transportation and handling.
- B. Unload, store, and erect metal composite material panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal composite material panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal composite material panels to ensure dryness, with positive slope for drainage of water. Do not store metal composite material panels in contact with other materials that might cause staining, denting, or surface damage.
- D. Retain strippable protective covering on metal composite material panels during installation.

1.7 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation when existing and forecasted weather conditions permit assembly of metal composite material panels to be performed according to manufacturers' written instructions and warranty requirements.

1.8 COORDINATION

- A. Coordinate metal composite material panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

- A. Written warranty signed by Manufacturer and installer in which manufacturer agrees to repair or replace components of metal composite material panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Panel Finish: Written warranty signed by Manufacturer in which manufacturer agrees to repair finish or replace metal composite material panels that show evidence of deterioration of factory applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer with experience in the design of metal composite wall panels to design and coordinate the cladding assembly using performance requirements and design criteria indicated.
- B. Structural Performance: Provide metal composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 330:
 - 1. Wind Loads: Caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with SEI/ASCE 7 to establish wind pressure based on the following criteria:
 - a. Ultimate Design Wind Speed (V_{ult}): 120 mph.
 - b. Nominal Design Wind Speed (V_{asd}): 90 mph.
 - c. Occupancy Category: III.
 - d. Exposure Category: C.
 - e. Internal Pressure Coefficient (GCPI): Plus/minus 0.18.
 - 2. Special Wind Load Exception: Wall cladding systems and components on the AIRSIDE of Airport Terminal buildings shall be designed to resist a minimum of 50 lbf/sq. ft. applied over any 15 sq. ft. area of cladding per FAA AC 150/5300-13, Chapter 8, "The Effects and Treatment of Jet Blast," regardless of minimum wind loads determined per SEI/ASCE 7.
 - 3. Other Design Loads: Indicated on Drawings.
 - 4. Deflection Limits: For wind loads, no greater than 1/240 of the span.
- C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 283 at specified test-pressure difference:
 - 1. Test Pressure Difference: 1.57 lbf/sq. ft. (75 Pa) and 6.24 lbf/sq. ft. (300 Pa).

- D. Air Infiltration: Panel system shall not have air infiltration rate more than 0.12 cfm per sq. ft. (0.6 L/s per sq. m) of fixed wall area when tested in accordance with ASTM E 283 at static air pressure differential of 1.57 lbf/sq. ft. (75 Pa) when tested as part of AAMA 508 test protocol.
- E. Cyclic Static Air Pressure Differential: Panel system shall be pressure cycled tested in accordance with ASTM E 1233. Testing shall consist of 100 cycles from 5 lbf/sq. ft. to 25 lbf/sq. ft. and system must pressure equalize in less than 0.08 seconds when tested as part of AAMA 508 test protocol.
- F. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at specified test pressure difference:
 - 1. Test Pressure Difference: 2.86 lbf/sq. ft. (137 Pa) and 6.24 lbf/sq. ft. (300 Pa).
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.
- H. Fire Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL Fire Resistance Directory or from the listings of another qualified testing agency.
- I. Surface Burning Characteristics: Provide wall panels with a flame-spread index of 25 or less and a smoke developed index of 450 or less, per ASTM E 84.
- J. Bond Integrity: When tested for bond integrity, ASTM D 1781 (simulating resistance to panel delamination), there shall be no adhesive failure of bond between core and skin nor cohesive failure within core, based on following values:
 - 1. Bond Strength: 214 lbs./sq. in. (Vertical Pull)
 - 2. Peel Strength:
 - a. 22.5-inch pound/inch dry.
 - b. 22.5-inch pound/inch after 8 hours in water at 200 degrees F.
 - c. 22.5-inch pound/inch after 21 days soaking in water at 70 degrees F.

2.2 METAL COMPOSITE MATERIAL WALL PANELS

- A. Metal Composite Material (MCM) Wall Panel Systems: Provide factory formed and assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Basis-of-Design: Citadel Architectural Products, Inc. (FL14436-R3).
- B. Aluminum Faced Composite Wall Panels: Formed with 0.020 inch (0.50 mm) thick, aluminum sheet facings.
 - 1. Panel Thickness: 0.157 inch (4 mm), minimum.
 - 2. Core: Fire retardant.
 - 3. Exterior Finish: To match existing.
 - a. Color: Custom to match existing, to be approved by Architect.

- C. Attachment Assembly Components: Formed from extruded aluminum.
- D. Attachment Assembly: Subgirt and spline.
- E. Miscellaneous Materials:
 - 1. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide sections required for support and alignment of metal composite material panel system.
 - 2. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal composite material panels unless otherwise indicated.
 - 3. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal composite material panels.
 - 4. Panel Fasteners: Self tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal composite material panels by means of plastic caps or factory applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
 - 5. Panel Sealants: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain weathertight; and as recommended in writing by metal composite material panel manufacturer.

2.3 FABRICATION

- A. Fabricators: Subject to compliance with requirements, provide products fabricated by one of the following:
 - 1. Advanced Exterior Systems.
 - 2. East Coast Metal Systems, Inc.
 - 3. Metal Design Systems.
 - 4. NOW Specialties Inc.
 - 5. Sobotec Ltd.
 - 6. Universe Corporation.
- B. Fabricate and finish metal composite material panels and accessories at the factory, using procedures and processes necessary to comply indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA Architectural Sheet Metal Manual that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat lock seams. Tin edges to be seamed, form seams, and solder.

4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA Architectural Sheet Metal Manual or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.4 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Aluminum Panels and Accessories; to match existing, and:
 1. Two Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Mica Fluoropolymer: AAMA 2605. Two coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 3. Exposed Anodized Finish:
 - a. Clear Anodic Finish: AAMA 611, AA-MxxCxxAxx, Class I, 0.018 mm or thicker.
 - b. Color Anodic Finish: AAMA 611, AA-MxxCxxAxx/Axx, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances, metal composite material panel supports, and conditions affecting performance of the work.
 1. Examine wall framing to verify that girts, angles, channels, studs, and structural panel support members and anchorage have been installed within alignment tolerances required by metal composite material wall panel manufacturer.
 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite material wall panel manufacturer.
 - a. Verify that air or water resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

- B. Examine roughing in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation.
- C. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal composite material panel manufacturer's written recommendations.

3.3 METAL COMPOSITE MATERIAL PANEL INSTALLATION

- A. Wall Panels: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal composite material panels.
 - 2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air or water resistive barriers and flashings concealed by metal composite material panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal composite material panel work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - 8. Provide weathertight escutcheons for pipe and conduit penetrating panels.
- B. Fasteners, Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.
- D. Attachment Assembly: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
 - 1. Include attachment to supports, panel to panel joinery, panel to dissimilar material joinery, and panel system joint seals.
- E. Installation: Attach metal composite material wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.
 - 1. Dry Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with gasket system – to match existing system.
- F. Clip Installation: Attach panel clips to supports at locations, spacings, and with fasteners recommended by manufacturer. Attach routed and returned flanges of wall panels to panel clips with recommended fasteners.

1. Seal horizontal and vertical joints between adjacent metal composite material wall panels with gaskets – to match existing system.
- G. Subgirt and Spline Installation: Install support assembly at locations, spacings, and with fasteners recommended by manufacturer. Use subgirts and splines that provide support and complete secondary drainage assembly, draining to the exterior at horizontal joints. Attach metal composite material wall panels by interlocking perimeter extrusions attached to panels with subgirts and splines. Fully engage integral subgirt and spline gaskets and leave horizontal and vertical joints with open reveal. Terminate edge of panels flush with perimeter extrusions.
1. Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
 2. Do not apply sealants to joints unless otherwise indicated.
- H. Track Support Installation: Install support assembly at locations, spacings, and with fasteners recommended by manufacturer. Use horizontal tracks and vertical tracks that provide support and secondary drainage assembly, draining to the exterior at horizontal joints through drain tube. Attach metal composite material wall panels to tracks by interlocking panel edges with recommended T clips.
1. Attach routed and returned flanges of wall panels to perimeter extrusions with recommended fasteners.
 2. Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
 3. Do not apply sealants to joints unless otherwise indicated.
- I. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal composite material panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; if not indicated, provide types recommended in writing by metal composite material panel manufacturer.
- J. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA Architectural Sheet Metal Manual. Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal composite material wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), non-accumulative, on level, plumb, and location lines as indicated, and within 1/8 inch (3 mm) offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing agency to perform field tests and inspections.
- B. Water Spray Test: After installation, test area of assembly 5,000 sq. ft of wall area, or fraction thereof, for water penetration according to AAMA 501.2.
- C. Metal composite material wall panels will be considered defective if they do not pass test and inspections.
- D. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- E. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.
- B. After metal composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 54 19 - POLYVINYL CHLORIDE (PVC) MEMBRANE ROOFING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Adhered polyvinyl chloride (PVC) roofing system.
 2. Substrate board.
 3. Roof insulation.
 4. Cover board.
 5. Walkways.

1.2 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA The NRCA Roofing Manual: Membrane Roof Systems apply to the work.

1.3 ACTION SUBMITTALS

- A. Product Data: Submit technical data for each type of product; including insulation and roof system component fasteners, and a copy of FM Approvals' RoofNav listing.
- B. Shop Drawings: Submit roof plans, sections, details, and attachments to other work, including the following:
1. Layout and thickness of insulation.
 2. Base flashings and membrane terminations.
 3. Flashing details at penetrations.
 4. Tapered insulation thickness and slopes.
 5. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
 6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
 7. Tie-in with air barrier.
- C. Samples: Submit samples for:
1. Roof membrane and flashing, of color required.
 2. Walkway pads or rolls, of color required.
- D. Wind Uplift Resistance Submittal: Submit for roofing system, indicating compliance with wind uplift performance requirements.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit data for Installer and manufacturer.
- B. Manufacturer Certificates:
1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements.
 - a. Submit evidence of compliance with performance requirements.

2. Warranty Certificate: Submit certificate signed by roof membrane manufacturer, certifying that materials supplied are acceptable for roofing system warranty.
- C. Product Test Reports: For roof membrane and insulation, tests performed by independent qualified testing agency indicating compliance with specified requirements.
- D. Evaluation Reports: Submit ICC-ES reports for components of roofing system.
- E. Field Test Reports:
 1. Fastener pullout test results and manufacturer's revised requirements for fastener patterns.
- F. Field quality control reports.
- G. Maintenance Data: Submit roofing system data to include in maintenance manuals.
- H. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by work performed and that the existing warranty is in full effect.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer having minimum 10 years documented experience in the manufacture of roofing systems that is [UL listed] [listed in FM Approvals' RoofNav] for roofing system identical to the system being installed.
- B. Installer Qualifications: Entity having minimum 5 years documented experience, who is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product, and is eligible to receive manufacturer's warranty.
- C. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.
- D. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at site.
- E. Preinstallation Roofing Conference: Conduct conference at site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.7 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.8 WARRANTY

- A. Total System Warranty: Written warranty signed by manufacturer in which manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Warranty includes roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, and components of roofing system.
 - 2. Warranty Period 20 years from date of Substantial Completion and shall include coverage for wind speeds up to 100 mph from date of Substantial Completion.
- B. Installer's Warranty: Submit roofing Installer's warranty, signed by Installer, covering its work, including components of roofing system such as roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.
 - 1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
 - 2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D 3746, ASTM D 4272/D 4272M, or the Resistance to Foot Traffic Test in FM Approvals 4470.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:
 - 1. Zone 1 (Roof Area Field): 71.4 lbf/sq. ft. (kPa/sq. m).
 - 2. Zone 2 (Roof Area Perimeter): 119.7 lbf/sq. ft. (kPa/sq. m).
 - a. Location: From roof edge to 8 foot inside roof edge.
 - 3. Zone 3 (Roof Area Corners): 180 lbf/sq. ft. (kPa/sq. m).
 - a. Location: 8 foot in each direction from building corner.

4. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and shall be listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
 5. Fire/Windstorm Classification: Class 1A-120.
 6. Hail Resistance Rating: MH
- D. ENERGY STAR Listing: Roofing system shall be listed on the DOE's ENERGY STAR Roof Products Qualified Product List for low slope roof products.
- E. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.
- F. Exterior Fire Test Exposure: ASTM E 108 or UL 790, Class A for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- G. Fire Resistance Ratings: Comply with fire resistance rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 POLYVINYL CHLORIDE (PVC) ROOFING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Sarnafil Inc.
 2. Seaman Corporation.
- B. PVC Sheet: ASTM D 4434, Type II, Grade I, glass fiber reinforced, felt backed.
1. Products: Subject to compliance with requirements, provide the following:
 - a. Sarnafil Inc.; Sarnafil G410 felt backed. (NOA No. 15-0731.12).
 2. Thickness: 72 mils nominal.
 3. Exposed Face Color: White.
- C. KEE Sheet: ASTM D 6754, fabric reinforced, felt backed.
1. Products: Subject to compliance with requirements, provide the following:
 - a. Seaman Corporation; FiberTite-XT fleece backed. (NOA No. 15-1026.09).
 2. Thickness: 50 mils nominal.
 3. Exposed Face Color: White.

2.1 AUXILIARY MEMBRANE ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.

- c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Single-Ply Roof Membrane Adhesives: 250 g/L.
 - f. Single-Ply Roof Membrane Sealants: 450 g/L.
 - g. Nonmembrane Roof Sealants: 300 g/L.
 - h. Sealant Primers for Nonporous Substrates: 250 g/L.
 - i. Sealant Primers for Porous Substrates: 775 g/L.
 - j. Other Adhesives and Sealants: 250 g/L.
- B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as sheet membrane.
- C. Bonding Adhesive: Manufacturer's standard, urethane- or solvent-based adhesive in low VOC formulation.
- D. Edge Metal: Heat-weldable metal sheet, formed from manufacturer's standard unsupported thermoplastic sheet membrane, not less than 30 mils thick, laminated to 0.022-inch-thick G90 galvanized steel sheet, and capable of being formed into a variety of shapes and profiles.
- E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel bars, approximately 1 by 1/8-inch-thick; with anchors.
- F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.2 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by thermoplastic membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, glass-fiber mat facer on both major surfaces.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Sarnafil Inc.
 - b. Seaman Corporation.
 - 2. Compressive Strength: 20 psi.
 - 3. Size: 48 by 48 inches.
 - 4. Thickness:
 - a. Base Layer: Not less than 1-1/2 inches.
 - b. Upper Layer: As required to meet specified R-value.
 - 5. Tapered Insulation: Provide factory-tapered insulation boards Material: Match specified roof insulation.
 - 6. Minimum Thickness: 1/4 inch.

7. Slope:
 - a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.
- C. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.3 INSULATION ACCESSORIES

- A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
 1. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
- D. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum board or ASTM C 1278/C 1278M fiber-reinforced gypsum board.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Georgia-Pacific Gypsum LLC.
 - b. National Gypsum Company.
 - c. USG Corporation.
 2. Thickness: 1/2 inch.
 3. Surface Finish: Factory primed.

2.4 WALKWAYS

- A. Flexible Walkways: Factory-formed, double layer, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, maximum 36 inches (914 mm) wide, approximately 3/16 inch (5 mm) thick and acceptable to roofing system manufacturer; contrasting color or visually distinctive from roof membrane; minimum 3 inch gap between pads to allow drainage.
 1. Products:
 - a. Crossgrip XTRA; Sika USA
 - b. FTR Crossgrip; Seaman Corporation

2.5 ROOF SYSTEM AND COMPONENT ASSEMBLY PROTECTION

- A. All roof components and component system installations shall be fully protected against puncture, marring and other damage by materials, personnel, equipment, temporary supports or any other materials, equipment or other construction activities for the full duration of construction and until Final Completion.

- B. Protection shall consist of a minimum of 1-inch thick extruded polystyrene board insulation, ASTM C578, Type IV with 3/4-inch CDX plywood cover for the entire roof area where construction activities occur.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements and other conditions affecting performance of the work.
 - 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof drain bodies are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100.
 - 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 - 5. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than 75 percent, or as recommended by roofing system manufacturer, when tested according to ASTM F 2170.
 - a. Test Frequency: One test probe per each 1000 sq. ft. (93 sq. m), or portion thereof, of roof deck, with no fewer than three test probes.
 - b. Submit test reports within 24 hours of performing tests.
 - 6. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
 - 7. Verify that joints in precast concrete roof decks have been grouted flush with top of concrete.
 - 8. Verify that adjacent cementitious wood fiber panels are vertically aligned to within 1/8 inch (3.2 mm) at top surface.
- B. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 ROOFING INSTALLATION

- A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Coordinate installation and transition of roofing system component serving as an air barrier with specified air barriers.

3.4 INSULATION INSTALLATION

- A. Coordinate installing roofing system components, so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install insulation under area of roofing in thickness required to achieve a minimum thermal resistance value of R-30, except at sumps surrounding roof drains.
 - 1. Install insulation in two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
- D. Installation Over Metal Decking:
 - 1. Install roof substrate board over metal decking as indicated herein.
 - 2. Install fully adhered vapor retarder over substrate board.
 - 3. Install fully adhered layers of insulation with end joints staggered not less than 12 inches in adjacent rows and with long joints continuous at right angle to flutes of decking.
 - a. Locate end joints over crests of decking.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
 - d. Fill gaps exceeding 1/4 inch with spray in place foam insulation compatible with board materials.
 - e. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
 - f. Adhere base layer of insulation to substrate board using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - 4. Install upper layer of insulation and tapered insulation with joints of each layer offset not less than 24 inches from previous layer of insulation.
 - a. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than 1/4 inch in width.

- d. Fill gaps exceeding 1/4 inch with spray in place foam insulation compatible with board materials.
- e. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- f. Adhere additional layers of insulation to base layer using adhesive according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:
 - 1) Set additional layers of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining coverboard in place.

3.5 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining boards in place.

3.6 ADHERED MEMBRANE ROOFING INSTALLATION

- A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.
- B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.
- C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Membrane Adhesive: Apply to substrate at rate required by manufacturer, and install fabric- or fleece-backed roof membrane.
- E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.
- F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
- G. Contractor shall ensure installation of membrane is free of wrinkles, fish-mouths or other anomalies in all membranes, related flashings and accessories.
- H. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane as required by manufacturer.
 2. Verify field strength of seams a minimum of twice daily and repair seam sample areas. Retain seam samples for review by Owner, Architect and manufacturer's representative. Samples shall be marked with date and location typical.
 3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
- I. Apply approved urethane sealant over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

3.7 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.8 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated and as follows. Loose lay or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions for compliance with RoofNav Assembly and uplift requirements.
 1. For loose laid walkways, provide 2-inch-wide heat welded tabs field fabricated from PVC membrane at regular intervals to prevent dislocation of the walkway materials. Place tabs on both sides of walkway at each end and at segment centers. Loop tabs through openings of the walkway products and heat weld to PVC roof membrane.
 2. Install flexible walkways at the following locations and as indicated on Drawings:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder and ships' ladder.
 - e. Between each roof access ladder, Ships' Ladder and each rooftop unit location or path connecting rooftop unit locations
 - f. As required by roof membrane manufacturer's warranty requirements.
 - g. Provide 6-inch clearance between adjoining pads and rolls.

3.9 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: At the start of the installation, periodically as the Work progresses, and after completion, furnish the services of the roofing manufacturer's technical representative at the job site as necessary to advise on every phase of the Work. As a minimum, furnish full-time attendance during the first 2 work days, at least once every week during installation, and furnish technical assistance to the Installer as may be required. The representative shall examine the roofing substrates before installation of the vapor retarder; and examine the completed vapor retarder installation before it is covered.
1. Vapor retarder: Inspect the vapor retarder prior to and during installation to assure substrate is properly prepared to receive the vapor retarder, full adhesion and manufacturer's quality requirements are maintained throughout the installation period. If vapor retarder is utilized as a temporary roof, the manufacturer's representative shall inspect the vapor retarder prior to the installation of the remaining roof assembly to ensure the integrity of the vapor retarder system. Perform any and all repairs recommended by the manufacturer's representative prior to continuing installation.
 - a. Provide indicated roof protection as required by this Section for all areas of installed vapor retarder and temporary roof components.
 - b. All penetrations and identified possible breach points shall be repaired by the Contractor at no additional cost to the project.
 - c. Significant breach points or other anomalies noted during the review of the vapor retarder may require an additional layer of vapor retarder to be provided by the Contractor at no additional cost to the project as determined by the Architect in consultation with the roofing system manufacturer's representative.
 2. Fastener Tests: Manufacturer's representative shall witness Contractor perform two fastener pull out tests per SPRI FX-1 test procedure to verify the integrity of the roofing fasteners and compliance with required performance criteria.
 3. Securement Tests: Perform two membrane adhesive pull tests according to SPRI IA-1 to verify the integrity of the roof membrane adhesive and compliance with the required performance criteria.
 4. Field Seams: Inspect the field seams to assure manufacturer's quality requirements are maintained throughout the installation period. Each field seam shall be 100% inspected and a written report prepared by the roofing manufacturer's technical representative shall be submitted for review prior to final acceptance.
 5. Coordinate final inspections by the roofing membrane Manufacturer shall be coordinated at least two weeks in advance with the Owner, Architect, and roofing consultant so that their attendance can be properly coordinated. Final inspection reports and signed, completed punch list reports by the Manufacturer shall be submitted to the Owner. Submittal of the roofing warranty alone is not acceptable.
- B. Testing Agency: Engage a qualified testing agency to perform tests and to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components, and to furnish reports to Architect.
1. Electronic Field Vector Mapping: Immediately upon completion of the roof system installation the Testing Agency shall survey entire roof area for potential leaks using

electronic field vector mapping. Installer shall inform roofing manufacturer, Architect and Owner's representative of the schedule date for EFVM testing.

2. Installer shall make repairs as recommended by the roofing system manufacturer's recommendations to uphold the warranty at no additional cost to the project.
- C. A roof inspection is required by manufacturer before warranty issue. Revise scope of inspection and source of report to a qualified roofing consultant or an independent testing agency and inspection if preferred.
 - D. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
 - E. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements at no additional cost to the project.
 - F. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.10 PROTECTING AND CLEANING

- A. Roof system and component protection installation:
 1. Protect all roof components and partial system installations against puncture and other damage by materials, material staging and transportation, personnel, equipment, temporary supports or any other materials, equipment or other construction activities for the full duration of construction and until Final Completion. Components shall include but not be limited to the vapor retarder or any portion thereof.
 2. Lay specified insulation board over installed roof system or related components for full area. Utilize full size boards without mechanical fasteners or adhesive. Stagger all seams at half-board running bond type pattern and cover with 3/4-inch CDX plywood as specified. Plywood cover shall also be placed with staggered seams at half-board running bond type pattern without mechanical fasteners or adhesive. Ensure seams of insulation and plywood are no greater than 1/8 inch in all areas. Provide sand bag weights at seams or other intervals to guard against uplift and shifting of protection materials. Protection shall remain in place for the duration of all construction activities.
 3. When protection is removed, the entire area shall be swept to collect and remove fasteners and other small items which may cause penetrations in the roofing system or components. Remove all foreign items from the roof area and provide thorough cleaning to remove any deleterious items, marring, surface defects or discoloration of the finished system.
- B. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- C. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a

condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

- D. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manufactured through wall flashing.
2. Manufactured reglets with counterflashing.
3. Formed roof drainage sheet metal fabrications including scuppers.
4. Formed low slope roof sheet metal fabrications.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data for each type of product including construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Shop Drawings: Submit plans, elevations, sections, and attachment details.
1. Detail fabrication and installation layouts, expansion joint locations, and keyed details. Distinguish between shop and field assembled work.
 2. Include identification of material, thickness, weight, and finish for each item and location in Project.
 3. Include details for forming, including profiles, shapes, seams, and dimensions.
 4. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 5. Include details of termination points and assemblies.
 6. Include details of expansion joints and expansion joint covers, including showing direction of expansion and contraction from fixed points.
 7. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 8. Include details of special conditions.
 9. Include details of connections to adjoining work.
 10. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches (1:10).
- C. Finish Samples: To match each color and finish of sheet metal flashing and trim of existing building.
1. Sheet Metal Material: 12 inches (300 mm) by 12 inches (300 mm), of each color and finish.
- D. Samples: Submit for each type of exposed finish, based on approved finish samples.
1. Sheet Metal Flashing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
 2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.
 3. Unit Type Accessories and Miscellaneous Materials: Full size Sample.
 4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit data for fabricator.
- B. Product Test Reports: Submit reports for each product, for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Submit data for sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Fabricator having minimum 5 years documented experience who employs skilled workers trained to custom fabricate sheet metal flashing and trim similar to that required.
 - 1. For roof edge flashings that are SPRI ES-1 tested and FM Approvals approved, shop shall be listed as able to fabricate required details as tested and approved.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.
- C. Preinstallation Conference: Conduct conference at site.
 - 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review special roof details, roof drainage, roof penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
 - 3. Review requirements for insurance and certificates if applicable.
 - 4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.6 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.8 WARRANTY

- A. Finishes Warranty: Written warrant signed by Manufacturer in which Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA The NRCA Roofing Manual and SMACNA Architectural Sheet Metal Manual requirements for dimensions and profiles shown unless more stringent requirements are indicated.
 - 1. Design Pressure: Top of Parapet up to 50 feet above grade.
 - a. Horizontal: 64.5 lb/sq. ft. at perimeter and 79.6 lb/sq.ft. at corner
 - b. Vertical: 99.7 lb/sq. ft.. at perimeter and 150 lb/sf.tf. at corner
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

2.2 MATERIALS

- A. Metal Finishes: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Metallic Coated Steel Sheet: Provide zinc coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 (Z275) coating designation); pre-painted by coil coating process to comply with ASTM A 755/A 755M.
 - 1. Surface: Smooth, flat.
 - 2. Exposed Coil Coated Finish: To match existing.
 - a. Three Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Mica Fluoropolymer: AAMA 621. Two coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

- c. Metallic Fluoropolymer: AAMA 621. Three coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - d. FEVE Fluoropolymer: AAMA 621. Two coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - e. Siliconized Polyester: Epoxy primer and silicone modified, polyester enamel topcoat; with dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
3. Color: Selected by Architect, to match existing.
- C. Stainless Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 316, dead soft, fully annealed; with smooth, flat surface.
1. Finish: 3 (coarse, polished directional satin).
 - a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- D. Underlayment Materials
1. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt saturated organic felt; nonperforated.
 2. Self-Adhering, High Temperature Sheet: Minimum 30 mils (0.76 mm) thick, consisting of a slip resistant polyethylene or polypropylene film top surface laminated to a layer of butyl or SBS modified asphalt adhesive, with release paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Carlisle Metal Products.
 - 2) GCP Applied Technologies Inc.
 - 3) Henry Company.
 - 4) Polyguard Products, Inc.
 - b. Thermal Stability: ASTM D 1970; stable after testing at 240 degrees F (116 degrees C) or higher.
 - c. Low Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 degrees F (29 degrees C) or lower.
 3. Slip Sheet: Rosin sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum.
- E. Miscellaneous Materials: Provide materials and types of fasteners, protective coatings, sealants, and miscellaneous items necessary for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
1. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
 - a. Blind fasteners or self-drilling screws, gasketed, with hex washer head.
 - 1) Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory applied coating. Provide metal backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - c. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.

2. Sealant Tape: Pressure sensitive, 100 percent solids, polyisobutylene compound sealant tape with release paper backing. Provide permanently elastic, nonsag, nontoxic, non-staining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
3. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight. Refer to Section 079200.
4. Butyl Sealant: ASTM C 1311, single component, solvent release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked type expansion joints with limited movement.
5. Bituminous Coating: Cold applied asphalt emulsion according to ASTM D 1187.

2.3 FABRICATION

- A. Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 2. Obtain field measurements for accurate fit before shop fabrication.
 3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8 inch (3 mm) offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, non-expansion type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.
- G. Seams: Fabricate nonmoving seams with flat lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- H. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4 inch (100 mm) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fabricate from the following materials:
 1. Galvanized Steel: 0.028 inch (0.71 mm) thick.
 2. Metallic Coated Steel Sheet, as specified within this Section.

2.4 LOW SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof to Wall Transition: Fabricate from the following materials: Shop fabricate interior and exterior corners.
 - 1. Stainless Steel: 0.025 inch (0.64 mm) thick.
- B. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
 - 1. Stainless Steel: 0.019 inch (0.48 mm) thick.
- C. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
 - 1. Stainless Steel: 0.019 inch (0.48 mm) thick.
- D. Flashing Receivers: Fabricate from the following materials:
 - 1. Stainless Steel: 0.016 inch (0.40 mm) thick.
- E. Roof Penetration Flashing: Fabricate from the following materials:
 - 1. Stainless Steel: 0.019 inch (0.48 mm) thick.
- F. Roof Drain Flashing: Fabricate from the following materials:
 - 1. Stainless Steel: 0.016 inch (0.40 mm) thick.

2.5 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:
 - 1. Stainless Steel: 0.019 inch (0.48 mm) thick.
- B. Overhead Piping Safety Pans: Fabricate from the following materials:
 - 1. Stainless Steel: 0.025 inch (0.64 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 3. Verify air or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation after correcting unsatisfactory conditions.

3.2 UNDERLAYMENT INSTALLATION

- A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).
- B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions

of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.

- C. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

3.3 SHEET METAL FABRICATION INSTALLATION

- A. Sheet Metal Fabrications: Anchor sheet metal flashing and trim and other components of the work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 - 5. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
 - 1. Coat concealed side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
 - 2. Use lapped expansion joints where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
 - 1. Use sealant filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 degrees F and 70 degrees F (4 degrees C and 21 degrees C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant type joints at temperatures below 40 degrees F (4 degrees C).
 - 2. Prepare joints and apply sealants to comply with requirements in Section 079200.

3.4 ROOF FLASHING INSTALLATION

- A. Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing: Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
 - 1. Anchor to resist uplift and outward forces according to recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.
- C. Pipe or Post Counterflashing: Install counterflashing umbrella with close fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches (100 mm) over base flashing. Install stainless steel draw band and tighten.
- D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints minimum of 4 inches (100 mm).
 - 1. Secure in waterproof manner by means of anchor and washer at 12-inch (305 mm) centers along perimeter and 6 inches (150 mm) o.c. at corners areas unless otherwise indicated.
- E. Roof Penetration Flashing: Coordinate installation of roof penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.
- B. Overhead Piping Safety Pans: Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.

3.6 INSTALLATION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8 inch (3 mm) offset of adjoining faces and of alignment of matching profiles.
- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA Guide Specification for Residential Metal Roofing.

3.7 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.

- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 71 00 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manufactured copings.
 - 2. Manufactured reglets and counterflashings.

1.2 ACTION SUBMITTALS

- A. Product Data: Submit technical data, including construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Submit plans, elevations, expansion joint locations, keyed details, and attachments to other work. Distinguish between plant and field assembled work.
 - 1. Submit details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
 - 2. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
 - 3. Submit detail termination points and assemblies, including fixed points.
 - 4. Indicate details of special conditions.
- C. Samples: Submit Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.
 - 1. Include copings, reglets and counterflashings made from 12-inch (300 mm) lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit data for manufacturer.
- B. Product Certificates: Submit certificated for each type of roof specialty supporting compliance with requirements.
- C. Product Test Reports: For copings, for tests performed by a qualified testing agency.
- D. Florida Product Approval (FL) or Miami-Dade County Product Notice of Acceptance (NOA): For roof edge termination systems.
 - 1. Impact Resistance Data: Manufacturer's current Product Approval Notice indicating product acceptance in accordance with requirements of the Florida Building Code TAS 201, TAS 202, and TAS 203 or Miami-Dade PA 201, PA 202, PA203, and High Velocity Hurricane Zone. Notice of Approval shall indicate a product control number, expiration date of approval, and the specific conditions governing the approval.
 - 2. Impact Resistance Requirements: Meet impact tests as outlined in the Florida Building Code.
 - a. Large missile impact test (up to and including 30 feet in height).
 - b. Small missile impact test (above 30 feet in height).

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Manufacturer/Fabricator Qualifications: Entity having minimum 5-years' experience in the production of roof specialties whose products comply with requirements and are FM Approvals listed for specified class and SPRI ES-1 tested to specified design pressure.
- B. Source Limitations: Obtain roof specialties approved by manufacturer providing roofing system warranty.
- C. Preinstallation Conference: Conduct conference at site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof specialty substrates by field measurements before fabrication; indicate measurements on Shop Drawings.
- B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.8 WARRANTY

- A. Roof System Warranty: Written warranty signed by manufacturer in which roof specialties are included in the roofing warranty provisions.
- B. Painted Finishes: Written warrant signed by manufacturer in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

- B. FM Approvals' Listing: Manufacture and install copings that are listed in FM Approvals' RoofNav and approved for windstorm classification, Class 1-120. Identify materials with FM Approvals' markings.
- C. SPRI Wind Design Standard: Manufacture and install copings tested according to SPRI ES-1 and capable of resisting the following design pressures:
 - 1. Design Pressure: Top of Parapet up to 50 feet above grade.
 - a. Horizontal: 64.5 lb/sq. ft. at perimeter and 79.6 lb/sq.ft. at corner
 - b. Vertical: 99.7 lb/sq. ft.. at perimeter and 150 lb/sf.tf. at corner
- D. Thermal Movements: Allow for thermal movements from ambient and surface Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

2.2 MATERIALS

- A. Metals:
 - 1. Zinc Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation.
 - 2. Stainless Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.
- B. Underlayment Materials:
 - 1. Self-Adhering, High Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip resisting polyethylene film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Carlisle Coatings & Waterproofing; CCW WIP 300HT.
 - 2) GCP Applied Technologies; Ultra.
 - 3) Henry Company; Blueskin PE200 HT.
 - 4) Metal-Fab Manufacturing, LLC; MetShield.
 - 5) Owens Corning; WeatherLock Specialty Tile & Metal Underlayment.
 - b. Thermal Stability: ASTM D 1970/D 1970M; stable after testing at 240 degrees F (116 degrees C).
 - c. Low Temperature Flexibility: ASTM D 1970/D 1970M; passes after testing at minus 20 degrees F (29 degrees C).
 - 2. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt saturated organic felt, nonperforated.
 - 3. Slip Sheet: Rosin sized building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum.
- C. Miscellaneous Materials:
 - 1. Fasteners: Fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 - a. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 - b. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
 - c. Fasteners for Zinc Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot dip zinc coated steel according to ASTM A 153/A 153M or ASTM F 2329.

2. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing specialty manufacturer for each application.
3. Butyl Sealant: ASTM C 1311, single component, solvent release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked type joints with limited movement.
4. Bituminous Coating: Cold applied asphalt emulsion complying with ASTM D 1187/D 1187M.
5. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.3 COPINGS

- A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet (3.6 m), concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hickman Company, W. P. (NOA No. 11-0929.08).
 - b. Metal-Era, Inc. (NOA No. 13-0419.03).
 - c. Petersen Aluminum Corporation (NOA No. 13-0909.15).
 2. Metallic Coated Steel Sheet Coping Caps: Zinc coated (galvanized) steel, nominal thickness required to meet performance requirements.
 - a. Surface: Smooth, flat finish.
 - b. Finish: Two coat fluoropolymer
 - c. Color: Selected by Architect, to match existing.
 3. Corners: Factory mitered and continuously welded.
 4. Coping Cap Attachment Method: Snap on, fabricated from coping cap material.
 - a. Snap on Coping Anchor Plates: Concealed, galvanized steel sheet, 12 inches (300 mm) wide, with integral cleats.

2.4 REGLETS AND COUNTERFLASHINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. ATAS International, Inc.
 2. Castle Metal Products.
 3. Cheney Flashing Company.
 4. Fry Reglet Corporation.
 5. Heckmann Building Products, Inc.
 6. Hickman Company, W. P.
 7. Metal-Era, Inc.
 8. Metal-Fab Manufacturing.
- B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
 1. Stainless Steel: 0.025 inch (0.64 mm) thick.
 2. Corners: Factory mitered and continuously welded.
 3. Surface Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 4. Concrete-Type Embedded: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.

5. Masonry-Type Embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.
- C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches (100 mm) and in lengths not exceeding 12 feet (3.6 m) designed to snap into reglets and compress against base flashings with joints lapped, from the following exposed metal:
 1. Stainless Steel: 0.025 inch (0.64 mm) thick.
- D. Accessories:
 1. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
 2. Counterflashing Wind Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
- E. Finish:
 1. Zinc Coated Steel Finish: Two coat fluoropolymer
 - a. Color: Selected by Architect, to match existing.
 2. Stainless Steel Finish: No. 4 (bright, polished directional satin).

2.5 FINISHES

- A. Comply with NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Coil Coated Galvanized Steel Sheet Finishes:
 1. High Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with ASTM A 755/A 755M and coating and resin manufacturers' written instructions.
 - a. Two Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Concealed Surface Finish: Apply pretreatment and acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions to verify actual locations, dimensions, and other conditions affecting performance of the work.
 1. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.

- B. Proceed with installation after correcting unsatisfactory conditions.

3.2 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.
 - 1. Apply continuously under copings and reglets and counterflashings.
 - 2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.
- B. Felt Underlayment: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).
- C. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

3.3 INSTALLATION

- A. Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof specialty systems.
 - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - 3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 - 4. Torch cutting of roof specialties is not permitted.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of stainless-steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 - 1. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise indicated on Drawings.
 - 2. When ambient temperature at time of installation is between 40 degrees F and 70 degrees F (4 degrees C and 21 degrees C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal concealed joints with butyl sealant as required by roofing specialty manufacturer.

- F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 degrees F (4 degrees C).

3.4 COPING INSTALLATION

- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.
 - 1. Interlock face and back leg drip edges of snap on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements.

3.5 ROOF EDGE SPECIALITIES INSTALLATION

- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.6 REGLET AND COUNTERFLASHING INSTALLATION

- A. Coordinate installation of reglets and counterflashings with installation of base flashings.
- B. Embedded Reglets: Refer to Section 04 22 00 for installation of reglets.
- C. Surface Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches (100 mm) over top edge of base flashings.
- D. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches (100 mm) over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.7 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 71 29 - MANUFACTURED ROOF EXPANSION JOINTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Waterproof roof expansion joints.
 - 2. Flanged bellows roof expansion joint.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data for each type of product including construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Submit plans, elevations, sections, and attachment details for each expansion joint.
 - 1. Submit details of splices, intersections, transitions, fittings, method of field assembly, and location and size of each field splice.
 - 2. Provide isometric drawings of intersections, terminations, changes in joint direction or planes, and transition to other expansion joint systems depicting how components interconnect with each other and adjacent construction to allow movement and achieve waterproof continuity.
- C. Samples: Submit for each exposed product and for each color specified, 6 inches (150 mm) in size.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit data for Installer.
- B. Product Test Reports: Submit reports for each fire barrier provided as part of a roof expansion joint assembly, for tests performed by a qualified testing agency.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Installer of roofing membrane, having minimum 5 years documented experience, who is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product, and is eligible to receive manufacturer's warranty.
- B. Source Limitations: Provide each type of roof expansion joints that are approved by the roofing manufacturer and are part of roofing membrane warranty.
- C. Preinstallation Conference: Conduct conference at site.

1.5 WARRANTY

- A. Written warranty signed by manufacture in which manufacturer and Installer agree to repair or replace roof expansion joints and components that leak, deteriorate beyond normal weathering, or otherwise fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint seals, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

2.2 WATERPROOF ROOF EXPANSION JOINT

- A. Provide watertight, expansion joint in roof deck and roofing system. System shall perform waterproofing and movement-accommodation functions as the result of a single installation and without the addition of gutters, vapor barriers, bladders, or other devices suspended beneath or within the system.
 - 1. System shall be comprised of the following components:
 - a. heat weldable, PVC flexible alloy with dual-level flange.
 - b. manufacturer supplied termination bar and anchors
 - c. Factory welded downturn transition in the joint sealed at a ship-lapped 45-degree angle to mate with an interlocking factory-fabricated joint transition piece.
 - 2. Basis of Design: RJ-0400 RoofJoint by Emseal or approved equal; Provide Emshield DFR or approved equal insert for fire rating to match roof assembly.
 - 3. Color: White
- B. Materials
 - 1. Stainless Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.
 - 2. PVC Membrane: ASTM D 4434/D 4434M, type recommended by manufacturer for application.

2.3 MISCELLANEOUS MATERIALS

- A. Adhesives: Recommended by roof expansion joint manufacturer.
- B. Fasteners: Recommended fasteners, suitable for application and designed to withstand design loads.
 - 1. Exposed Fasteners: Gasketed. Use screws with hex washer heads matching color of material being fastened.
- C. Mineral Fiber Blanket: ASTM C 665.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joint openings, substrates, and expansion control joint systems that interface with roof expansion joints, for suitable conditions where roof expansion joints will be installed.
- B. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for handling and installing roof expansion joints.
 - 1. Anchor roof expansion joints securely in place, with provisions for required movement. Use fasteners, protective coatings, sealants, and miscellaneous items as required to complete roof expansion joints.
 - 2. Install roof expansion joints true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 - 3. Provide for linear thermal expansion of roof expansion joint materials.
 - 4. Provide uniform profile of roof expansion joint throughout its length; do not stretch or squeeze membranes.
 - 5. Provide uniform, neat seams.
 - 6. Install roof expansion joints to fit substrates and to result in watertight performance.
- B. Directional Changes: Install factory fabricated units at directional changes to provide continuous, uninterrupted, and watertight joints.
- C. Transitions to Other Expansion Control Joint Assemblies: Coordinate installation of roof expansion joints with other exterior expansion control joint assemblies specified in Section 079513 to result in watertight performance. Splices: Splice roof expansion joints to provide continuous, uninterrupted, and waterproof joints.
- D. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

END OF SECTION

SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Equipment supports.
 2. Roof hatches.
 3. Roof hatch safety railing.
 4. Pipe and duct supports.
 5. Pipe portals.
 6. Preformed flashing sleeves.
 7. Wind-restraints for rooftop installed equipment and materials.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data for each type of roof accessory including construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Submit plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant and field assembled work.
- C. Samples: Submit for each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof mounted items. Show the following:
1. Size and location of roof accessories.
 2. Method of attaching roof accessories to roof or building structure.
 3. Other roof mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
 4. Required clearances.
- B. Miami-Dade County Product Notice of Acceptance (NOA): For roof hatches.
1. Impact Resistance Data: Manufacturer's current Product Approval Notice indicating product acceptance in accordance with requirements of the Florida Building Code TAS 201, TAS 202, and TAS 203 or Miami-Dade PA 201, PA 202, PA203, and High Velocity Hurricane Zone. Notice of Approval shall indicate, as minimum, product control number, expiration date of approval, and the specific conditions governing the approval.
 2. Impact Resistance Requirements: Meet impact tests as outlined in the Florida Building Code.
 - a. Large missile impact test (up to and including 30 feet in height).
 - b. Small missile impact test (above 30 feet in height).

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.5 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough in information or Shop Drawings of equipment to be supported.

1.6 WARRANTY

- A. Guard Railings and Fall Protection: Written warranty signed by manufacturer's in which manufacturer agrees to repair or replace guard rails and components of fall protection equipment that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 5 years from date of Substantial Completion.
- B. Painted Finishes: Written warranty signed by manufacturer in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

2.2 METAL MATERIALS

- A. Zinc Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation.
- B. Exposed Coil Coated Finish: Prepainted by coil coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Two Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 - 2. Concealed Finish: Pretreat with white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil (0.013 mm).
- C. Aluminum Zinc Alloy Coated Steel Sheet: ASTM A 792/A 792M, AZ50 (AZM150) coated.
 - 1. Exposed Coil Coated Finish: Prepainted by the coil coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

2. Concealed Finish: Pretreat with white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil (0.013 mm).
- D. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy for finish required, with temper to suit forming operations and performance required.
 1. Exposed Coil Coated Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two Coat Fluoropolymer Finish: AAMA 620. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 2. Concealed Finish: Pretreat with white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil (0.013 mm).
- E. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), alloy and temper for type of use, finished to match assembly where used, otherwise mill finished.
- F. Stainless Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.
- G. Steel Shapes: ASTM A 36/A 36M, hot dip galvanized according to ASTM A 123/ A 123M unless otherwise indicated.

2.3 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Glass Fiber Board Insulation: ASTM C 726, thickness as indicated.
- C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.
- D. Bituminous Coating: Cold applied asphalt emulsion complying with ASTM D 1187.
- E. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 1. Fasteners for Zinc Coated or Aluminum Zinc Alloy Coated Steel: Series 300 stainless steel.
 2. Fasteners for Aluminum Sheet: Series 300 stainless steel.
 3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
- F. Gaskets: Tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- G. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
- H. Butyl Sealant: ASTM C 1311, single component, solvent release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

2.4 ROOF CURBS

- A. Roof Curbs: Internally reinforced roof curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck mounting flange at perimeter bottom.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AES Industries, Inc.
 - b. Bristolite Daylighting Systems, Inc.
 - c. Curbs Plus, Inc.
 - d. Custom Solution Roof and Metal Products.
 - e. Greenheck Fan Corporation.
 - f. LMCurbs.
 - g. Metallic Products Corp.
 - h. Milcor; Commercial Products Group of Hart & Cooley, Inc.
 - i. Pate Company (The).
 - j. Roof Products, Inc.
 - k. Thybar Corporation.
 - l. Vent Products Co., Inc.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Supported Load Capacity: Shall be coordinated by the Contractor for all equipment to be supported.
- D. Material: Zinc coated (galvanized) steel sheet, 0.079 inch (2.01 mm) thick minimum and sized to meet load capacity.
1. Finish: Mill phosphatized
 2. Color: Selected by Architect.
- E. Construction:
1. Curb Profile: Profile indicated on Drawings compatible with roofing system.
 2. Fabricate curbs to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.
 3. Top Surface: Level top of curb, with roof slope accommodated
 4. Insulation: Factory insulated with 1-1/2 inch (38 mm) thick glass fiber board insulation.
 5. Liner: Same material as curb, of manufacturer recommended thickness and finish.
 6. Nailer: Factory installed wood nailer under top flange on side of curb, continuous around curb perimeter.
 7. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb, of size and spacing required to meet wind uplift requirements.
 8. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from 3/4 inch (19 mm) thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
 9. Metal Counterflashing: Removable, fabricated of same metal and finish as curb.
 10. Security Grille: Provide for all units.

2.5 MECHANICAL EQUIPMENT SUPPORTS

- A. Equipment Supports: Internally reinforced metal equipment supports capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, and integrally formed deck mounting flange at perimeter bottom.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AES Industries, Inc.
 - b. Curbs Plus, Inc.
 - c. Custom Solution Roof and Metal Products.
 - d. Greenheck Fan Corporation.
 - e. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
 - f. Pate Company (The).
 - g. Roof Products, Inc.
- B. Size: Coordinate dimensions with roughing in information or Shop Drawings of equipment to be supported.
- C. Material: Zinc coated (galvanized) or aluminum zinc alloy coated steel sheet, 0.052 inch (1.32 mm) thick.
1. Finish: Baked enamel or powder coat.
 2. Color: White.
- D. Construction:
1. Insulation: Factory insulated with 1-1/2 inch (38 mm) thick glass fiber board insulation.
 2. Liner: Same material as equipment support, of standard thickness and finish.
 3. Factory installed continuous wood nailers 3-1/2 inches (90 mm) wide at tops of equipment supports.
 4. Metal Counterflashing: Removable, fabricated of same metal and finish as equipment support.
 5. On ribbed or fluted metal roofs, form deck mounting flange at perimeter bottom to conform to roof profile.
 6. Fabricate equipment supports to minimum height of 8 inches (200 mm) above finished roof membrane unless otherwise indicated.
 7. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb, of size and spacing required to meet wind uplift requirements.

2.6 ROOF HATCH

- A. Roof Hatches: Metal roof hatch units with lids and insulated single walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid to curb counterflashing and weathertight perimeter gasketing, straight sides and integrally formed deck mounting flange at perimeter bottom.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bilco Company (The).
 - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - c. Milcor; Commercial Products Group of Hart & Cooley, Inc.
 - d. O'Keeffe's Inc.
 - e. Pate Company (The).
 - f. Precision Ladders, LLC.
 - g. Williams Bros. Corporation of America (The).
- B. Type and Size: Single leaf lid, 30 inches by 36 inches (750 mm by 900 mm).

- C. Loads: Minimum 40-lbf/sq. ft. (1.9-kPa) external live load and 20-lbf/sq. ft. (0.95-kPa) internal uplift load.
- D. Hatch Material: Stainless steel sheet.
 - 1. Thickness: Manufacturer recommended thickness for hatch size indicated, 0.078 inch (1.98 mm), minimum.
 - 2. Finish: No. 2D, directional polish finish.
- E. Construction:
 - 1. Insulation: Polyisocyanurate board.
 - a. R-Value: 12.0 according to ASTM C 1363.
 - 2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's recommended metal liner of same material and finish as outer metal lid.
 - 3. Fabricate curbs to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.
- F. Hardware: Spring operators, hold open arm, stainless steel spring latch with turn handles, stainless steel butt or pintle type hinge system, and padlock hasps inside and outside.
- G. Ladder Assist Post: Roof hatch manufacturer's recommended device for attachment to roof access ladder.
 - 1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
 - 2. Height: 42 inches (1060 mm) above finished roof deck.
 - 3. Material: Stainless steel.
 - 4. Post: 1-5/8-inch (41 mm) diameter pipe.
 - 5. Finish: Baked enamel or powder coat.
 - a. Color: Selected by Architect.

2.7 PIPE SUPPORTS

- A. Pipe Supports: Adjustable height, extruded aluminum tube, filled with urethane insulation; 2 inches (50 mm) in diameter; with aluminum baseplate, EPDM base seal, manufacturer's recommended hardware for mounting to structure or structural roof deck as indicated, and extruded aluminum carrier assemblies; suitable for quantity of pipe runs and sizes.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by Thaler Metal USA Inc.
 - 2. Pipe Support Height: Indicated on Drawings.
 - 3. Roller Assembly: With stainless steel roller, sized for supported pipes.
 - 4. Pipe Support Flashing: Sleeve flashing with integral base flange; aluminum sheet, 0.063 inch (1.60 mm) thick.
 - 5. Finish: Standard.
- B. Light Duty Pipe Supports: Extruded aluminum base assembly and Type 304 stainless steel roller assembly for pipe sizes indicated, including manufacturer's recommended load distributing baseplate.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by Thaler Metal USA Inc.
 - 2. Finish: Standard.

2.8 PIPE PORTALS

- A. Curb Mounted Pipe Portal: Insulated roof-curb units with welded or mechanically fastened and sealed corner joints, straight sides and integrally formed deck mounting flange at perimeter

bottom; with weathertight curb cover with single or multiple collared openings and pressure-sealed conically shaped EPDM protective rubber caps sized for piping indicated, with stainless-steel snaplock swivel clamps.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.

B. Flashing Pipe Portal: Formed aluminum membrane mounting flashing flange and sleeve with collared opening and pressure-sealed conically shaped EPDM protective rubber cap sized for piping indicated, with stainless-steel snaplock swivel clamps.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.

2.9 PREFORMED FLASHING SLEEVES

A. Exhaust Vent Flashing: Double walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches (300 mm) high, with removable metal hood and slotted metal collar.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Custom Solution Roof and Metal Products.

b. Thaler Metal USA Inc.

2. Metal: Aluminum sheet, 0.063 inch (1.60 mm) thick.

3. Diameter: As indicated.

4. Finish: Standard.

B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Custom Solution Roof and Metal Products.

b. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.

c. Thaler Metal USA Inc.

2. Metal: Aluminum sheet, 0.063 inch (1.60 mm) thick.

3. Height: 13 inches (330 mm).

4. Diameter: As indicated.

5. Finish: Standard.

2.10 FINISH REQUIREMENTS

A. Comply with NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 EXAMINATION

A. Examine substrates, areas, and conditions to verify actual locations, dimensions, and other conditions affecting performance of the work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation after correcting unsatisfactory conditions.

2.12 INSTALLATION

- A. Install roof accessories according to manufacturer's written instructions.
 - 1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 - 3. Use fasteners, separators, sealants, and miscellaneous items necessary to complete installation of roof accessories and fit them to substrates.
 - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum and stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Roof Curb Installation: Install each roof curb so top surface is level.
- D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.
- E. Roof Hatch Installation:
 - 1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
 - 2. Attach ladder assist post according to manufacturer's written instructions.
- F. Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.
 - 1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
- G. Preformed Flashing Sleeve and Flashing Pipe Portal Installation: Secure flashing sleeve to roof membrane according to flashing sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.
- H. Seal joints with elastomeric sealant as required by roof accessory manufacturer.

2.13 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.

- B. Touch up factory primed surfaces with compatible primer ready for field painting according to Section 09 91 13.
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.
- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 81 00 - APPLIED CEMENTITIOUS FIREPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sprayed fire resistive materials.
 - 2. Patching and repair of existing applied fireproofing.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data indicating component materials and dimensions and include construction and application details.
- B. Shop Drawings: Structural framing plans and schedules indicating:
 - 1. Extent of fireproofing for each construction and fire resistance rating.
 - 2. Applicable fire resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - 3. Minimum fireproofing thicknesses needed to achieve required fire resistance rating of each structural component and assembly.
 - 4. For existing applied fireproofing, indicate locations and types of surface preparations required before repairing applied fireproofing.
 - 5. Extent of sprayed fireproofing for each construction and fire resistance rating, including the following:
 - a. Applicable fire resistive design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - b. Minimum thickness necessary to achieve required fire resistance ratings of structural components and assemblies.
 - 6. Treatment of fireproofing after application.
- C. Samples: Submit for each exposed product and for each color and texture specified, 4 inches (102 mm) square in size.
- D. UL Design Numbers: Submit UL Design Numbers and required thickness and location for work.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit data for Installer.
- B. Product Certificates: Submit data for each type of fireproofing.
- C. Evaluation Reports: Submit ICC-ES reports for each type of fireproofing.
- D. Preconstruction Test Reports: Submit test report for fireproofing.
- E. Field quality control reports.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An entity or individual having minimum 5 years documented experience, who is certified, licensed, or qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

1. A manufacturer's willingness to sell its sprayed fire resistive materials to Contractor or installer engaged by Contractor does not in itself confer qualification on the buyer.
 - B. Technical Representation: Engage manufacturer's technical representative at the site to supervise patching and repair of sprayed resistive fireproofing materials.
 - C. Testing Laboratory Qualifications: Independent laboratory complying with ASTM E 699 and having experience and capability to conduct satisfactorily the testing indicated without delaying progress of the work.
 - D. Source Limitations: Obtain fireproofing from single source.
 - E. Mockups: Build mockups to verify selections, to establish quality standards for materials and execution, and for preconstruction testing.
 1. Build mockup of each type of fireproofing and different substrate and each required finish, in locations agreed upon with the Architect.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
 - F. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups of fireproofing.
 1. Field Mockup: In locations agreed to with the Architect.
 2. Patching of Fireproofing: When required by authorities having jurisdiction for existing repaired or patched fireproofing, engage a qualified testing agency to perform preconstruction testing on fireproofing.
 3. Provide test specimens and assemblies representative of proposed materials and construction.
 - G. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.
 1. Bond/Adhesion Strength: Test for cohesive and adhesive strength according to ASTM E 736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified.
 2. Density: Test for density according to ASTM E 605. Provide density indicated in referenced fire resistance design, but not less than minimum specified.
 3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with fireproofing.
 4. Schedule sufficient time for testing and analyzing results to prevent delaying the work.
 5. For materials failing tests, obtain applied fireproofing manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.
 - H. Preinstallation Conference: Conduct conference at site.
 1. Review products, design ratings, restrained and unrestrained conditions, densities, thickness, bond strengths, and other performance requirements.
- 1.5 COORDINATION
- A. Sequence and coordinate application of sprayed fireproofing with other related work specified elsewhere to comply with the following requirements:

1. Provide temporary enclosure if necessary to confine spraying operations and protect the environment.
2. Avoid unnecessary exposure of fire resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.
3. Do not apply fire resistive material to metal roof deck substrates until concrete topping, if any, has been completed. For metal roof decks without concrete topping, do not apply fire resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire resistive material.
4. Do not apply fire resistive material to metal floor deck substrates until concrete topping has been completed.
5. Do not install enclosing or concealing construction until after fire resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in original, unopened packages with intact and legible manufacturer labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire resistance ratings applicable to project.
- B. Use materials with limited shelf life within period indicated. Remove from site and discard materials whose shelf life has expired. Store materials inside, under cover, and aboveground; keep dry until ready for use. Remove from project site and discard wet or deteriorated materials.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 44 degrees F (7 degrees C) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or forced air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire resistance design and manufacturer's written instructions.
- B. Fire Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
- C. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1 *Polarized Light Microscopy*.

2.2 SPRAYED FIRE RESISTIVE MATERIALS

- A. Sprayed Fire Resistive Material: Factory mixed, portland cement based, lightweight, dry formulation, complying with indicated fire resistance design, and mixed with water at site to form a slurry or mortar before conveyance and application or conveyed in a dry state and mixed with atomized water at place of application.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carbolite Company; RPM International; AD Southwest Fireproofing Type 7HD.
 - b. GCP Applied Technologies; Monokote Z146.
 - c. Isolatek International, Inc; Fendolite M-II.
 - d. Southwest Fireproofing Products Co; Type 7HD.
 2. Application: Designated for exterior use by a qualified testing agency acceptable to authorities having jurisdiction.
 3. Bond Strength: Minimum 6000-lbf/sq. ft. (287.28-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
 4. Density: Not less than 40 lb/cu. ft. (640 kg/cu. m) and as specified in the approved fire-resistance design, according to ASTM E 605.
 5. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch (9 mm).
 6. Combustion Characteristics: ASTM E 136 or ASTM E 1354.
 7. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 0.
 - b. Smoke-Developed Index: 0.
 8. Compressive Strength: Minimum 500 lbf/sq. in. (3445 kPa) according to ASTM E 761.
 9. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
 10. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
 11. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
 12. Air Erosion: Maximum weight loss of 0.000 g/sq. ft. (0.000 g/sq. m) in 24 hours according to ASTM E 859.
 13. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21 or rating of 10 according to ASTM D 3274 when tested according to ASTM D 3273.
 14. Finish: As selected by Architect from manufacturer's standard finishes. Apply separate topcoat after finishing.
 15. Top Coat Color: As selected by the Architect.
 16. Basis of Design: Monokote by GCP Applied Technologies. Subject to compliance with requirements, provide basis of design or products by one of the following:
 - a. Carbolite Company; a subsidiary of RPM International.
 - b. GCP Applied Technologies Inc.
 - c. Isolatek International.
 - d. Pyrok, Inc.
 - e. Schundler Company (The).
 - f. Southwest Fireproofing Products Co.
 17. Application: Designated for exterior use by a qualified testing agency acceptable to authorities having jurisdiction.
 18. Bond Strength: Minimum 150 lbf/sq. ft. (7.18-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736. Exterior applications shall have bond strength required by the manufacturer for the climatic conditions for the project location.
 19. Density: Not less than density specified in the approved fire resistance design, according to ASTM E 605.

20. Thickness: As required for fire resistance design indicated, measured according to requirements of fire resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch (9 mm), or as required by the manufacturer for exterior locations for the climatic conditions for where the project is located.
 21. Combustion Characteristics: ASTM E 136.
 22. Surface Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame Spread Index: 10 or less.
 - b. Smoke Developed Index: 10 or less.
 23. Compressive Strength: Minimum 100 lbf/sq. in. (689 kPa) according to ASTM E 761.
 24. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
 25. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
 26. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
 27. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) in 24 hours according to ASTM E 859.
 28. Fungal Resistance: Treat products with antimicrobial formulation to result in no growth on specimens per ASTM G 21.
 29. Finish: Spray textured finish.
 - a. Color: Selected by Architect.
- B. Auxiliary Materials: Provide auxiliary materials compatible with fireproofing and substrates and approved by UL in fire resistance designs indicated.
1. Substrate Primers: Primers approved by fireproofing manufacturer and complying with requirements:
 - a. Primer and substrate are identical to those tested in required fire resistance design by UL.
 - b. Primer bond strength in required fire resistance design complies with specified bond strength for fireproofing and with requirements in UL Fire Resistance Directory based on a series of bond tests according to ASTM E 736.
 2. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL Fire Resistance Directory.
 3. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire resistance designs indicated and fireproofing manufacturer's written instructions. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.
 4. Reinforcing Fabric: Glass fiber or carbon fiber fabric of type, weight, and form required to comply with fire resistance designs indicated; approved and provided by fireproofing manufacturer.
 5. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.
- C. Sealer: Transparent drying, water dispersible, tinted protective coating recommended in writing by fireproofing manufacturer for each fire resistance design.
- D. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire resistance design.
1. Cement Based Topcoat: Factory mixed, cementitious hard coat formulation for trowel or spray application over SFRM.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Carboline Company; a subsidiary of RPM International.
 - 2) Isolatek International.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for substrates and other conditions affecting performance of the work and according to each fire resistance design.
 - 1. Verify substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
 - 2. Verify objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 - 3. Verify substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or suspended construction that interferes with fireproofing application.
 - 4. Verify concrete work on steel deck is complete before beginning fireproofing work.
 - 5. Verify roof construction, installation of rooftop HVAC equipment, and related work are complete before beginning fireproofing work.
- B. Conduct bonding/adhesion, compatibility, and strength tests according to fireproofing manufacturer's written instructions to verify substrates are free of substances capable of interfering with bond.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the work.
- D. Proceed with installation after correcting unsatisfactory conditions

3.2 PREPARATION

- A. Cover adjacent work subject to damage from fallout or overspray of fireproofing materials during application.
- B. Clean substrates of substances that could impair bond of fireproofing.
- C. Prime substrates where included in fire resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.
- D. For applications visible on completion, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that telegraph through fire resistive products after application.

3.3 APPLICATION

- A. Construct fireproofing assemblies identical to fire resistance design indicated and products specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and related materials and procedures affecting fireproofing work.
- B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; applicable to particular conditions of installation and as required to achieve fire resistance ratings indicated.
- C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.

1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and related items penetrating fireproofing are in place.
 2. Defer installing ducts, piping, and similar items that interfere with the application of fireproofing until application is completed.
- D. Metal Decks:
1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, is completed.
 2. Do not apply fireproofing to underside of metal roof deck until roofing is completed; prohibit roof traffic during application and drying of fireproofing.
- E. Install auxiliary materials as required, as detailed, and in accordance with fire resistance design and fireproofing manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.
- F. Spray apply fireproofing to maximum extent possible. After spraying operation in each area, complete coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
- G. Extend fireproofing in full thickness over entire area of each substrate to be protected.
- H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.
- I. For applications over encapsulant materials, including lockdown (post removal) encapsulants, apply fireproofing that differs in color from that of encapsulant over which it is applied.
- J. Where sealers are used, apply products tinted to differentiate new application from fireproofing over which they are applied.
- K. Provide uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.
- L. Cure fireproofing according to fireproofing manufacturer's written instructions.
- M. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.
- N. Finishes: Where indicated, apply fireproofing to produce finish:
1. Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.

3.4 APPLICATION

- A. Concealed Sprayed Fireproofing: Apply concealed sprayed fireproofing in thickness and densities not less than those required to achieve fire resistance ratings designated for each condition.
1. Apply water overspray to concealed sprayed fiber fire resistive material if necessary to obtain designated fire resistance rating.
 2. Cure concealed sprayed fireproofing according to product manufacturer's written recommendations.
 3. Apply topcoat to concealed sprayed fireproofing.

- B. Exposed Fireproofing: Apply exposed sprayed fireproofing in thickness and densities not less than those required to achieve fire resistance ratings designated for each condition but apply in greater thickness and densities if indicated.
 - 1. Provide uniform finish complying with description indicated for each type of material and matching finish approved for field erected mockup.
 - 2. Apply exposed cementitious sprayed fireproofing to produce even, spray textured finish, produced by rolling flat surfaces of fire protected members with a damp paint roller to remove drippings and excessive roughness.
 - 3. Cure exposed sprayed fireproofing according to product manufacturer's written recommendations.
- C. Repaired Fireproofing: Tint topcoat with dye of a different color to indicate areas patched or repaired.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Test and inspect as required by the IBC Subsection 1705.14 Sprayed Fire-Resistant Materials.
- B. Perform tests and inspections of completed work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire resistance design.
- C. Fireproofing will be considered defective if it does not pass tests and inspections.
 - 1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
 - 2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- D. Prepare test and inspection reports.

3.6 CLEANING, PROTECTING, AND REPAIRING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing is without damage or deterioration at time of Substantial Completion.
- C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.
- D. Repair or replace work that has not successfully protected steel.
- E. Repair fireproofing damaged by other work before concealing with other construction. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel applied product.

END OF SECTION

SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Penetrations in fire resistance rated walls.
 2. Penetrations in horizontal assemblies.
 3. Penetrations in smoke barriers.

1.2 ACTION SUBMITTALS

- A. Product Data: Product Data: Technical data for each penetrating firestopping system including illustration of firestopping system and design designation.
- B. Product Schedule: Submit schedule for each penetration firestopping system indicating location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire protection engineer as an engineering judgment or equivalent fire resistance rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit data for Installer.
- B. Product Test Reports: Submit reports for each penetration firestopping system and for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

- A. Installer Certificates: Submit certificates from Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Entity having minimum 5 years documented experience that has been approved by FM Global according to FM Global 4991 Approval of Firestop Contractors or evaluated by UL and found to comply with its Qualified Firestop Contractor Program Requirements and employs applicators with the required experience and training to perform the work.
1. Manufacturer's willingness to sell its penetrating firestopping system products to Contractor or to Installer does not confer qualification on buyer.
 2. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements.
- B. Preinstallation Conference: Conduct conference at site.

1.6 COORDINATION

- A. Do not cover up through penetration firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's inspecting agency and building inspector when required by authorities having jurisdiction.
 - 1. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.
- B. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- C. Coordinate sizing of sleeves, openings, core drilled holes, or cut openings to accommodate penetration firestopping systems.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced air circulation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Fire Test Response Characteristics:
 - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test in accordance with referenced standards. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL Fire Resistance Directory.
 - 2) FM Global Building Materials Approval Guide.

2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and gases, and maintain original fire resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Fire Protection Products.
 - b. A/D Fire Protection Systems Inc.
 - c. Hilti, Inc.

- d. Nelson Firestop Products, Division of EGS Electrical Group.
 - e. Passive Fire Protection Partners.
 - f. RectorSeal.
 - g. Specified Technologies, Inc.
- B. Penetrations in Fire Resistance Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
1. F-Rating: Not less than the fire resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
1. F-Rating: At least one hour, but not less than the fire resistance rating of constructions penetrated.
 2. T-Rating: At least one hour, but not less than the fire resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
- D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30 inch wg (74.7 Pa).
1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at and no more than 50-cfm (0.024-cu. m/s) cumulative total for any 100 sq. ft. (9.3 sq. m) at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping Systems: Flame spread and smoke developed indexes of less than 25 and 450, respectively, per ASTM E 84.
- F. Manufactured Piping Penetration Firestopping System: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
1. <Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ProVent Systems, Inc.
 2. F-Rating: At least one hour, but not less than the fire resistance rating of constructions penetrated.
 3. T-Rating: At least one hour, but not less than the fire resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 4. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
 5. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast in place concrete slabs.
 6. Stack Fitting: ASTM A48/A48M, gray iron, hubless pattern wye branch with neoprene O ring at base and gray iron plug in thermal release harness. Include PVC protective cap for plug.
 7. Special Coating: Corrosion resistant on interior of fittings.
- G. Accessories: Provide components for each penetration firestopping system necessary to install fill materials and to maintain ratings required. Use components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
1. Permanent forming/damming/backing materials.
 2. Substrate primers.

- 3. Collars.
- 4. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast in Place Firestop Devices: Factory assembled devices for use in cast in place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum foil faced intumescent elastomeric sheet bonded to galvanized steel sheet.
- E. Intumescent Putties: Nonhardening, water resistant, intumescent putties containing no solvents or inorganic fibers.
- F. Intumescent Wrap Strips: Single component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat expanding pillows/bags consisting of glass fiber cloth cases filled with a combination of mineral fiber, water insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single component, silicone based, neutral curing elastomeric sealants.

2.4 MIXING

- A. Penetration Firestopping Materials: For products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the work.
- B. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form release agents from concrete.
- B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that remain exposed on completion of the work and would otherwise be permanently stained or damaged by contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

- A. Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming materials and other accessories of types required to support fill materials during application and in the position needed to produce cross sectional shapes and depths required to achieve fire ratings.
 - 1. After installing fill materials and allowing to fully cure, remove combustible forming materials and accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire resistance ratings.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5 mm) strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).
- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."

2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.
- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- C. Proceed with enclosing penetration firestopping systems with r construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite protections, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION

SECTION 07 84 43 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Joints in or between fire resistance rated constructions.
 - a. Floor-to-wall joints.
 - b. Head-of-wall joints.
 - c. Wall-to-wall joints.
 - 2. Joints in smoke barriers.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data for each joint firestopping system including illustration of firestopping system and design designation.
- B. Product Schedule: Submit schedule for each joint firestopping system including location, illustration of firestopping system, and design designation of qualified testing agency.
 - 1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular-joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire protection engineer as an engineering judgment or equivalent fire resistance rated assembly.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit data for Installer.
- B. Product Test Reports: Submit reports for each joint firestopping system, for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

- A. Installer Certificates: Submit certificates from Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Entity having minimum 5 years documented experience that has been approved by FM Global according to FM Global 4991 Approval of Firestop Contractors or evaluated by UL and found to comply with its Qualified Firestop Contractor Program Requirements and employs applicators with the required experience and training to perform the work.
 - 1. Manufacturer's willingness to sell its fire resistive joint system products to Contractor or to Installer does not confer qualification on buyer.
- B. Preinstallation Conference: Conduct conference at site.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced air circulation.

1.7 COORDINATION

- A. Do not cover up joint firestopping system installations that become concealed behind construction until each installation has been examined by Owner's inspecting agency and building inspector when required by authorities having jurisdiction.
 - 1. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.
- B. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.
- C. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire Test Response Characteristics:
 - 1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test in accordance with testing in referenced standards. Provide rated systems complying with requirements:
 - a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL Fire Resistance Directory.
 - 2) Intertek Group Directory of Listed Building Products.

2.2 JOINT FIRESTOPPING SYSTEMS

- A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire Resistance Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Fire Protection Products.
 - b. A/D Fire Protection Systems Inc.
 - c. Blazeframe Industries.
 - d. CEMCO.
 - e. Grabber Construction Products.
 - f. Hilti, Inc.
 - g. Nelson Firestop; a brand of Emerson Industrial Automation.

- h. NUCO Inc.
 - i. Passive Fire Protection Partners.
 - j. RectorSeal.
 - k. ROXUL.
 - l. Specified Technologies, Inc.
 - m. Thermafiber, Inc.; an Owens Corning company.
 2. Fire Resistance Rating: Equal to or exceeding the fire resistance rating of the wall, floor, or roof in or between which it is installed.
 3. Location: Joints include those installed in or between fire resistance rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies.
- C. Joints in Smoke Barriers: Provide fire resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Fire Protection Products.
 - b. A/D Fire Protection Systems Inc.
 - c. Hilti, Inc.
 - d. Nelson Firestop; a brand of Emerson Industrial Automation.
 - e. NUCO Inc.
 - f. Passive Fire Protection Partners.
 - g. RectorSeal.
 - h. Rockwool/Roxul.
 - i. Specified Technologies, Inc.
 - j. Thermafiber, Inc.; an Owens Corning company.
- D. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. Accessories: Provide components of fire resistive joint systems, including primers and forming materials, necessary to install elastomeric fill materials and to maintain ratings required. Use components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the work.
- B. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

- A. Surface Cleaning: Before installing fire resistive joint systems, clean joints immediately to comply with fire resistive joint system manufacturer's written instructions and the following requirements:
 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire resistive rating.
 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form release agents from concrete.

- B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

- A. Install fire resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support elastomeric fill materials during application and in position needed to produce cross sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire resistive joint system.
- C. Install elastomeric fill materials for fire resistive joint systems by proven techniques to produce the following results:
 - 1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire resistance ratings indicated.
 - 2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
 - 3. For elastomeric fill materials that will remain exposed after completing the work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5 mm) strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).
- B. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.
- B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.
- C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire resistive joint systems immediately and install new materials to produce fire resistive joint systems complying with specified requirements.

3.7 FIRE RESISTIVE JOINT SYSTEM SCHEDULE

- A. Floor to Wall, Fire Resistive Joint Systems:
 - 1. UL-Classified Systems: FW-D-#### (as required for joint width).
 - 2. Assembly Rating: As indicated.
 - 3. Nominal Joint Width: As indicated.
 - 4. Movement Capabilities: 50-percent compression or extension or horizontal shear.
 - 5. L-Rating at Ambient: Less than ## (as required) cfm/ft. (cu. m/s x m).
 - 6. L-Rating at 400 degrees F (204 degrees C): Less than ## (as required) cfm/ft. (cu. m/s x m).
- B. Head of Wall, Fire Resistive Joint Systems:
 - 1. UL Classified Systems: HW-D-#### (as required for joint width).
 - 2. Assembly Rating: As indicated.
 - 3. Nominal Joint Width: As indicated.
 - 4. Movement Capabilities: 50-percent compression or extension.
 - 5. L-Rating at Ambient: Less than ## (as required) cfm/ft. (cu. m/s x m).
 - 6. L-Rating at 400 degrees F (204 degrees C): Less than ## (as required) cfm/ft. (cu. m/s x m).
- C. Bottom of Wall, Fire Resistive Joint Systems:
 - 1. UL Classified Systems: BW- D-#### (as required for joint width).
 - 2. Assembly Rating: As indicated.
 - 3. Nominal Joint Width: As indicated.
 - 4. Movement Capabilities: 50-percent compression or extension.
 - 5. L-Rating at Ambient: Less than ## (as required) cfm/ft. (cu. m/s x m).
 - 6. L-Rating at 400 degrees F (204 degrees C): Less than ## (as required) cfm/ft. (cu. m/s x m).

END OF SECTION

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
1. Interior hollow metal steel doors and frames.
 2. Exterior hollow metal doors and frames.
 3. Hollow metal opening framing.
 4. Hollow metal panels.
 5. Integration of electrified hardware, access control systems, and security systems into door and frame assemblies.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 ACTION SUBMITTALS

- A. Product Data: Technical data including construction detail, material descriptions, core descriptions, label compliance, sound and fire resistance ratings, temperature rise ratings and finishes for each type of door and frame specified.
- B. Shop Drawings: Submit drawings using same designations in door and frame schedule on the Drawings:
1. Opening size(s), handing of doors.
 2. Frame throat dimensions
 3. Details of each frame type.
 4. Elevations and profiles of door design types.
 5. Details of door and frame construction including vertical and horizontal edge details and metal thickness.
 6. Location and installation requirements of door hardware and reinforcements, hardware group numbers.
 7. Details of anchorage, joint, field splice, and connections, details of moldings, removable stops, and glazing.
 8. Fire label requirements including fire rating time duration, maximum temperature rise requirements, and smoke label requirements.
 9. Indicate routing of electrical conduit and dimensions and locations of cutouts in doors and frames to accept electric hardware devices, signals, and control systems.
- C. Schedule: Provide schedule of steel doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Submit test reports for each type of steel door and frame assembly for tests performed by a qualified testing agency.

- B. Certificate of Compliance for Fire Rated Doors: Provide copies of Certificate of Compliance for fire rated door assemblies, smoke and draft control door assemblies, and temperature rise rated door assemblies.
 - 1. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm having minimum 5 years documented experience in manufacturing steel doors and frames, with sufficient production capacity to produce required units.
- B. Source Limitations: Obtain steel doors and frames from single source from single manufacturer.
- C. Preinstallation Conference: Conduct conference at site.

1.6 COORDINATION

- A. Coordinate anchorage installation for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver to site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver steel doors and frames palletized, packaged, or crated to provide protection during transit and site storage. Do not use nonvented plastic. Provide additional protection to prevent damage to factory finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work vertically under cover at site with head up. Place on minimum 4 inch (102 mm) high wood blocking. Provide minimum 1/4 inch (6 mm) space between each stacked door to permit air circulation.
- D. Inspect doors and frames, on delivery, for damage. Tool marks, rust, blemishes, and other damage on exposed surfaces is not acceptable. Remove and replace damaged items directed by Owner. Store doors and frames at building site in dry location and off ground to prevent deterioration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Steel Door and Frame Standard: Comply with applicable provisions of Hollow Metal Manufacturers Association (HMMA) Div. of National Association of Architectural Metal Manufacturers (NAAMM):
 - 1. HMMA Hollow Metal Manual.
 - 2. HMMA 861 Guide Specifications for Commercial Hollow Metal Doors and Frames.
- B. Fire Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire protection ratings indicated, based on

testing at positive pressure according to NFPA 252 or UL 10C. Provide metal labels permanently fastened on each door and frame assembly within size limitations established by the labeling authority having jurisdiction.

1. Smoke and Draft Control Assemblies: Provide assemblies with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
 2. Oversize Fire Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
- C. Fire Rated, Borrowed Lite Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire protection ratings indicated, based on testing according to NFPA 257 or UL 9.
- D. Windborne Debris Impact Resistance: Pass missile impact and cyclic pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for Wind Zone 3.
1. Large Missile Test: For glazed openings located within 30 feet (9.1 m) of grade.
- E. Windstorm Rating Classification: Exterior doors and frames shall comply with the following minimum ratings, regardless of opening size or configuration, when tested in accordance with ANSI A250.13:
1. Missile Impact Resistance: 350 ft./lbs.
 2. Design Pressure: 80 psf.
 3. Stiffness (Corner Deflection): Class II.
- F. Thermally Rated Door Assemblies: Fabricate doors and frames for thermal insulating assemblies and tested in accordance with ASTM C 236 or C 976.
1. Provide door assemblies with U-factor of not more than 0.50 degrees Btu/F x h x sq. ft. (2.84 W/K x sq. m) when tested according to ASTM C 518.
- G. Accessibility Requirements: Comply with applicable requirements.
1. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) 2010.
 2. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.

2.2 MATERIALS

- A. Manufacturers: Subject to compliance with requirements, provide products complying with requirements of one of the following:
1. Amweld International, LLC.
 2. Ceco Door Products; an Assa Abloy Group company.
 3. Commercial Door & Hardware Inc.
 4. Curries Company; an Assa Abloy Group company.
 5. Mesker Door Inc.
 6. Republic Doors and Frames.
 7. Rocky Mountain Metals, Inc.
 8. Steelcraft; an Allegion company.
- B. Cold Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

- D. Metallic Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- E. Inserts, Bolts, and Fasteners: Hot dip galvanized according to ASTM A 153/A 153M.
- F. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot dip galvanized according to ASTM A 153/A 153M, Class B.
- G. Mineral Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame spread and smoke developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- H. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- I. Glazing: Comply with requirements in Section 08 80 00.
- J. Bituminous Coating: Cold applied asphalt mastic, compounded for 15 mil (0.4 mm) dry film thickness per coat. Provide inert type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 EXTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Maximum Duty Doors and Frames: SDI A250.8, Level 4; SDI A250.4, Level A..
 - 1. Doors:
 - a. Type: Indicated in the Door Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm).
 - c. Face: Metallic coated steel sheet, minimum thickness of 0.067-inch (1.7 mm), with minimum A60 (ZF180) coating.
 - d. Edge Construction: Model 1, Full Flush.
 - e. Top Edge Closures: Close top edges of doors with inverted closures of same material as face sheets. Seal joints against water penetration.
 - f. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep hole openings in bottoms of exterior doors to permit moisture to escape.
 - g. Core: Polyurethane or Polyisocyanurate.
 - h. Fire Rated Core: Vertical steel stiffener with insulation core for fire rated doors.
 - 2. Frames:
 - a. Materials: Metallic coated steel sheet, minimum thickness of 0.067-inch (1.7 mm), with minimum A60 (ZF180) coating.
 - b. Construction: Full profile welded.
 - 3. Exposed Finish: Prime.

2.4 INTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

- B. Extra Heavy-Duty Doors and Frames: SDI A250.8, Level 3; SDI A250.4, Level A.
 - 1. Doors:
 - a. Type: Indicated in the Door Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm).
 - c. Face: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
 - d. Edge Construction: Model 1, Full Flush.
 - e. Core: Manufacturer's standard Kraft paper honeycomb, Polystyrene, Polyurethane, Polyisocyanurate, or Vertical steel stiffener.
 - f. Fire Rated Core: Vertical steel stiffener core for fire rated doors.
 - 2. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
 - b. Sidelite Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: Full profile welded.
 - 3. Exposed Finish: Prime.

2.5 BORROWED LITES

- A. Fabricate of metallic coated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
- B. Construction: Full profile welded.
- C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.
- D. Provide countersunk, flat or oval head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.6 HOLLOW METAL PANELS

- A. Provide hollow metal panels of same materials, construction, and finish as adjacent door assemblies.

2.7 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Type: Provide anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).
 - 3. Postinstalled Expansion Anchor: Minimum 3/8-inch (9.5 mm) diameter bolts with expansion shields or inserts, with pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

2.8 FABRICATION

- A. Fabricate steel doors and frames rigid and free from defects, warp, or buckle. Accurately form metal to required sized and profiles. Take field measurements as required for coordination with adjoining work. Where possible, fit and assemble units in manufacturer's plant. Clearly identify work which cannot be permanently factory assembled before shipment to assure proper assembly at site.
 - 1. Metallic Core Construction: Weld cores to both door face sheets.

2. Nonmetallic Core Construction: Laminate core material to both door face sheets with waterproof adhesive.
- B. Remove tool marks and surface imperfections; dress smooth exposed faces of welded joints. Use of metallic filler to conceal manufacturing defects is not acceptable.
- C. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- D. Hollow Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
1. Sidelite Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless noted otherwise.
 3. Grout Guards: Weld guards to frame at back of hardware mortises in grouted frames.
 4. Door Silencers: Except on weather stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double Door Frames: Drill stop in head jamb to receive two door silencers.
- E. Jamb Anchors:
1. Masonry Type: Locate anchors not more than 16 inches (400 mm) from top and bottom of frame. Space anchors not more than 32 inches (825 mm) o.c., to match coursing:
 - a. Two anchors per jamb up to 60 inches (1530 mm) high.
 - b. Three anchors per jamb from 60 to 90 inches (1530 mm to 2290 mm) high.
 - c. Four anchors per jamb from 90 to 120 inches (2290 mm to 3060 mm) high.
 - d. Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3060 mm) high.
 2. Stud Wall Type: Locate anchors not more than 18 inches (460 mm) from top and bottom of frame. Space anchors not more than 32 inches (815 mm) o.c.:
 - a. Three anchors per jamb up to 60 inches (1530 mm) high.
 - b. Four anchors per jamb from 60 to 90 inches (1530 mm to 2290 mm) high.
 - c. Five anchors per jamb from 90 to 96 inches (2290 mm to 2440 mm) high.
 - d. Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2440 mm) high.
 3. Compression Type: Not less than two anchors in each frame.
 4. Postinstalled Expansion Type: Locate anchors not more than 6 inches (150 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
- F. Head Anchors: Two anchors per head for frames more than 42 inches (1065 mm) wide and mounted in metal stud partitions.
- G. Hardware Preparation: Factory prepare hollow metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive nontemplated, mortised, and surface mounted door hardware. Offset reinforcement so faces of mortised hardware items are flush with door surfaces. Secure reinforcement by spot welding.

2. Comply with BHMA A156.115 and SDI 250.6 for preparing hollow metal doors and frames for hardware.
 - a. Hinges and Pivots: 0.167 inch (4.2 mm) thick by 1-1/2 inches (38 mm) wide by 9 inches (229 mm).
 - b. Lock Front, Strike, and Flushbolt Reinforcement: 0.093 inch (2.3 mm) thick by size as required by hardware manufacturer.
 - c. Lock Reinforcement Units: 0.067 inch (1.7 mm) thick by size as required by hardware manufacturer.
 - d. Closer Reinforcements: 0.093 inch (2.3 mm) thick one-piece channel by size as required by hardware manufacturer.
 - 1) For concealed overhead door closers, provide space, cutouts, reinforcing, and provisions for fastening in top rail of doors or head of frames as applicable.
 - e. Other Hardware Reinforcements: Required for adequate strength and anchorage; in lieu of reinforcement specified, hardware manufacturers recommended reinforcing units may be used.
 - f. Exit Device Reinforcements: 0.250 inch (6.35 mm) thick by 10 inches (245 mm) high by 4 inches (101 mm) wide centered on exit device case body, unless otherwise recommended by exit device manufacturer.

- H. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so each glazed lite is capable of being removed independently.
 3. Weld fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 4. Provide loose stops and moldings on inside of hollow metal doors and frames.
 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
 6. Provide stops for installation with countersunk flat or oval head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

- I. Plaster and Grout Guards and Removable Access Plates: Provide 0.016 inch (0.4mm) thick plaster guards or dust cover boxes of same material as frame, welded to frame at back of hardware cutouts to close off interior of openings and prevent mortar or other materials from obstructing hardware operation. Provide removable access plates in the heads of frames to receive overhead concealed door closers.

- J. Electrical Requirements: Coordinate provisions with installation of electrical items including electronic hardware, security system components, and similar items having electrical requirements; arrange so wiring can be readily removed and replaced.
 1. Provide cutouts and reinforcements required for steel doors and frames to accept security system components.
 2. Doors with Electric Hinges and Pivots: Provide with metal conduit or raceway to permit wiring from electric hinge or pivot to other electric door hardware.
 - a. Hinge Location: Center for doors less than 90 inches (2286 mm) tall or second hinge from door bottom for doors greater than 90 inches (2286 mm); top or bottom electric hinge locations shall not be permitted.

2.9 STEEL FINISHES

- A. Surface Preparation: Clean, treat and prime surfaces of fabricated steel door and frame work, inside and out, whether exposed or concealed in the construction.
 - 1. Clean surfaces with nonpetroleum solvent so surfaces are free of dirt, oil, grease, and contaminants that could impair paint bond.
 - 2. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 3 *Power Tool Cleaning* or SSPC-SP 6/NACE No. 3 *Commercial Blast Cleaning*.
 - 3. After cleaning, apply conversion coating suited to organic coating applied over surface.
 - 4. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint complying with ASTM A 780.
 - 5. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

- B. Factory Priming for Field Painted Finish: Apply shop primer immediately after surface preparation and pretreatment. Apply fast curing, corrosion inhibiting, lead and chromate free, universal primer complying with ANSI A224.1; compatible with substrate and field applied finish paint system indicated; providing sound foundation for field applied topcoats despite prolonged exposure. Apply primer coat of a smooth, even consistency of provide uniform dry film thickness of not less than 0.7 mils (0.02 mm). Touch up surfaces having runs, smears, or bare spots.
 - 1. Finish Coats: Spray finish coats complying with Section 09 90 00.
 - 2. Finish coats shall include primary primer, applied prior to finish coats, over factory primer.

- C. Field Finish: Comply with requirements of Sections 09 91 13 and 09 91 23.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and conditions affecting performance of the work. Examine roughing in for embedded and built-in anchors to verify actual locations before frame installation.

- B. Existing Steel Frames and Doors: Examine existing frames and doors for indications of hinge stress, improperly fitting and operating hardware, excessive wear, rust or corrosion, dents and patches, out of plumb, damaged core, fire rated opening clearances, delamination, forced entry and vandalism and similar wear indicators.

- C. Prepare written report listing conditions detrimental to performance of the work. Include recommendations for refurbishing steel doors and frames to like new condition. Identify doors and frames that cannot be refurbished and should be replaced.

- D. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

- A. Remove welds in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory applied finishes where spreaders are removed.

- B. Prior to installation and with installation spreaders in place, adjust and securely brace hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb, and perpendicular to frame head.

2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive non-templated, mortised, and surface mounted door hardware.

3.3 INSTALLATION

- A. Install hollow metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow Metal Frames: Comply with SDI A250.11 or NAAMM-HMMA 840.
1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed work.
 - a. Extend frame anchorages below fills and finishes. Coordinate the installation of built in anchors for wall and partition construction required with work.
 - b. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch up finishes.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Field apply corrosion resistant coating to backs of frames in contact with grout or plaster containing anti-freezing agents.
 2. Welded Frames: Set anchorage devices where required for securing frames to in place concrete or masonry construction. Set anchorage devices opposite each anchor location as specified and anchorage device manufacturer's written instructions. Leave drilled holes rough, not reamed, and free of dust and debris.
 3. Fire Rated Openings: Install frames according to NFPA 80.
 4. Floor Anchors: Install floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 5. Metal Stud Partition: Solidly pack mineral fiber insulation inside frames.
 6. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
 7. Concrete Walls: Solidly pack mineral fiber insulation inside frames.
 8. In Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 9. Installation Tolerances: Adjust hollow metal frames to specified tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Hollow Metal Doors: Fit and adjust hollow metal doors accurately in frames, within clearances specified.

1. Nonfire Rated Steel Doors: Comply with SDI A250.8 or NAAMM-HMMA 841 and NAAMM-HMMA guide specification indicated.
 - a. Nonfire Rated Steel Doors:
 - 1) Between Door and Frame Jambs and Head: 1/8 inch (3 mm) plus or minus 1/32 inch (0.8 mm).
 - 2) Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch (3 mm to 6 mm) plus or minus 1/32 inch (0.8 mm).
 - 3) At Bottom of Door: 5/8 inch (15 mm) plus or minus 1/32 inch (0.8 mm).
 - 4) Between Door Face and Stop: 1/16 inch to 1/8 inch (1.6 mm to 3 mm) plus or minus 1/32 inch (0.8 mm).
 2. Rated Assemblies: Place doors in frames with clearances specified in NFPA Standard No. 80:
 - a. Doors, Frames, and Meeting Edges, Pairs of Doors: 1/8 inch.
 - b. Bottom: Maximum 3/8 inch between door and raised noncombustible sill.
 - c. Bottom: Maximum 3/4 inch above finished floor between door and floor where there is no sill.
 - d. Bottom: Maximum 1/2 inch between door and nominal floor covering surface.
 - e. Astragals: Comply with NFPA 80.
 3. Smoke Control Doors: Install doors according to NFPA 105.
- D. Glazing: Comply with installation requirements in Section 08 80 00 and with hollow metal manufacturer's written instructions.
1. Secure stops with countersunk flat or oval head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.
- E. Hardware: Apply hardware in accordance with hardware manufacturer's instructions and Section 08 71 00. Drill and tap for machine screws as required. Do not use self-tapping sheet metal screws. Adjust door installation to provide uniform clearance at head and jambs, and to contact stops uniformly. Adjust hardware items just prior to final inspection. Leave work in complete and proper operating condition.
- F. Repair of Existing Doors and Frames (If applicable):
1. Hinge Damage: Remove the door and hinge. Drill welding holes in area where hinger reinforcement is located. Clam hinge reinforcement in its original position and plug weld. Grind smooth, prime, and finish paint. Rehang door ensuring it operates smoothly and no longer sags.
 2. Holes: Patch weld the hole. For fire rated doors, comply with NFPA requirements.
 3. Dents: If dent has not penetrated the for face, fill dent with recommended patching compound, sand smooth, and refinish the door.
- 3.4 ADJUSTING
- A. Final Adjustments: Test and adjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or unacceptable.
- 3.5 CLEANING AND TOUCHUP
- A. Remove grout and other bonding material from hollow-metal work immediately after installation.
 - B. Prime Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air drying, rust inhibitive primer.
 - C. Metallic Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

- D. Factory Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
- E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.
- F. Institute protective measures required throughout the remainder of the construction period to ensure that steel doors and frames will be without damage or deterioration, at time of substantial completion.

END OF SECTION

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid core doors with wood veneer faces.
 - 2. Factory finishing flush wood doors.
- B. Integration of Security System: The integration of a security system into the flush wood door is required. Make provisions for and coordinate components and installation.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data including details of core and edge construction, **[louvers,]** trim for openings and factory finishing.
 - 1. Submit laboratory test report results of hinge loading, cycle/slam, stile edge screw withdrawals, and stile edge split resistance for fire rated doors.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
 - 1. Dimensions and locations of blocking.
 - 2. Dimensions and locations of mortises and holes for hardware.
 - 3. Dimensions and locations of cutouts.
 - 4. Undercuts.
 - 5. Requirements for veneer matching.
 - 6. Doors to be factory finished and finish requirements.
 - 7. Fire protection ratings for fire rated doors.
- C. Samples:
 - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished work.

1.3 INFORMATIONAL SUBMITTALS

- A. Certificate of Compliance for Fire Rated Doors: Provide copies of Certificate of Compliance for all fire rated door assemblies, smoke and draft control door assemblies, and temperature rise rated door assemblies.

1.4 QUALITY ASSURANCE

- A. Quality Standard: Comply with the applicable provisions and recommendations of AWI Architectural Woodwork Quality Standards; where standards and specifications conflict the more stringent shall be required.
- B. Source Limitations: Obtain flush wood doors from single manufacturer.

- C. Preinstallation Conference: Conduct conference at site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Protect wood doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Store wood doors on a flat level surface in a dry, well ventilated, place. Keep wood doors a minimum of 3-1/2 inches off floor surface and protected by a protective covering under the bottom door and over the top door. Cover to protect wood doors from dirt, water and abuse but allow for air circulation under and around the stack. Do not store wood doors in direct sunlight.
- C. Package doors individually in heavy duty cardboard cartons prior to shipment from factory. Mark each door on top and bottom rail with opening number used on Shop Drawings using temporary, removable, or concealed markings.
- D. Handle wood doors with clean gloves. Lift and carry wood doors when moving around the site, do not drag wood doors across one another.
- E. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.7 WARRANTY

- A. Written warranty signed by Manufacturer in which Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42 inch by 84 inch (1067 mm by 2134 mm) section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3 inch (0.25 mm in a 76.2 mm) span.
 - 2. Warranty Period for Solid Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Quality Standard: In addition to requirements specified, comply with AWI Architectural Woodwork Standards.
- B. Fire Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Temperature Rise Limit: Provide doors that have a maximum transmitted temperature end point of not more than 450 degrees F (250 degrees C) above ambient after 30 minutes of standard fire test exposure.
 2. Cores: Provide core specified or mineral core as needed to provide fire protection rating indicated.
 3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 4. Pairs: Provide fire retardant stiles that are listed and labeled for applications indicated without formed steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
- C. Smoke and Draft Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- D. Accessibility Requirements: For door hardware on doors in an accessible route, comply with applicable requirements.
1. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) 2010.
 2. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.

2.2 FLUSH WOOD DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eggers Industries.
 2. Marshfield-Algoma; Masonite Architectural.
 3. Oshkosh Door Company.
 4. VT Industries Inc.
- B. Quality Standard: In addition to requirements specified, comply with AWI Architectural Woodwork Standards.
- C. Particleboard Core Doors:
1. Particleboard: ANSI A208.1, Grade LD-2.
 2. Blocking: Provide wood blocking in particleboard core doors as necessary to eliminate through bolting hardware, and as follows:
 - a. 5 inch (125 mm) top rail blocking, in doors indicated to have closers.
 - b. 5-inch (125 mm) bottom rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 3. Provide doors with glued wood stave or structural composite lumber cores instead of particleboard cores for doors indicated to receive exit devices.
 4. Edge Construction: At hinge stiles, provide laminated edge construction with improved screw holding capability and split resistance. Comply with specified requirements for exposed edges.
 - a. Screw Holding Capability: 550 lbf (2440 N) per WDMA T.M.-10.
- D. Structural Composite Lumber Core Doors:
1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf (3100 N).
 - b. Screw Withdrawal, Edge: 400 lbf (1780 N).

- E. Mineral Core Doors:
1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire protection rating indicated.
 2. Blocking: Provide composite blocking with improved screw holding capability approved for use in doors of fire protection ratings indicated:
 - a. 5 inch (125 mm) top rail blocking.
 - b. 5 inch (125 mm) bottom rail blocking, in doors indicated to have protection plates.
 - c. 5-inch (125 mm) midrail blocking, in doors indicated to have armor plates.
 - d. 5-inch (125 mm) midrail blocking, in doors indicated to have exit devices.
 3. Edge Construction: At hinge stiles, provide laminated edge construction meeting label requirements and tested to specified direct screw withdrawal, split resistance, cycle slam, and hinge loading criteria. Comply with specified requirements for exposed edges.
 - a. Screw Holding Capability: 550 lbf (2440 N) per WDMA T.M.-10.
 4. Vertical Edge Construction: Provide edge construction with intumescent seals concealed by outer stile meeting or exceeding the specified direct screw withdrawal, split resistance, cycle slam, and hinge loading criteria. Comply with specified requirements for exposed edges.
 - a. Split Resistance: Not less than 696 pounds when tested in accordance with WDMA TM-5; or, not less than 1305 pounds when tested in accordance with ASTM D143.
 - b. Cycle/Slam: Not less than 200,000 cycles with no loosening of hinge screws or other visible signs of failure when tested in accordance with the requirements of WDMA TM-7; or, not less than 502,000 cycles when tested in accordance with ANSI A151.1
 - c. Direct Screw Withdrawal: Not less than 700 pounds when tested in accordance with WDMA TM-10; or, not less than 877 pounds when tested in accordance with ASTM D1037 using #12 x 1-1/4 steel screws, threaded to the head with either A or AB wood threads.
 - d. Hinge Loading: Not less than 684 pounds average when tested in accordance with WDMA TM-8.
 5. Pairs: Provide formed steel edges and astragals with intumescent seals.
 - a. Finish steel edges and astragals with baked enamel same color as doors.

2.3 VENEER FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid Core Doors:
1. Grade: Premium, with Grade AA faces.
 2. Species: To match existing.
 3. Cut: To match existing.
 4. Match between Veneer Leaves: To match existing.
 5. Assembly of Veneer Leaves on Door Faces: To match existing.
 6. Pair and Set Match: Provide for doors hung in same opening].
 7. Exposed Vertical Edges: Applied wood edges of same species as faces and covering edges of crossbands - edge Type D.
 8. Core: Either glued wood stave or structural composite lumber.
 9. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.

2.4 FABRICATION

- A. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
 - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- B. Openings: Factory cut and trim openings through doors.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00.

2.5 FACTORY FINISHING

- A. Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Transparent Finish:
 - 1. Grade: Premium.
 - 2. Finish: AWI Architectural Woodwork Standards System 9, UV curable, acrylated epoxy, polyester, or urethane.
 - 3. Staining: To match existing.
 - 4. Effect: Semi-filled finish, produced by applying an additional finish coat to partially fill the wood pores.
 - 5. Sheen: To match existing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- B. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

- A. Hardware: Refer to Section 08 71 00.
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
 - 1. Install fire rated doors according to NFPA 80.
 - 2. Install smoke and draft control doors according to NFPA 105.

- C. Job Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
 - a. Comply with NFPA 80 for fire rated doors.
 - 2. Bevel nonfire rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
 - 3. Bevel fire rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.

- D. Factory Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.

- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 08 33 23 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Insulated exterior service doors.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data including construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
1. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
 2. Include description of automatic closing device and testing and resetting instructions.
- B. Shop Drawings: Submit plans, elevations, sections, and mounting details.
1. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Include points of attachment and corresponding static and dynamic loads imposed on structure.
 3. Exterior Components: Include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
- C. Delegated Design Submittal: Submit for overhead coiling doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Summary of forces and loads on walls and jambs, including wind loads.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit data for Installer.
- B. Miami-Dade County Product Notice of Acceptance (NOA): For overhead coiling doors.
1. Impact Resistance Data: Manufacturer's current Product Approval Notice indicating product acceptance in accordance with requirements of the Florida Building Code TAS 201, TAS 202, and TAS 203 or Miami-Dade PA 201, PA 202, PA203, and High Velocity Hurricane Zone. Notice of Approval shall indicate, as minimum, product control number, expiration date of approval, and the specific conditions governing the approval.
 2. Impact Resistance Requirements: Meet impact tests as outlined in the Florida Building Code.
 - a. Large missile impact test (up to and including 30 feet in height).
 - b. Small missile impact test (above 30 feet in height).

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Submit data for overhead coiling doors to include in maintenance manuals.
- B. Record Documents: Submit documents for fire rated doors including list of door numbers and applicable room name and number to which door accesses.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Entity having minimum 5 years documented experience who employs installers and supervisors trained and approved by manufacturer for both installation and maintenance of units required.
- B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
 - 1. Obtain operators and controls from overhead coiling door manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store materials in original packaging, labeled to indicate model and series. Store materials in protected dry location off the ground in accordance with manufacturer's instructions.

1.7 WARRANTY

- A. Written warranty signed by manufacturer in which manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design overhead coiling doors, including comprehensive engineering analysis by a qualified professional engineer using performance requirements and design criteria indicated.
- B. Structural Performance, Exterior Doors: Capable of withstanding design wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated in accordance with SEI/ASCE 7.
 - 1. Design Wind Load: Indicated on Drawings.
 - a. Importance Factor: 1.15.
 - b. Exposure Category: D.
 - 2. Testing: In accordance with ASTM E 330/E 330M.
 - 3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
 - 4. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.
- C. Windborne Debris Impact Resistance: Provide impact protective overhead coiling doors that pass missile impact and cyclic pressure tests in accordance with ASTM E 1996 for Wind Zone 1.
 - 1. Large Missile Test: For overhead coiling doors located within 30 feet (9.14 m) of grade.
 - 2. Small Missile Test: For overhead coiling doors located more than 30 feet (9.14 m) above grade.
- D. Air Infiltration: Maximum rate of 1.0 cfm/sq. ft. (5.1 L/s per sq. m) at 15 and 25 mph (24.1 and 40.2 km/h) when tested in accordance with ASTM E 283.
- E. Curtain R-Value: 10.0 degrees F x h x sq. ft./Btu.
- F. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

2.2 DOOR ASSEMBLY

- A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Overhead Door Corporation; 625 Series Insulated Heavy-Duty Rolling Service Doors (NOA No. 13-1121.05), or comparable product by one of the following:
 - 2. Clopay Building Products.
 - 3. Cookson Company.
 - 4. Cornell Iron Works, Inc.
 - 5. McKeon Rolling Steel Door Company, Inc.
 - 6. Overhead Door Corporation.
 - 7. Wayne-Dalton Corp.
- B. Door Curtain Material: Galvanized steel.
- C. Door Curtain Slats: Flat profile slats of 2-5/8-inch (67 mm) center to center height.
 - 1. Gasket Seal. Continuous gaskets between slats.
- D. Bottom Bar: Two angles, each not less than 1-1/2 inch by 1-1/2 inch by 1/8 inch (38 mm by 38 mm by 3 mm) thick; fabricated from hot dip galvanized steel and finished to match door.
- E. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.
- F. Hood: Match curtain material and finish.
 - 1. Shape: Square.
 - 2. Mounting: Face of wall.
- G. Locking Devices: Equip door with slide bolt for padlock.
 - 1. Locking Device Assembly: Single jamb side.
- H. Manual Door Operator: Chain hoist operator.
- I. Curtain Accessories: Equip door with weatherseals.
- J. Door Finish:
 - 1. Baked Enamel or Powder Coated Finish: Color selected by Architect.
 - 2. Interior Curtain Slat Facing: Finish selected by Architect.

2.3 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated:
 - 1. Steel Door Curtain Slats: Zinc coated (galvanized), cold rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 0.028 inch (0.71 mm); and as required.
 - 2. Insulation: Fill slats for insulated doors with thermal insulation complying with maximum flame spread and smoke developed indexes of 75 and 450, respectively, in accordance with ASTM E 84 or UL 723. Enclose insulation completely within slat faces.
 - 3. Metal Interior Curtain Slat Facing: Match metal of exterior curtain slat face, with 24-gauge galvanized steel.
- B. Curtain Jamb Guides: Angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to

operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

2.4 HOODS

- A. Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface mounted hoods and fascia for any portion of between jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
 - 1. Galvanized Steel: Nominal 0.028-inch (0.71 mm) thick, hot dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.
 - 2. Stainless Steel: 0.025 inch (0.64 mm) thick, stainless steel sheet, Type 304, complying with ASTM A 666.

2.5 LOCKING DEVICES

- A. Slide Bolt: Fabricate with side locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
- B. Locking Device Assembly: Fabricate with cylinder lock, spring loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 - 1. Lock Cylinders: Refer to Section 08 71 00.
 - 2. Keys: Three for each cylinder.
- C. Chain Lock Keeper: Suitable for padlock.

2.6 CURTAIN ACCESSORIES

- A. Weatherseals for Exterior Doors: Equip each exterior door with weather stripping gaskets fitted to entire exterior perimeter of door for a weather resistant installation unless otherwise indicated.
 - 1. At door head, use 1/8 inch (3 mm) thick, replaceable, continuous sheet baffle secured to inside of hood or field installed on the header.
 - 2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8 inch (3 mm) thick seals of flexible vinyl, rubber, or neoprene.

2.7 COUNTERBALANCE MECHANISM

- A. Counterbalance doors by means of a standard mechanism with adjustable tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Spring: One or more oil tempered, heat treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast steel barrel plugs.
- C. Torsion Rod for Counterbalance Shaft: Fabricate of cold rolled steel, sized to hold fixed spring ends and carry torsional load.
- D. Brackets: Mounting brackets of either cast iron or cold rolled steel plate.

2.8 MANUAL DOOR OPERATORS

- A. Equip door with manual door operator by door manufacturer.
- B. Chain Hoist Operator: Consisting of endless steel hand chain, chain pocket wheel and guard, and gear reduction unit with a maximum 25-lbf (111-N) force for door operation. Provide alloy steel hand chain with chain holder secured to operator guide.

2.9 FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Steel and Galvanized Steel Finishes:
 - 1. Baked Enamel or Powder Coat Finish: Baked on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions for compliance with requirements for substrate construction and other conditions affecting performance of the work.
- B. Examine locations of electrical connections.
- C. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.
- D. Fire Rated Doors: Install in accordance with NFPA 80.
- E. Smoke Control Doors: Install in accordance with NFPA 80 and NFPA 105.
- F. Power Operated Doors: Install in accordance with UL 325.

3.3 FIELD QUALITY CONTROL

- A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so doors operate easily, free of warp, twist, or distortion.
 - 1. Adjust exterior doors and components to be weather resistant.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.5 DEMONSTRATION

- A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

SECTION 08 42 26 - SLIDING AUTOMATIC ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. New Exterior and interior, sliding, power operated automatic entrances.
 - 2. Salvaging and reinstallation of existing exterior and interior, sliding, power operated automatic entrances.

1.2 DEFINITIONS

- A. AAADM: American Association of Automatic Door Manufacturers.
- B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.
- C. IBC: International Building Code.
- D. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.
- E. For automatic door terminology, refer to BHMA A156.10 for definitions of terms.

1.3 COORDINATION

- A. Coordinate sizes and locations of recesses in concrete floors for recessed sliding tracks that control automatic entrances. Concrete, reinforcement, and formwork requirements are specified elsewhere.
- B. Templates: Distribute for doors, frames, and other work specified to be factory prepared for installing automatic entrances.
- C. Coordinate hardware with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish. Coordinate hardware for automatic entrances with hardware required for rest of Project.
- D. Electrical System Roughing-in: Coordinate layout and installation of automatic entrances with connections to power supplies and access-control system, and remote monitoring systems.
- E. System Integration: Integrate sliding automatic entrances with other systems as required for a complete working installation.
 - 1. Provide electrical interface control capability for activation of sliding automatic entrances by security access system on doors with electric locking.
 - 2. Provide electrical interface to deactivate door operators on activation of fire alarm system.
 - 3. Provide electrical interface to allow for remote monitoring of automatic entrance door panel status.

1.4 ACTION SUBMITTALS

- A. Product Data: Technical data including construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic entrances.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Submit shop drawings including plans, elevations, sections, hardware mounting heights, and attachment details.
 - 1. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Include diagrams for power, signal, and control wiring.
 - 3. Indicate locations of activation and safety devices.
 - 4. Include hardware schedule and indicate hardware types, functions, quantities, and locations.
- C. Samples: Submit each type of exposed finish.
- D. Delegated Design Submittal: For sliding automatic entrances indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit data for Installer.
- B. Product Certificates: Submit certificates for each type of automatic entrance. Include emergency exit features of automatic entrances serving as a required means of egress.
- C. Product Test Reports: Submit reports for tests performed for heavy glass automatic entrance by a qualified testing agency.
- D. Field quality control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit data for automatic entrances, safety devices, **[access]** and control systems to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturing entity with Company Certificate issued by AAADM indicating that manufacturer has a Certified Inspector on staff.
- B. Installer Qualifications: Entity having minimum 5 years documented experience who is the manufacturer's authorized representative trained and approved for installation and maintenance of units required.
 - 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
- C. Certified Inspector Qualifications: Certified by AAADM.

- D. Source Limitations: Obtain sliding automatic entrances from single source from single manufacturer.
- E. Preinstallation Conference: Conduct conference at site.

1.8 COORDINATION

- A. Templates: Distribute for doors, frames, and work specified to be factory prepared for installing automatic entrances.
- B. Coordinate hardware with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish. Coordinate hardware for automatic entrances with hardware required for rest of Project.
- C. Electrical System Roughing in: Coordinate layout and installation of automatic entrances with connections to power supplies.
- D. System Integration: Integrate sliding automatic entrances with other systems necessary for a complete working installation.
 - 1. Provide electrical interface to allow for remote monitoring of automatic entrance door panel status.

1.9 WARRANTY

- A. Written warranty signed by manufacturer in which manufacturer agrees to repair or replace components of automatic entrances that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Faulty operation of operators, controls, and hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design sliding automatic entrances including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

- B. Structural Performance: Automatic entrances shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Wind Loads: Indicated on Drawings.
 - 2. Other Design Loads: Indicated on Drawings.
- C. Windborne Debris Impact Resistance: Pass missile impact and cyclic-pressure tests according to ASTM E 1996 for Wind Zone 4.
 - 1. Large Missile Test: For glazed openings located within 30 feet (9.1 m) of grade.
 - 2. Small Missile Test: For glazed openings located more than 30 feet (9.1 m) above grade.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.
- E. Operating Temperature Range: Automatic entrances shall operate within minus 20 degrees F to plus 122 degrees F (minus 29 degrees C to plus 50 degrees C).
- F. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 1.25 cfm/sq. ft. (6.4 L/s x sq. m) of fixed entrance system area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa) and 6.24 lbf/sq. ft. (300 Pa).
- G. Emergency Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrances serving as a required means of egress.
- H. Opening Force:
 - 1. Power Operated Doors: Not more than 50 lbf (222 N) required to manually set door in motion if power fails, and not more than 15 lbf (67 N) required to open door to minimum required width.
 - 2. Breakaway Device for Power Operated Doors: Not more than 50 lbf (222 N) required for a breakaway door or panel to open.
- I. Entrapment Prevention Force:
 - 1. Power Operated Sliding Doors: Not more than 30 lbf (133 N) required to prevent stopped door from closing.
- J. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- K. Power Operated Door Standard: BHMA A156.10.

2.2 SLIDING AUTOMATIC ENTRANCES

- A. Provide automatic entrances, including doors, sidelites, framing, headers, carrier assemblies, roller tracks, door operators, controls, and accessories required for a complete installation.
- B. Sliding Automatic Entrance:
 - 1. Bi-parting Sliding Units:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Besam Entrance Solutions; ASSA ABLOY, Basis-of-Design
 - b. Other manufacturers subject to Architect and Owner approval.
 2. Configuration: Biparting sliding doors with two sliding leaves and sidelites on each side.
 - a. Traffic Pattern: Two way.
 - b. Emergency Breakaway Capability: Sliding leaves only.
 - c. Mounting: Between jambs.
 3. Operator Features:
 - a. Power opening and closing.
 - b. Drive System: belt.
 - c. Adjustable opening and closing speeds.
 - d. Adjustable hold-open time between zero and 30 seconds.
 - e. Obstruction recycle.
 - f. On-off/hold-open switch to control electric power to operator, key operated.
- C. Sliding Door Carrier Assemblies and Overhead Roller Tracks: Carrier assembly that allows vertical adjustment; consisting of nylon or Delrin covered, ball bearing center steel wheels operating on a continuous roller track, or ball bearing center steel wheels operating on a nylon or Delrin covered, continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly.
1. Rollers: Minimum of two ball-bearing roller wheels and two antirise rollers for each active leaf.
- D. Electrical service to door operators shall be provided under Division 26 Electrical. Minimum service to be 120 VAC, 5 amps.
- E. Controls: Activation and safety devices according to BHMA standards.
1. Activation Device: Motion sensor mounted on each side of door header to detect pedestrians in activating zone and to open door.
 2. Safety Device: Two photoelectric beams mounted in sidelite jambs on each side of door to detect pedestrians in presence zone and to prevent door from closing.
 3. Opening Width Control: Two position switch that in the normal position allows sliding doors to travel to full opening width and in the alternate position reduces opening to a selected partial opening width.
 4. Finish: Finish framing, door(s), and header with finish matching adjacent curtain wall.
 - a. Color: Selected by Architect.

2.3 ENTRANCE COMPONENTS

- A. Framing Members: Extruded aluminum, minimum 0.125 inch (3.2 mm) thick and reinforced as required to support imposed loads.
1. Nominal Size: 1-3/4 inches by 6 inches (45 mm by 150 mm).
 2. Extruded Glazing Stops and Applied Trim: Minimum 0.062-inch (1.6 mm) wall thickness.
- B. Stile and Rail Doors: 1-3/4 inch (45 mm) thick, glazed doors with minimum 0.125 inch (3.2 mm) thick, extruded aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded or incorporate concealed tie rods that span full length of top and bottom rails.
1. Glazing Stops and Gaskets: Square, snap on, extruded aluminum stops and preformed gaskets.
 2. Stile Design: Thin stile, less than 1-3/4 inch (45 mm) nominal width.
 3. Rail Design: Indicated on Drawings.

- C. Headers: Fabricated from minimum 0.125 inch (3.2 mm) thick extruded aluminum and extending full width of automatic entrance units to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
 - 1. Mounting: Concealed, with one side of header flush with framing.
 - 2. Capacity: Capable of supporting doors of up to 175 lb (79 kg) per leaf over spans of up to 14 feet (4.3 m) without intermediate supports.
 - a. Provide sag rods for spans exceeding 14 feet (4.3 m).
- D. Brackets and Reinforcements: High strength aluminum with nonstaining, nonferrous shims for aligning system components.
- E. Signage: Provide signage to comply with BHMA standards.
 - 1. Application Process: Decals.
 - 2. Provide sign materials with instructions for field application after glazing is installed.

2.4 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Extrusions: ASTM B 221 (ASTM B 221M).
 - 2. Sheet: ASTM B 209 (ASTM B 209M).
- B. Steel Reinforcement: Reinforcement with corrosion resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Use surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
- C. Stainless steel Bars: ASTM A 276/A 276M or ASTM A 666, type 316.
- D. Stainless Steel Tubing: ASTM A 554, Grade MT 316.
- E. Stainless Steel Sheet: ASTM A 240/A 240M or ASTM A 666, type 316, stretcher leveled standard of flatness, in entrance thickness.
- F. Glazing: Refer to Section 08 80 00.
- G. Sealants and Joint Fillers: Refer to Section 07 92 00.
- H. Bituminous Coating: Cold applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- I. Fasteners and Accessories: Corrosion resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.5 DOOR OPERATORS AND CONTROLS

- A. Provide operators and controls, including activation and safety devices, according to BHMA standards, for condition of exposure, and for long term, maintenance free operation under normal traffic load for type of occupancy indicated.
- B. Door Operators: Provide door operators of size recommended by manufacturer.

1. Door Operator Performance: Door operators open and close doors and maintain doors in fully closed position when subjected to design wind loads.
2. Electromechanical Operators: Self-contained overhead unit recommended by manufacturer for door size, weight, and movement; powered by minimum of 1/4 horsepower, permanent magnet DC motor with gear reduction drive, solid state microprocessor controller; and encoder. and with manual operation with power off. Compliant with UL 325.
 - a. Operation: Power opening and power closing.
 - b. Features:
 - 1) Adjustable opening and closing speeds.
 - 2) Adjustable back check and latching.
 - 3) Adjustable braking.
 - 4) Adjustable hold-open time between 0 and 30 seconds.
 - 5) Obstruction recycle.
 - 6) On/Off switch to control electric power to operator.
 - 7) Energy conservation switch that reduces door-opening width.
 - 8) Closed loop speed control with active braking and acceleration.
 - 9) Adjustable obstruction recycle time delay.
 - 10) Self adjusting stop position.
 - 11) Self adjusting closing compression force.
 - 12) Onboard sensor power supply.
 - 13) Onboard sensor monitoring.
 - 14) Optional Switch to open/Switch to close operation.
 - 15) Mounting: Concealed.
 - 16) Drive System: Synchronous belt type.
- C. Photoelectric Beams: Pulsed infrared, sender receiver assembly for recessed mounting. Beams shall not be active when doors are fully closed.
- D. Key Switch: Recess mounted, door control switch with key controlled actuator; enclosed in 2 inch by 4-inch (50 mm by 100 mm) junction box. Provide faceplate engraved with letters indicating switch functions.
 1. Faceplate Material: Stainless steel, selected by Architect from manufacturer's full range.
 2. Functions: Two way automatic, hold open, one-way exit, off, full open, and partial open.
 3. Mounting: Recess mounted, semi-flush in wall.
- E. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.6 HARDWARE

- A. Provide units in sizes and types recommended by automatic entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish unless otherwise indicated.
- B. Breakaway Device for Power Operated Doors: Device that allows door to swing out in direction of egress to full 90 degrees from any operating position. Maximum force to open door shall be as stipulated. Interrupt powered operation of door operator while in breakaway mode.
 1. Include one adjustable detent device mounted at the top of each breakaway panel to control breakaway force.
 - a. Panel Closer: Factory installed concealed hydraulic door closer.

- b. Limit Arms: Limit swing to 90 degrees, spring loaded with adjustable friction damping.
- C. Automatic Locking: Electrically controlled device mounted in header that automatically locks sliding door in closed position, preventing door panels from sliding manually. Provide fail safe operation if power fails.
 - 1. Power Interruption: Lock shall be disengaged, allowing doors to slide manually.
 - 2. Means of Egress: Standard breakaway feature.
- D. Uninterrupted Power Supply: UL 1778, fully integrated unit mounted above ceiling.
 - 1. Power Interruption: Supply power to operator, controls, activation device, and safety systems of sliding automatic door for up to 1.5 hours of normal operation.
 - 2. Include low battery shutdown feature to safely open or close door prior to complete battery discharge.
 - 3. Include audible battery replacement alarm to indicate that battery will no longer accept a charge and replacement is required.
- E. Weather Stripping: Replaceable components.
 - 1. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon fabric or aluminum strip backing.

2.7 FABRICATION

- A. Factory fabricate automatic entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.
 - 1. Form aluminum shapes before finishing.
 - 2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
 - 3. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, fabricated from stainless steel.
 - a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - b. Reinforce members as required to receive fastener threads.
 - 4. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
- B. Framing: Provide automatic entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to site.
 - 1. Fabricate tubular and channel frame assemblies with welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
 - 2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
 - 3. Form profiles that are sharp, straight, and free of defects or deformations.
 - 4. Provide components with concealed fasteners and anchor and connection devices.
 - 5. Fabricate components with accurately fitted joints, with ends coped or mitered to produce hairline joints free of burrs and distortion.
 - 6. Fabricate exterior components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior. Provide anchorage and alignment brackets for concealed support of assembly from building structure.
 - 7. Allow for thermal expansion of exterior units.

- C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as necessary to support imposed loads and for installing hardware.
- D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.
- E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA Glazing Manual.
- F. Hardware: Factory install hardware to greatest extent possible; remove as necessary for final finishing operation and for delivery to and installation at site. Cut, drill, and tap for factory installed hardware before applying finishes.
 - 1. Provide sliding type weather stripping, mortised into door, at perimeter of doors.
- G. Controls: Factory install activation and safety devices in doors and headers as required by BHMA A156.10 for type of door and direction of travel.
 - 1. Install photoelectric beams in vertical jambs of sidelites, with dimension above finished floor as follows:
 - a. Top Beam: 48 inches (1219 mm).
 - b. Bottom Beam: 24 inches (610 mm).

2.8 FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances.
- B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic entrance installation.
- C. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

- A. Install automatic entrances according to manufacturer's written instructions and cited BHMA A156.10 for direction of pedestrian travel, including signage, controls, wiring, and connection to the building's power supply.

1. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
 2. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
 3. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous coating.
- B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
1. Install surface mounted hardware using concealed fasteners to greatest extent possible.
 2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
 3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior.
 4. Level recesses for recessed thresholds using nonshrink grout.
- C. Door Operators: Connect door operators to electrical power distribution system.
- D. Controls: Install and adjust activation and safety devices according to manufacturer's written instructions and cited BHMA standard for direction of pedestrian travel. Connect control wiring according to Division 26.
- E. Glazing: Install glazing as specified in Section 08 80 00.
- F. Sealants: Comply with requirements specified in Section 07 92 00 to provide weathertight installation.
1. Set thresholds, framing members and flashings in full sealant bed.
 2. Seal perimeter of framing members with sealant.
- G. Signage: Apply signage on both sides of each door, as required by cited BHMA standard for direction of pedestrian travel.
- H. Wiring within Automatic Entrance Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's written limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 FIELD QUALITY CONTROL

- A. Certified Inspector: Owner may engage a Certified Inspector to test and inspect components, assemblies, and installations, including connections.
- B. Automatic entrances will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust hardware, moving parts, door operators, and controls to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.
 1. Adjust exterior doors for tight closure.

- B. Readjust door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits during other than normal occupancy hours.

3.5 CLEANING

- A. Clean glass and metal surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.
 - 1. Comply with requirements in Section 08 80 00 for cleaning and maintaining glass.

3.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of automatic entrance Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper automatic entrance operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 1. Engage a Certified Inspector to perform safety inspection after each adjustment or repair and at end of maintenance period. Furnish completed inspection reports to Owner.
 - 2. Perform maintenance, including emergency callback service, during normal working hours.
 - 3. Include 24 hour per day, 7 day per week emergency callback service.

3.7 DEMONSTRATION

- A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic entrances.

END OF SECTION

SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Glazed aluminum window walls.

1.2 ACTION SUBMITTALS

- A. Combined Submittals: Submit combined shop drawing which has been reviewed, annotated, and coordinated by each of the principal exterior cladding subcontractors.
1. As an indication of review, and as a condition of acceptance by the Architect, provide combined submittal with a cover sheet clearly indicating the signatures of the Contractor and each exterior cladding subcontractor.
 2. Coordinate curtainwall, storefronts and entrances, MCM, and other products.
- B. Product Data: Technical data identifying type of curtainwall assembly including construction details, framing methods, material descriptions, identification and dimensions of individual components and profiles, and finishes.
- C. Shop Drawings: Submit plans, elevations, sections, full size details, and attachments to other work.
1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 2. Include full size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- D. Samples: Submit samples for each type of exposed finish required in standard sizes.
- E. Delegated Design Submittal: Submit documentation indicating compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit data for Installer and field-testing agency.
- B. Florida Product Approval (FL) or Miami-Dade County Product Notice of Acceptance (NOA): For glazed aluminum curtain walls.

- C. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components from manufacturer.
 - 1. Basis for Certification: NFRC certified energy performance values for each glazed aluminum curtain wall.
- D. Product Test Reports: Submit reports for glazed aluminum curtain walls, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
- E. Source quality control reports.
- F. Field quality control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Submit data for glazed aluminum curtain walls to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Manufacturer/Fabricator Qualifications: Fabricator specializing in the fabrication of aluminum framed curtainwall and components, having minimum 10 years documented experience, and with sufficient production capacity, organized quality control and testing procedures, and published written and illustrated installation manuals, to produce and install the assemblies required.
- B. Installer Qualifications: Firm that specializes in the erection of aluminum curtain wall, having minimum 10 years documented experience, and approved or certified by manufacturer/fabricator.
 - 1. Engineering Responsibility: Prepare data for curtainwall, storefront, and window systems, including Shop Drawings, based on testing and engineering analysis of manufactured units in systems similar to those indicated.
 - a. Professional Engineer Qualifications: A professional engineer who is legally licensed to practice in the State of Florida, experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of heavy glass storefront and entrance system similar to those indicated in material, design, and extent.
- C. Source Limitations: Obtain curtain wall assembly components, including framing and accessories, from single manufacturer.
- D. Welding Standards: Welding shall be performed by skilled and qualified mechanics. Welding shall be performed in accordance with the applicable provisions of AWS D1.1 *Structural Welding Code - Steel* and AWS D1.2 *Structural Welding Code - Aluminum*.
- E. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies related to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

- F. Mockups: Build mockups to verify selections and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Testing shall be performed on mockups according to specified requirements.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.
- G. Preinstallation Conference: Conduct conference at site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Identify components of curtainwall work after fabrication by marks clearly indicating location in the building. Package components to protect from damage during shipping and handling.
- B. Storage on Site: Store units, components, and materials in clean, dry location, away from uncured concrete, masonry work, sprayed on fireproofing work, and construction activities. Cover with nonstaining waterproof paper, tarpaulin, or polyethylene sheeting to permit circulation of air inside the covering.
- C. Keep handling on site to a minimum. Exercise care to avoid damage to finishes of metals or breakage of glass.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of supporting structure by field measurements before fabrication so curtainwall work is accurately designed, fabricated, and fitted to the structure. Indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work. Use Contractor's lines and benchmarks as a basis for measurements.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating curtainwalls without field measurements. Coordinate supporting structure construction to ensure actual dimensions correspond to established dimensions.

1.8 WARRANTY

- A. Assembly Warranty: Written warranty signed by manufacturer and installer in which the manufacturer agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

- B. Finish Warranty: Written warranty signed by manufacturer in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory applied finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer with experience in the design of curtainwalls and aluminum storefronts to design glazed aluminum curtain walls using performance requirements and design criteria indicated.
- B. Comply with performance requirements specified as determined by testing of glazed aluminum curtain walls representing those indicated without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Florida Building Code
 - 1. TAS 201: Impact Test Procedures
 - 2. TAS 202: Criteria for Testing Impact & Non-Impact Resistant Building Envelope Components Using Uniform Static Pressure
 - 3. TAS 203: Criteria for Testing Products Subject to Cyclic Wind Pressure Loading
- D. Structural Loads:
 - 1. Wind Loads: Design and size components of curtain wall assembly to withstand loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with SEI/ASCE 7 to establish wind pressure based on the following criteria:
 - a. Wind Loads: Indicated on Drawings.
 - b. Ultimate Design Wind Speed (V_{ult}): 153 mph, unless noted otherwise on Drawings.
 - c. Nominal Design Wind Speed (V_{asd}): See Drawings.
 - d. Occupancy Category: III, unless noted otherwise on Drawings.
 - e. Exposure Category: C, unless noted otherwise on Drawings.
 - f. Internal Pressure Coefficient (GCPI): Plus/minus 0.18.
 - 2. Special Wind Load Exception: Wall cladding systems and components on the AIRSIDE of Airport Terminal buildings shall be designed to resist a minimum of 50 lbf/sq. ft. applied over any 15 sq. ft. area of cladding per FAA AC 150/5300-13, Chapter 8, "The Effects and Treatment of Jet Blast," regardless of minimum wind loads determined per SEI/ASCE 7.

3. Other Design Loads: Indicated on Drawings.
- E. Deflection of Framing Members: At design wind pressure:
1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19.1 mm), whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.
- F. Structural: Test according to ASTM E 330:
1. When tested at positive and negative wind load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative windload design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- G. Air Infiltration: Test according to ASTM E 283 for infiltration:
1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa) and 6.24 lbf/sq. ft. (300 Pa).
- H. Water Penetration under Static Pressure: Test according to ASTM E 331:
1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft. (720 Pa).
- I. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- J. Federal Standard 16 CFR 1201, Consumer Product Safety Commission (CPSC): *Safety Standard for Architectural Glazing Materials*, published in Code of Federal Regulations (CFR).
1. Comply with applicable requirements of authorities having jurisdiction, wherever requirements conflict the more stringent shall be required. Obtain approvals from authorities.
 2. As a minimum, provide safety glazing complying with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category II materials.
- K. Energy Performance: Certify and label energy performance according to NFRC as follows:
1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x degrees F (2.55 W/sq. m x K) as determined according to NFRC 100.
 2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.35 as determined according to NFRC 200.
 3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 63 as determined according to NFRC 500.
- L. Windborne Debris Impact Resistance: Pass missile impact and cyclic pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 and TAS 201/203 for Wind Zone 4.

1. Large Missile Test: For glazed openings located within 30 feet (9.1 m) of grade.
2. Small Missile Test: For glazed openings located more than 30 feet (9.1 m) above grade.

- M. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change: 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

2.2 FRAMING

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America; 1600 Wall System (NOA No. 15-0604.07) or comparable product by one of the following:
1. EFCO Corporation; Series 5500 (TS).
 2. Oldcastle BuildingEnvelope; Reliance-TC.
 3. Tubelite; 400 Series.
 4. United States Aluminum; Series 3250.
 5. Wausau Window and Wall Systems; HP-Wall Series.
 6. YKK AP America Inc; YES 750 OGP.
- B. Framing Members: Extruded or formed aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken.
 2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Glazing Plane: Front.
 4. Finish: High performance organic finish.
 5. Fabrication Method: Either factory or field fabricated system.
- C. Pressure Caps: Aluminum components that mechanically retain glazing. Include snap on aluminum trim that conceals fasteners.
- D. Brackets and Reinforcements: High strength aluminum with nonstaining, nonferrous shims for aligning system components.
- E. Materials:
1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.
 2. Steel Reinforcement: Zinc rich, corrosion resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 GLAZING

- A. Glazing: Comply with Section 088000.
- B. Glazing Gaskets: Comply with Section 088000.
- C. Glazing Sealants: Recommended by manufacturer.

2.4 ACCESSORIES

- A. Fasteners and Accessories: Corrosion resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot dip galvanized cast iron, malleable iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- C. Concealed Flashing: Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, ASTM A 240/A 240M of type recommended by manufacturer.
- D. Bituminous Paint: Cold applied asphalt mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30 mil (0.762 mm) thickness per coat.

2.5 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from exterior.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Fabricate components to resist water penetration:
 - 1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

2. Pressure equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.
- E. Curtain Wall Framing: Fabricate components for assembly using manufacturer's standard assembly method.
- F. Factory Assembled Frame Units:
1. Rigidly secure nonmovement joints.
 2. Prepare surfaces that are in contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion.
 3. Preparation includes, but is not limited to, cleaning and priming surfaces.
 4. Seal joints watertight unless otherwise indicated.
 5. Install glazing to comply with requirements in Section 088000.
- G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
- 2.6 ALUMINUM FINISHES
- A. High Performance Organic Finish: Three coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Color and Gloss: To match existing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas for compliance with requirements for installation tolerances and conditions affecting performance of the work. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions.
1. Do not install damaged components.
 2. Fit joints to produce hairline joints free of burrs and distortion.
 3. Rigidly secure nonmovement joints.
 4. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 5. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
 6. Seal joints watertight unless otherwise indicated.
- B. Metal Protection:
1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.

2. Where aluminum is in contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
- D. Install components plumb and true in alignment with established lines and grades.
- E. Install glazing as specified in Section 088000.

3.3 ERECTION TOLERANCES

- A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:
 1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
 2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
 - c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
 4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Test Area: Perform tests on representative areas of glazed aluminum curtain walls.
- C. Field Quality Control Testing: Perform the following test on representative areas of glazed aluminum curtain walls.
 1. Water Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of two tests in areas as directed by Architect.
 2. Water Penetration: ASTM E 1105 at a minimum uniform static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing, but not less than 6.24 lbf/sq. ft. (300 Pa), and shall not evidence water penetration.
- D. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Hardware for wood and hollow metal doors.
 2. Hardware for aluminum doors.
 3. Thresholds.
 4. Weatherstripping, seals and door gaskets.

1.2 ACTION SUBMITTALS

- A. Hardware Schedule:
1. Submit hardware supplier's typewritten copies of proposed finish hardware schedule for review.
 2. Prepare schedule using Sequence and Format for Hardware Schedule as recommended by Door and Hardware Institute (DHI).
 3. After acceptance of schedule, provide schedule to Architect for file and distribution purposes.
 4. DO NOT order hardware until FIELD AND FILE schedule has been received.
- B. Product Data:
1. Manufacturer's cut sheets for each hardware item.
 2. Details for type strike plates, length of spindle, hand, backset and bevel of locks, hand and degree of opening for closers and other functions of mechanisms.
 3. Installation instructions and maintenance information.
 4. Copies of final hardware schedule reflecting changes made during construction.
- C. Samples:
1. Provide Architect one sample of finish hardware item when requested by Owners Authorized Representative.
 2. Architect will hold samples until completion of Project.
 3. Upon completion of Project, turn over samples to Owner to serve as product samples for Owner's building maintenance department.
- D. Shop Drawings:
1. Push Plate: Indicate concealed fastening and graphics.
 2. Thresholds: Indicate thickness of materials, method of anchoring and details of construction.
 3. Door Closers: Indicate mounting location of closer body (push side, pull side, top jamb).
 4. Wiring Diagrams: For any electrified hardware furnished on this project, provide complete wiring diagrams along with riser drawings and elevations, showing locations where such material is to be installed. These documents shall be submitted with the Hardware Schedule.
- E. Wiring Diagrams: Provide complete wiring diagrams for each opening requiring components listed by opening in the hardware submittal. Operational descriptions to detail how each where only magnetic hold-opens are specified. Provide a copy with each hardware schedule submitted after approval. Supply a copy with delivery of hardware to jobsite and another copy to Owner at time of job completion.

- F. Operational Descriptions: Provide complete operational descriptions of electrical components listed by opening in the hardware submittals. Operational descriptions to detail how each electrical component functions with the opening incorporating all conditions of ingress and egress. Provide a copy with each hardware schedule submitted for approval, Supply another copy with delivery of hardware to jobsite and another copy to Owner at time of job completion.
- G. Electronic Hardware Elevation Drawings: Provide elevation drawings of electric hardware and systems identifying locations of the system components with respect to their placement in the door opening. Provide a copy with each hardware schedule submitted for approval. Supply another copy with delivery of hardware to jobsite and another copy to Owner at time of job completion.

1.3 INFORMATIONAL SUBMITTALS

- A. Certifications: Upon request of Architect, submit hardware manufacturer's letter of compliance that products meet ANSI requirements and have been tested and are grades required by specification.
- B. Templates: Furnish templates and accepted finish hardware schedule to door and frame manufacturers for use in fabrication.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Tools: Deliver hardware adjustment tools for each item of finish hardware.
- B. Operation and Maintenance Data: At completion of the project provide to the Owner a copy of the latest, revised and updated schedule of finish hardware, complete with catalog cuts and keying schedule. Provide manufacturer's parts list and maintenance instructions for each type of hardware supplied and necessary wrenches and tools required for proper maintenance of hardware.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Representative: Furnish services of Architectural Hardware Consultant to prepare hardware schedule, keying, coordination with other trades, consultation with Architect and Owner, and on-site inspections.
- B. Fire Resistant Hardware: Comply with requirements of door and frame manufacturer for UL listed assembly; bear UL labels.
- C. Pre-Installation Conference for Hardware: Prior to installation for finish hardware, there shall be a scheduled conference between the General Contractor, Architect's opening consultant, hardware supplier, installers and related trades to review materials, procedures and coordination of related work.
- D. Post-Installation Inspection for Hardware: Upon completion of installation of all Finish Hardware and prior to Owner acceptance of the project, arrange a post installation inspection of all mechanical and electrical door hardware. Inspection shall include the Contractor, Architect, Architect's hardware consultant, hardware supplier, hardware manufacturer's representatives, and installation contractor. Repair or replace any product found to be installed improperly or functioning incorrectly. Any additional costs related to repair or replacement shall not be the responsibility of the Owner.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Package hardware items separately with necessary screws, bolts, miscellaneous parts, instructions, and where necessary, installation templates for installation. Clearly label packages to identify contents and finish location in building.
- B. Deliver hardware required for shop application to shop, mill or factory in ample time to not impede progress of work.
- C. Receive hardware when delivered. Provide dry, secure lock-up for hardware delivered to project, but not yet installed. Provide space for unpacking, sorting, checking and storage of finish hardware.
- D. Control handling and installation of hardware items that are not immediately replaceable so completion of work will not be delayed by hardware losses, both before and after installation.
- E. Contractor and hardware supplier shall jointly inventory.

1.7 WARRANTY

- A. Submit additional warranty on following items:
 - 1. Mortise Locks: Five five-year limited warranty.
 - 2. Door Closers: Ten-year limited warranty.
 - 3. Electromechanical Hardware: Two-year limited warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide products indicated or comparable products by other manufacturers listed.

2.2 HINGES

- A. Acceptable Manufacturers:
 - 1. McKinney Products Company; an ASSA ABLOY Group company.
 - 2. Hager Companies.
 - 3. Stanley Commercial Hardware; Div. of The Stanley Works.
 - 4. IVES Hardware; an Allegion plc company.
- B. Full Mortise Hinges: Five knuckle, ANSI A156.1, with non-rising pins, anti-friction bearings on all hinges, heavy weight construction where noted in Schedule.
- C. Non-Removable Pins: Provide butts with set screw in barrel making hinge non-removable when door is in closed position for exterior and interior doors with locks, and doors with security controls (credential reader and electromechanical/electromagnetic hardware items).
- D. Reverse Spring Hinges: Full mortise, where noted in schedule.

E. Applications:

Type	McKinney	Hager	Stanley	Ives
Type 2	TA2714	BB1279	FBB179	5BB1
Type 4	T4A3786	BB1168	FBB168	5BB1HW

1. Interior doors with closers: Type 2 or 4.
2. Interior doors over 36 inches wide: Type 4.
3. Interior doors 36 inches or less without closer: Type 2.
4. Provide NRP (non-removable pins) at out-swinging lockable doors.

F. Sizes:

1. 1-3/4-inch Doors 4-1/2 inch by 4-1/2 inch

G. Quantities:

1. 2 - hinges per leaf for openings through 60 inches high.
2. 1 - additional hinge per leaf for each additional 30 inches in height or fraction thereof.

H. Drill 5/32-inch hole and use No. 12, 1-1/4-inch steel threaded to the head wood screws for hinges on wood doors.

2.3 ELECTRIC HINGES

A. Acceptable Manufacturers:

1. McKinney Products Company; an ASSA ABLOY Group company.
2. Hager Companies.
3. Stanley Commercial Hardware; Div. of The Stanley Works.

B. Electrified functions with factory installed common connections with Molex-type connectors.

1. Basis-of-Design Product: ElectroLynx by McKinney Products Company; an ASSA ABLOY Group company.

C. Provide sufficient number of concealed wires to accommodate electric function of specified hardware.

D. Locate electric hinges at second hinge from bottom. Where electric hinges are used in conjunction with exit devices, locate hinge nearest to exit device.

E. Provide mortar guard (similar to McKinney MG-16) for each electric hinge specified.

2.4 CONTINUOUS GEARED HINGES

A. Acceptable Manufacturers:

1. IVES Hardware; an Allegion plc company.
2. McKinney Products Company; an ASSA ABLOY Group company.
3. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
4. Roton – Hager Companies
5. Stanley Commercial Hardware; Div. of The Stanley Works.

B. Applications:

McKinney	Pemko	Roton	Stanley	Ives
MCK-12HD	FM83SLFHD	780-112HD	661HD	112HD
MCK-FM300	-	790-900	651	700

- C. Provide sufficient number of concealed wires to accommodate electric function of specified hardware, supply as three-piece hinge (removable electronic wire section in middle leaf).
- D. Continuous hinges: Heavy duty, at exterior doors and doors with exit devices.
- E. Materials: Aluminum hinges at storefront doors and electrified openings; stainless steel at all other locations indicated.

2.5 MECHANICAL LOCKSETS AND LATCH SETS

A. Acceptable Products:

- 1. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group Company; ML2000 Series x PSP lever/escutcheon trim.
- 2. SARGENT Manufacturing Company; an ASSA ABLOY Group company; 8200 Series x LW1P lever/escutcheon trim.
- 3. Schlage Commercial Lock Division; an Allegion plc company; L9000 Series x 17N lever/escutcheon trim.
- 4. Best Access Systems; 40H Series x 14J lever/escutcheon trim.

B. Mortise Locks and Latch Sets:

- 1. Heavy duty construction with wrought cases, minimum case thickness of 0.093", BHMA certified ANSI A156.13; Operational Grade 1.
- 2. Fronts: 8" x 1-1/4", adjustable to 1/8" in 2" with 2-3/4" backset.
- 3. Minimum projection of latch bolt: 3/4-inch.
- 4. Minimum throw of dead bolt: 1-inch.
- 5. Beveled, rounded or rabbeted faces where required.
- 6. Where lock stiles are too narrow for backsets of locks specified, furnish special backsets.
- 7. Electronic functions supplied with factory-installed request-to-exit monitor switch, security monitor switch, latch bolt monitor switch, and electrified trim components, as scheduled.
- 8. Electrified functions with factory installed common plug-in connectors.
 - a. Basis-of-Design Product: ElectroLynx by McKinney Products Company; an ASSA ABLOY Group company.

C. Lever Handles and Escutcheons:

- 1. Cast of forged brass or bronze material, levers supported by internal spring.
- 2. On doors into hazardous areas that are accessible to physically handicapped persons, provide knurled lever contact surfaces. Abrasive coating is not permitted

D. Strikes:

- 1. Furnish locks and latches with wrought box strikes.
- 2. On single swing doors, provide latch strike plates with minimum lip projection necessary to project from trim.
- 3. On pair of doors with or without astragal, lip projection of latch strike plates shall not extend beyond face of lock style of inactive leaf.
- 4. Size: 4-7/8" x 1-1/4" x 3/32".

- E. Dummy Trim: Match to lock specified on pair of doors, provide complete set both sides of doors.

2.6 KEYING

- A. Factory construction master-keyed locksets based on Existing Facility Master Key System.

- B. Owner will establish keying based on GMK system. Provide following number of keys:

- 1. GMK: Six each.

2. MK: Six each.
 3. Change keys: Three for each lock.
 4. Construction keys: 12 master keys.
- C. Construction Keying: Provide keyed construction cores for locks during construction.
- D. Index, tag and deliver permanent keys in sealed container to Owner.
- E. Contractor to provide keyed permanent cores for installation by Owner.

2.7 ELECTRO-MAGNETIC LOCKSETS

- A. Acceptable Manufacturers:
1. Schlage Commercial Lock Division; an Allegion plc company.
 2. Securitron Magnalock Corporation; an ASSA ABLOY Group company.
- B. Electromagnetic Locks: BHMA A156.23; electrically powered; with electromagnet attached to frame and armature plate attached to door; full-exterior or full-interior type, as required by application indicated.
1. Provide with integrated bond sensor.
 2. Electrified functions with factory installed common plug-in connectors.
 - a. Basis-of-Design Product: ElectroLynx by McKinney Products Company; an ASSA ABLOY Group company.

2.8 ELECTRIC MONITOR STRIKES AND STRIKE-MOUNTED LATCH MONITORS

- A. Acceptable Products:
1. Securitron Magnalock Corporation; an ASSA ABLOY Group company: Latch Monitor LML-1.
 2. HES Innovations; an ASSA ABLOY Group company; Folger Adams Electric Strike 310-4 LCBMA.
- B. Electrified functions with factory installed common plug-in connectors.
1. Basis-of-Design Product: ElectroLynx by McKinney Products Company; an ASSA ABLOY Group company.

2.9 DOOR POSITION SWITCH

- A. Acceptable Product:
1. Sargent; 3287.
 2. GE Security; Sentrol #2707 AD-L.

2.10 ELECTRIC POWER TRANSFER DEVICES

- A. Acceptable Manufacturers:
1. Schlage Commercial Lock Division; an Allegion plc company.
 2. Securitron Magnalock Corporation; an ASSA ABLOY Group company.
- B. Electrified functions with factory installed common plug-in connectors.
1. Basis-of-Design Product: ElectroLynx by McKinney Products Company; an ASSA ABLOY Group company.

2.11 ELECTRO-MAGNETIC DOOR HOLDERS

- A. Acceptable Manufacturers:

1. LCN Closers; an Allegion plc company.
 2. Rixson; an ASSA ABLOY Group company.
- B. Electromagnetic Door Holders: BHMA A156.15, Grade 1; wall-mounted electromagnetic single, floor-mounted electromagnet, or single floor-mounted electromagnet double units with strike plate attached to swinging door; coordinated with fire detectors and interface with fire alarm system for labeled fire-rated door assemblies.

2.12 EXIT DEVICES

- A. Acceptable Products:
1. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company; ED 5000 Series
 2. SARGENT Manufacturing Company; an ASSA ABLOY Group company; 80 Series.
 3. Von Duprin; an Allegion plc company.; 33A & 99 Series
- B. Description:
1. Listed under "Fire Exit Hardware" in accident equipment list of Underwriters Laboratories, BHMA certified ANSI A156.3
 2. Chassis mounted unit construction with removable covers, identical wall thickness on all types of exit devices.
 3. Minimum top and bottom rods of vertical rod devices: 3/8" diameter.
 4. Stainless steel main arm pivot and springs.
 5. Stainless steel surface for exit device touch pad.
 6. Base metal stainless steel, brass, or bronze.
 7. Heavy-duty pull trim, or lever trim to match locksets.
 8. Electronic functions supplied with factory-installed request-to-exit monitor switch(s), latch bolt retraction system, latch bolt monitor switch, electrified trim components, as scheduled.
 9. Electrified functions with factory installed common plug-in connectors:
 - a. Basis-of-Design Product: ElectroLynx by McKinney Products Company; an ASSA ABLOY Group company.

2.13 SURFACE MOUNTED DOOR CLOSERS

- A. Acceptable Manufacturers:
1. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company; DC8000 Series.
 2. LCN Closers; an Allegion plc company; 4040 Series.
 3. SARGENT Manufacturing Company; an ASSA ABLOY Group company; 351 Series.
- B. Surface Closers: BHMA certified ANSI A156.4, universal regular or parallel arm, nonhanded, nonsized.
1. Cast iron OR aluminum body, rack and pinion construction with compression spring, fully hydraulic.
 2. Closing speed, latching speed and backcheck controlled by independently operated concealed key valves.
 3. Intensity of backcheck feature to be adjustable.
 4. Equipped with spring adjustment allowing adjustment of spring power to suit individual door conditions.
 5. Suitable for mounting on 1-3/4" minimum top rail of door.
 6. Size as recommended by manufacturer for door size and weight.
 7. Provide mounting plates, sex nuts and bolts.
 8. No graphics allowed on cover.
 9. Provide parallel arms for exterior doors, hall doors, and outswinging interior doors.
 10. Provide stop arms for exterior door closers with parallel arms.

11. For doors in areas accessible to physically handicapped persons, provide doors with adjustable opening force and delayed closing actions.
12. Mount closers to doors with thru-bolts.

C. Arm Finish: Painted, aluminum enamel.

D. Closer Cover Finish: Sprayed enamel, color selected by Architect.

2.14 MECHANICAL STOPS AND HOLDERS

A. Acceptable Manufacturers:

1. IVES Hardware; an Allegion plc company.
2. Rockwood Manufacturing Company.
3. Trimco.
4. Rixson; an ASSA ABLOY Group company (for overhead stops; surface-applied and concealed application).

B. Wall- and Floor-Mounted Stops: BHMA A156.16

1. Wall Stops: Convex gray rubber bumper and brass, bronze or steel with concealed fasteners.
2. Floor Stops: Dome type with plated brass, bronze or steel stop.
3. Floor Stop and Holder: Two-piece floor mounted stop with door holder.

C. Overhead Stops and Holders: BHMA A156.8:

1. Provide where scheduled, and for doors that open against equipment, casework, sidelights, other objects that would make wall stops inappropriate
2. Furnish door stop for each door leaf.

2.15 FLUSH BOLTS AND STRIKES

A. Acceptable Manufacturers:

1. IVES Hardware; an Allegion plc company.
2. Rockwood Manufacturing Company.
3. Trimco.

B. Flush Bolts: BHMA A156.16; minimum 3/4-inch throw, designed for mortising into door edge.

1. Furnish flush bolts with dustproof strikes.

2.16 SILENCERS

A. Acceptable Manufacturers:

1. IVES Hardware; an Allegion plc company.
2. Rockwood Manufacturing Company.
3. Trimco.

B. Silencers: Preformed neoprene or rubber, gray.

C. Provide on interior metal door frames, except for frames for weatherstripped or smoke-sealed doors. Provide three silencers minimum for single doors and two for pairs of doors.

2.17 SMOKE SEALS

A. Acceptable Manufacturers:

1. National Guard Products.
2. Pemko Manufacturing Co.; an ASSA ABLOY Group company.

3. Reese Enterprises, Inc.

B. Smoke Seals: Where smoke- and draft-control door assemblies are required, provide seals that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.

C. Type: Extruded silicone bulb-type with self-adhesive backing.

2.18 WEATHERSTRIPPING

A. Acceptable Manufacturers:

1. National Guard Products.
2. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
3. Reese Enterprises, Inc.

B. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

C. Type: Silicone head and jamb pressure-sensitive gasket.

2.19 THRESHOLD

A. Acceptable Manufacturers:

1. National Guard Products.
2. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
3. Reese Enterprises, Inc.

B. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Type: Two-piece grooved aluminum treads, for handicap access clear anodized finish, fabricated with mitered corners and returns.

2.20 DOOR BOTTOM SEAL

A. Acceptable Manufacturers:

1. National Guard Products.
2. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
3. Reese Enterprises, Inc.

B. Door Shoes: Neoprene gasket material held in place by aluminum housing; mounted to bottom edge of door with screws.

1. Mounting: Surface mounted on bottom edge of door.

2.21 PUSH AND PULLS

A. Acceptable Manufacturers:

1. IVES Hardware; An Allegion plc Company.
2. Rockwood Manufacturing Company.
3. Trimco.

B. Operating Trim: BHMA A156.6; stainless steel, unless otherwise indicated.

2.22 KICK PLATES

- A. Acceptable Manufacturers:
 - 1. IVES Hardware; An Allegion plc Company.
 - 2. Rockwood Manufacturing Company.
 - 3. Trimco.
- B. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

2.23 KEY CABINET

- A. Surface mounted unit manufactured from patent level cold-rolled furniture steel, electro-welded construction; no sag continuous piano type pin hinge; pin tumbler locking device.
- B. Index system including dual tag system, visible key receipt system, three-way visible index and key gathering envelopes.
- C. Sized to contain and index keys for project plus 100 percent expansion.
 - 1. Acceptable Manufacturers:
 - a. Lund
 - b. Key Control
 - c. Telkee.

2.24 FABRICATION

- A. Form surfaces true, smooth, and free from burrs; of uniform color, reasonably free from imperfections affecting appearance and serviceability. Dress portions of lock mechanism which come in contact or bear upon other parts to true, smooth surface.
- B. Drawings show swing or hand of each door. Finish each item of hardware for proper installation and operation of door swing.
- C. Manufacture hardware to conform to published templates, ANSI A156.7, and prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws except as specifically indicated.
- D. Furnish screws for installation with each hardware item. Provide Phillips flathead screws except as otherwise noted. Finish exposed screws to match hardware finish.
- E. Provide concealed fasteners for hardware units that are not exposed when door is closed, except to extent no standard manufacturer units of type specified are available with concealed fasteners.
- F. Provide appropriate nuts and thru-bolts with closers.
- G. Provide fasteners that are compatible with bolt unit fastened and substrate, and which will not cause corrosion or deterioration of hardware, base material, or fastener.

2.25 HARDWARE FINISHES

- A. Match finish of each hardware unit at each door or opening. Reduce differences in color and textures as much as possible where base metal or metal forming process is different for individual units of hardware exposed at same door or opening.

- B. Architect will determine of acceptability of match with samples and other hardware at each door. Units will be judged when held 2'-0" apart at 3'-0" distance.
- C. Finish designations used in schedules and elsewhere are those listed in Materials and Finished Standard 1301 by BHMA.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Hardware schedule should include thickness of door, hand and backset of hardware items, method of fastening and other detail requirements.
- B. Check Drawings and door schedule and provide required hardware for openings. Provide required hardware for labeled opening to conform with NFPA 80 and applicable building codes.
- C. Coordinate with door and frame manufacturers.
- D. Trim undesignated openings with hardware of equal quality and design to that specified for similar opening.

3.2 INSTALLATION

- A. Install finish hardware plumb, level and true to line in accordance with manufacturer's printed instructions and job conditions.
- B. Locate hardware to comply with NBHA standards.
- C. Install finish hardware to template.
- D. Cut and fit to substrate avoiding damage or weakening. Reinforce attachment substrates as necessary for installation and operation.
- E. Completely cover cutouts with hardware item.
- F. Mortise work to correct location and size without gouging, splintering or causing irregularities in exposed finish work.
- G. Surfaces for paint or other finish:
 - 1. Where cutting and fitting is required on substrates to be painted or similarly finished, install, fit and adjust hardware prior to finishing.
 - 2. Remove hardware and place in original packaging.
 - 3. Reinstall hardware after finishing operation is complete.
- H. Install hardware items affixed to concrete with machine screws and threaded expansion shields.

3.3 ADJUSTING AND CLEANING

- A. Check and adjust each operating hardware item to ensure proper operating or function of unit.
- B. Lubricate moving parts as recommended by hardware manufacturer. Use graphite type lubrication if none other is recommended.

- C. Repair or replace defective materials or units that cannot be adjusted and lubricated to operate freely and smoothly. Reinstall items found improperly installed.
- D. Prior to Final Acceptance date, readjust and relubricate as necessary.

3.4 FIELD QUALITY CONTROL

- A. Instruct Owner's designated personnel in proper adjustment and maintenance of hardware and finishes at time of final hardware adjustment.

3.5 MAINTENANCE

- A. Continued Maintenance Service: Approximately six months after acceptance of hardware in each area:
 - 1. Re-adjust every item of hardware to restore proper function of doors and hardware.
 - 2. Consult with and instruct Owner's personnel in recommended additions to maintenance procedures.
 - 3. Clean and lubricate operational items wherever installed.
 - 4. Replace hardware items that have deteriorated or failed due to faulty design, materials or installation of hardware units.

HARDWARE SETS:

- 1. MK - McKinney
- 2. PE - Pemko
- 3. RO - Rockwood
- 4. SA – Sargent

Set: 1.0

Doors: A125C, A154B

Description: Exterior DE CR2

2 Hinge (heavy weight)	T4A3386 4-1/2" x 4-1/2"	US32D	MK
1 Hinge (heavy weight)	T4A3386 QC12 4-1/2" x 4-1/2"	US32D	MK
1 Fail Secure Exit Device	59 HC 8876-24v ETP	US32D	SA
2 Mortise Cylinder & Permanent Core	Match Building Standard		00
1 Door Closer	SRI 351 CPS	EN	SA
1 Kick Plate	K1050 10" x 2" L.D.W.	US32D	RO
1 Threshold	1715A		PE
1 Gasketing	303AV TKSP8		PE
1 Rain Guard	346C TKSP8		PE
1 Door Bottom	216AV TKSP8		PE
1 Door Position Switch	3287		SA
1 ElectroLynx Harness (door)	QC-C x L.A.R.		MK
1 ElectroLynx Harness (frame)	QC-C1500		MK
1 Riser Diagram	RISER DIAGRAM		RU
1 Wiring Diagram	WIRING DIAGRAM		RU
2 Card Reader	by security integrator		00
1 Power Supply	BPS-12/24-V.A.R.		SU

Notes: Presentation of authorized credential thru wall mounted reader to signal electronic exit lever to release, shunt delayed egress circuit and allow entry. Egress by exit push pad after 15 second delay (alarm will sound) unless presentation of authorized credential to shunt delayed egress circuit. Access by key at

all times. Exit device to remain locked (fail secure) if power fails. Card reader on opposite side to shunt delayed egress circuit and allow egress.

All exterior doors on this project shall meet ANSI A250.13 standards for windstorm AND Florida Product Approval standards. The door hardware specified is listed as a basis of design. If alternate hardware is proposed, please provide third-party test results and compliance information to architect.

Set: 2.0

Doors: A150A, A150B, A150C

Description: Exterior CR

2 Hinge (heavy weight)	T4A3386 4-1/2" x 4-1/2"	US32D	MK
1 Hinge (heavy weight)	T4A3386 QC12 4-1/2" x 4-1/2"	US32D	MK
1 Fail Secure Exit Device	55 HC 8876-24v ETP	US32D	SA
1 Mortise Cylinder & Permanent Core	Match Building Standard		00
1 Door Closer	SRI 351 CPS	EN	SA
1 Kick Plate	K1050 10" x 2" L.D.W.	US32D	RO
1 Threshold	1715A		PE
1 Gasketing	303AV TKSP8		PE
1 Rain Guard	346C TKSP8		PE
1 Door Bottom	216AV TKSP8		PE
1 Door Position Switch	3287		SA
1 ElectroLynx Harness (door)	QC-C x L.A.R.		MK
1 ElectroLynx Harness (frame)	QC-C1500		MK
1 Riser Diagram	RISER DIAGRAM		RU
1 Wiring Diagram	WIRING DIAGRAM		RU
1 Card Reader	by security integrator		00
1 Power Supply	BPS-12/24-V.A.R.		SU

Notes: Presentation of authorized credential thru wall mounted reader to signal electronic exit lever to release and allow entry. Egress by exit push pad. Access by key at all times. Exit device to remain locked (fail secure) if power fails.

All exterior doors on this project shall meet ANSI A250.13 standards for windstorm AND Florida Product Approval standards. The door hardware specified is listed as a basis of design. If alternate hardware is proposed, please provide third-party test results and compliance information to architect.

Set: 3.0

Doors: A185B, A185C, A186B

Description: Exterior Storefront Sliding Door

1	Mortise Cylinder & Permanent Core	Match Building Standard	00
1	BBO	Balance of hardware by door mfg..	00

Set: 3.1

Doors: A185A, A186A

Description: Vestibule Storefront sliding Door

1	HBO	All hardware by door manufacturer	00
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Set: 3.2

Doors: A152A

Description: Exterior Corridor Pair CR

2	Hinge (heavy weight)	T4A3386 QC12 4-1/2" x 4-1/2"	US32D	MK
4	Hinge (heavy weight)	T4A3386 4-1/2" x 4-1/2"	US32D	MK
1	Vert Rod Exit, Exit Only	59 MD8610 EO	US32D	SA
1	Fail Secure Exit Device	59 MD8674-24v ETP	US32D	SA
3	Mortise Cylinder & Permanent Core	Match Building Standard		00
2	Door Closer	SRI 351 CPS	EN	SA
2	Kick Plate	K1050 10" x 2" L.D.W.	US32D	RO
1	Threshold	1715A		PE
1	Gasketing	303AV TKSP8		PE
1	Rain Guard	346C TKSP8		PE
2	Door Bottom	216AV TKSP8		PE
2	Astragal (paired)	18041CNB TKSP8		PE
2	Door Position Switch	3287		SA
2	ElectroLynx Harness (door)	QC-C x L.A.R.		MK
2	ElectroLynx Harness (frame)	QC-C1500		MK
1	Riser Diagram	RISER DIAGRAM		RU
1	Wiring Diagram	WIRING DIAGRAM		RU
2	Card Reader	by security integrator		00
1	Power Supply	BPS-12/24-V.A.R.		SU

Notes: Presentation of authorized credential thru wall mounted reader to signal electronic exit lever to release, shunt delayed egress circuit and allow entry. Egress by exit push pad after 15 second delay (alarm will sound) unless presentation of authorized credential to shunt delayed egress circuit. Access by key at all times. Exit device to remain locked (fail secure) if power fails. Card reader on opposite side to shunt delayed egress circuit and allow egress.

All exterior doors on this project shall meet ANSI A250.13 standards for windstorm AND Florida Product Approval standards. The door hardware specified is listed as a basis of design. If alternate hardware is proposed, please provide third-party test results and compliance information to architect.

Set: 4.0

Doors: A150E, A150F, A151B, A154B, A156A, A159A, A161A, A163A, A187A

Description: Access Controlled Single

2 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Hinge, Full Mortise	TA2714 QC12 4-1/2" x 4-1/2"	US26D	MK
1 Fail Secure Lock	RX 8271-24V LW1P	US26D	SA
1 Mortise Cylinder & Permanent Core	Match Building Standard		00
1 Door Closer	351 UO	EN	SA
1 Kick Plate	K1050 10" x 2" L.D.W.	US32D	RO
1 Wall Stop	409	US32D	RO
1 Gasketing	S88D x L.A.R.		PE
1 Door Position Switch	3287		SA
1 ElectroLynx Harness (door)	QC-C x L.A.R.		MK
1 ElectroLynx Harness (frame)	QC-C1500		MK
1 Riser Diagram	RISER DIAGRAM		RU
1 Wiring Diagram	WIRING DIAGRAM		RU
1 Card Reader	by security integrator		00
1 Power Supply	BPS-12/24-V.A.R.		SU

Notes: Presentation of authorized credential thru wall mounted card reader to signal lock lever to release and allow entry. Egress by lock lever. Opening to remain secure with fire alarm activation or power failure.

Set: 4.1

Doors: A151C

Description: Access Controlled Pair

5 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Hinge, Full Mortise	TA2714 QC12 4-1/2" x 4-1/2"	US26D	MK
1 Coordinator	2600 Series LAR	US28	RO
1 Dust Proof Strike	570	US26D	RO
1 Flush Bolt Set	2845 - 2945	US26D	RO
1 Fail Secure Lock	RX 8271-24V LW1P	US26D	SA
1 Mortise Cylinder & Permanent Core	Match Building Standard		00
2 Door Closer	351 CPS	EN	SA
2 Kick Plate	K1050 10" x 2" L.D.W.	US32D	RO
2 Astragal (paired)	18041CNB TKSP8		PE
1 Gasketing	S88D x L.A.R.		PE
2 Door Position Switch	3287		SA
1 ElectroLynx Harness (door)	QC-C x L.A.R.		MK
1 ElectroLynx Harness (frame)	QC-C1500		MK
1 Riser Diagram	RISER DIAGRAM		RU
1 Wiring Diagram	WIRING DIAGRAM		RU
1 Card Reader	by security integrator		00
1 Power Supply	BPS-12/24-V.A.R.		SU

Notes: Astragal by door manufacturer.

Presentation of authorized credential thru wall mounted card reader to signal lock lever to release and allow entry. Egress by lock lever. Opening to remain secure with fire alarm activation or power failure.

Set: 4.2

Doors: A151A

Description: Access Controlled Pair

5 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Hinge, Full Mortise	TA2714 QC12 4-1/2" x 4-1/2"	US26D	MK
1 Coordinator	2600 Series LAR	US28	RO
1 Dust Proof Strike	570	US26D	RO
1 Flush Bolt Set	2845 - 2945	US26D	RO
1 Fail Secure Lock	RX 8271-24V LW1P	US26D	SA
1 Mortise Cylinder & Permanent Core	Match Building Standard		00
2 Door Closer	351 UO	EN	SA
2 Overhead Stop (concealed)	690 Series	EN	SA
2 Kick Plate	K1050 10" x 2" L.D.W.	US32D	RO
2 Astragal (paired)	18041CNB TKSP8		PE
1 Gasketing	S88D x L.A.R.		PE
2 Door Position Switch	3287		SA
1 ElectroLynx Harness (door)	QC-C x L.A.R.		MK
1 ElectroLynx Harness (frame)	QC-C1500		MK
1 Riser Diagram	RISER DIAGRAM		RU
1 Wiring Diagram	WIRING DIAGRAM		RU
1 Card Reader	by security integrator		00
1 Power Supply	BPS-12/24-V.A.R.		SU

Notes: Astragal by door manufacturer.
Presentation of authorized credential thru wall mounted card reader to signal lock lever to release and allow entry. Egress by lock lever. Opening to remain secure with fire alarm activation or power failure.

Set: 4.3

Doors: A167A

Description: Exterior Access Controlled Single

2 Hinge	TA2314 4-1/2" x 4-1/2"	US26D	MK
1 Hinge	TA2314 QC12 4-1/2" x 4-1/2"	US26D	MK
1 Fail Secure Lock	RX 8271-24V LW1P	US32D	SA
1 Mortise Cylinder & Permanent Core	Match Building Standard		00
1 Door Closer	SRI 351 UO	EN	SA
1 Kick Plate	K1050 10" x 2" L.D.W.	US32D	RO
1 Wall Stop	409	US32D	RO
1 Threshold	1715A		PE
1 Gasketing	303AV TKSP8		PE
1 Door Bottom	216AV TKSP8		PE
1 Door Position Switch	3287		SA
1 ElectroLynx Harness (door)	QC-C x L.A.R.		MK
1 ElectroLynx Harness (frame)	QC-C1500		MK
1 Riser Diagram	RISER DIAGRAM		RU
1 Wiring Diagram	WIRING DIAGRAM		RU
1 Card Reader	by security integrator		00
1 Power Supply	BPS-12/24-V.A.R.		SU

Notes: Presentation of authorized credential thru wall mounted card reader to signal lock lever to release and allow entry. Egress by lock lever. Opening to remain secure with fire alarm activation or power failure.

All exterior doors on this project shall meet ANSI A250.13 standards for windstorm AND Florida Product Approval standards. The door hardware specified is listed as a basis of design. If alternate hardware is proposed, please provide third-party test results and compliance information to architect.

Set: 5.0

Doors: A158A

Description: Exterior Electrical CR

2 Hinge (heavy weight)	T4A3386 5" x 4-1/2"	US32D	MK
1 Hinge (heavy weight)	T4A3386 QC12 5" x 4-1/2"	US32D	MK
1 Fail Secure Lock	RX 76 8271-24V LW1P	US32D	SA
1 Mortise Cylinder & Permanent Core	Match Building Standard		00
1 Door Closer	SRI 351 UO	EN	SA
1 Kick Plate	K1050 10" x 2" L.D.W.	US32D	RO
1 Wall Stop	409	US32D	RO
1 Threshold	1715A		PE
1 Gasketing	303AV TKSP8		PE
1 Door Bottom	216AV TKSP8		PE
1 Door Position Switch	3287		SA
1 ElectroLynx Harness (door)	QC-C x L.A.R.		MK
1 ElectroLynx Harness (frame)	QC-C1500		MK
1 Riser Diagram	RISER DIAGRAM		RU
1 Wiring Diagram	WIRING DIAGRAM		RU
1 Card Reader	by security integrator		00
1 Power Supply	BPS-12/24-V.A.R.		SU

Notes: Knurled lever outside.

Notes: Presentation of authorized credential thru wall mounted card reader to signal lock lever to release and allow entry. Egress by lock lever. Opening to remain secure with fire alarm activation or power failure.

All exterior doors on this project shall meet ANSI A250.13 standards for windstorm AND Florida Product Approval standards. The door hardware specified is listed as a basis of design. If alternate hardware is proposed, please provide third-party test results and compliance information to architect.

Set: 5.1

Doors: A182A

Description: Janitor

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lock	8204 LW1P	US26D	SA
1 Mortise Cylinder & Permanent Core	Match Building Standard		00
1 Door Closer	SRI 351 UO	EN	SA
1 Kick Plate	K1050 10" x 2" L.D.W.	US32D	RO
1 Mop Plate	K1050 4" x 1" L.D.W.	US32D	RO
1 Wall Stop	409	US32D	RO
1 Gasketing	S88D x L.A.R.		PE

Set: 5.2

Doors: A182B

Description: Plumbing Chase

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lock	8204 LW1P	US26D	SA
1 Mortise Cylinder & Permanent Core	Match Building Standard		00
1 Wall Stop	409	US32D	RO
1 Gasketing	S88D x L.A.R.		PE

Set: 6.0

Doors: A162A, A162B

Description: Office

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Office Lock	8255 LB LW1P	US26D	SA
1 Mortise Cylinder & Permanent Core	Match Building Standard		00
1 Door Closer	351 UO	EN	SA
1 Kick Plate	K1050 10" x 2" L.D.W.	US32D	RO
1 Wall Stop	409	US32D	RO
3 Silencer	608		RO

Set: 7.0

Doors: A157A

Description: Storage

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lock	8204 LW1P	US26D	SA
1 Mortise Cylinder & Permanent Core	Match Building Standard		00
1 Door Closer	351 UO	EN	SA
1 Kick Plate	K1050 10" x 2" L.D.W.	US32D	RO
1 Wall Stop	409	US32D	RO
3 Silencer	608		RO

Set: 8.0 **NOT USED****Set: 9.0**

Doors: A154A

Description: Classroom Function (Closer)

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	8237 LW1P	US26D	SA
1 Mortise Cylinder & Permanent Core	Match Building Standard		00
1 Door Closer	351 UO	EN	SA
1 Kick Plate	K1050 10" x 2" L.D.W.	US32D	RO
1 Wall Stop	409	US32D	RO
3 Silencer	608		RO

Set: 10.0 **NOT USED**

Set: 11.0 **NOT USED**

Set: 12.0

Doors: A150D
Description: Overhead

1 HBO	All hardware by door manufacturer	00
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Set: 13.0

Doors: A188A
Description: Family Restroom

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Privacy Lock	49 8265 LB LNP	US26D	SA
1 Door Closer	351 UO	EN	SA
1 Kick Plate	K1050 10" x 2" L.D.W.	US32D	RO
1 Mop Plate	K1050 4" x 1" L.D.W.	US32D	RO
1 Wall Stop	409	US32D	RO
1 Gasketing	S88D x L.A.R.		PE
1 Coat Hook	802	US26D	RO

Set: 14.0

Doors: A160A
Description: Fence (CR)

1 Fail Secure Lock	RX 8271-24V LW1P	US32D	SA
1 Mortise Cylinder & Permanent Core	Match Building Standard		00
1 Door Closer	351 UO	EN	SA
1 Riser Diagram	RISER DIAGRAM		RU
1 Wiring Diagram	WIRING DIAGRAM		RU
1 Door Loop	by security integrator		00
1 Card Reader	by security integrator		00
1 Door Position Switch	3287		SA
1 Power Supply	BPS-12/24-V.A.R.		SU
1 Electric Conduit Raceway	Balance of hardware by door mfg..		00
1 Lock Box	Balance of hardware by door mfg..		00
1 Strike Box	Balance of hardware by door mfg..		00
1 Closer Mount Box	Balance of hardware by door mfg..		00
1 Door Position Switch Box	Balance of hardware by door mfg..		00
1 BBO	Balance of hardware by door mfg..		00

Notes: Presentation of authorized credential thru wall mounted card reader to signal lock lever to release and allow entry. Egress by lock lever. Opening to remain secure with fire alarm activation or power failure.

Set: 15.0

Doors: A190

Description: Fence (Cipher Lock)

1 Keypad Lockset	Trilogy DL2775 x removable core	00
1 Permanent Core	Match Building Standard	00
1 Lock Box	Balance of hardware by door mfg..	00
1 Strike Box	Balance of hardware by door mfg..	00
1 BBO	Balance of hardware by door mfg..	00

Notes: Presentation of authorized credential thru battery-powered keypad reader or key override to release and allow entry.

END OF SECTION

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Glass for windows, doors, and storefront framing glazed curtain walls.
 - 1. Tempered glazing.
 - 2. Spandrel glazing.
 - 3. Laminate glazing.
 - 4. Insulated glazing.
 - 5. Glazing sealants and accessories.

1.2 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.3 ACTION SUBMITTALS

- A. Product Data: Technical data for each type of product including recommended installation and cleaning procedures.
 - 1. Provide structural, physical and environmental characteristics, size limitations, special handling, and installation requirements.
 - 2. Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, and special application requirements.
 - 3. Identify tint; indicate special precautions required.
- B. Shop Drawings: Sections and details of glass installation at framing members including head, mullions, transoms, jambs and sills.
- C. Glass Samples: Submit for each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) square.
 - 1. Tinted glass.
 - 2. Insulating glass.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturers of insulating glass units with sputter coated, low-E coatings.
- B. Product Certificates: Submit manufacturer's product certificates for glass and glazing products indicated compliance with requirements.
- C. Miami-Dade County Product Notice of Acceptance (NOA): For exterior glazing units.
- D. Impact Resistance Data: Manufacturer's current Product Approval Notice indicating product acceptance in accordance with requirements of the Florida Building Code TAS 201, TAS 202, and TAS 203 or Miami-Dade PA 201, PA 202, PA203, and High Velocity Hurricane Zone. Notice of Approval shall indicate, as minimum, product control number, expiration date of approval, and the specific conditions governing the approval.
 - 1. Impact Resistance Requirements: Meet impact tests as outlined in the Florida Building Code.
 - a. Large missile impact test (up to and including 30 feet in height).
 - b. Small missile impact test (above 30 feet in height).
- E. Product Test Reports: For coated glass, insulating glass, and glazing sealants, for tests performed by a qualified testing agency.
 - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- F. Preconstruction adhesion and compatibility test report.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Insulating Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
 - a. Insulating Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
 - 2. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - a. GANA Publications: Laminated Glazing Reference Manual and Glazing Manual.
 - b. IGMA Publication for Insulating Glass: SIGMA TM-3000, North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use.
 - 3. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
 - 4. Insulating Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

- B. Manufacturer Qualifications for Insulating Glass Units with Sputter Coated, Low E Coatings: Manufacturer having minimum 10 years documented experience who is a qualified insulating glass manufacturer who is approved and certified by coated-glass manufacturer.
- C. Installer Qualifications: Entity having minimum 10 years documented experience, who employs glass installers who are certified under the National Glass Association's Certified Glass Installer Program.
- D. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- E. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.
- F. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
 - 1. Obtain tinted glass from single source from single manufacturer.
 - 2. Obtain reflective coated glass from single source from single manufacturer.
- G. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- H. Preinstallation Conference: Conduct conference at site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review temporary protection requirements for glazing during and after installation.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - 2. Use ASTM C1087 to determine whether priming and specific joint preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 3. Test no fewer than eight samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - 4. Schedule enough time for testing and analyzing results to prevent delaying the work.
 - 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.
- B. Preconstruction Distortion Tolerance Testing: Test monolithic heat strengthened or coated glass of 6 mm (1/4 inch) thickness or more scheduled for use in mock up construction.
 - 1. Measuring Device: LightSentry measurement system or comparable when approved by Architect.
 - a. Roller Wave Criteria: Maximum 0.002 inches at center and 0.008 inches at edges from peak to valley.
 - b. Millidiopter Criteria: Over 90 percent of glass surface, plus or minus 120 A overall.
 - c. Reject each pane of glass exceeding the maximum distortion criteria.

2. Prepare test and inspection reports.

1.7 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and necessary sealant thickness, with reasonable tolerances.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
 1. Store glass under cover at site and protect from edge and surface damage.
 2. Do not remove factory applied labels until glass has been installed. Keep glass free from contamination and staining.
 3. Do not apply marking materials to glass.
- B. Comply with insulating glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.
- C. Do not remove labels until glass is installed. Keep glass free from contamination by materials capable of staining glass. Do not apply marking materials to either side of glass.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
- B. Do not remove labels until glass is installed. Keep glass free from contamination by materials capable of staining glass. Do not apply marking materials to either side of glass.

1.10 WARRANTY

- A. Coated Glass Products: Written warranty signed by manufacturer in which the manufacturer agrees to replace coated glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Laminated Glass: Written warranty signed by manufacturer in which the manufacturer agrees to replace to replace laminated glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated glass standard.
 1. Warranty Period: 10 years from date of Substantial Completion.

- C. Insulating Glass: Written warranty signed by manufacturer in which the manufacturer agrees to replace insulating glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer to design glazing systems complying with requirements.
- C. Structural Performance: Glazing shall withstand design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
 - 1. Design Wind Pressures: Indicated on Drawings.
 - 2. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
 - a. Wind Design Data: As indicated on Drawings.
 - 3. Special Wind Load Exception: Design wall cladding systems and components on the AIRSIDE of Airport Terminal buildings to resist a minimum of 50 lbf/sq. ft. applied over any 15 sq. ft. area of cladding per FAA AC 150/5300-13, Chapter 8, "The Effects and Treatment of Jet Blast," regardless of minimum wind loads determined per SEI/ASCE 7.
 - 4. Seismic Loads: Indicated on Drawings.
 - 5. Other Design Loads: Indicated on Drawings.
 - 6. Thickness of Patterned Glass: Base design of patterned glass on thickness at thinnest part of the glass.
 - 7. Maximum Lateral Deflection: For glass supported on all four edges, limit center of glass deflection at design wind pressure to not more than 1/50 times the short side length or 1 inch (25 mm), whichever is less.
 - 8. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- D. Windborne Debris Impact Resistance: Exterior glazing shall comply with basic protection testing requirements in ASTM E 1996 for Wind Zone 2 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on Project and shall be installed in same manner as glazing indicated for use on Project.
- E. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
 - 1. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

- a. Provide Category II materials complying with testing requirements in 16 CFR 1201 (Consumer Product Safety Commission *Safety Standard for Architectural Glazing Materials*, published in the Code of Federal Regulations) and ANSI Z97.1.
 - b. Permanently mark safety glass with certification label of Safety Glazing Certification Council (SGCC).
- F. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic glass lites, properties are based on units with lites of thickness indicated.
 2. For laminated glass lites, properties are based on products of construction indicated.
 3. For insulating glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 4. U-Factors: Center of glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
 5. Solar Heat-Gain Coefficient and Visible Transmittance: Center of glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 6. Visible Reflectance: Center of glazing values, according to NFRC 300.
 7. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
 8. Minimum Glass Thickness for Exterior Lites: 6 mm.
 9. Thickness of Tinted Glass: Provide same thickness for each tint color indicated.
 10. Strength: Where annealed float glass is indicated, provide annealed float glass, heat strengthened float glass, or fully tempered float glass necessary to comply with performance requirements.
 11. Where heat strengthened float glass is indicated, provide heat strengthened float glass or fully tempered float glass necessary to comply with performance requirements.
 12. Where fully tempered float glass is indicated, provide fully tempered float glass.
- G. Heat Strengthened and Fully Tempered Glass:
1. Fabrication Process: By horizontal (roller hearth) process.
 2. For uncoated glass, comply with requirements for Condition A.
 3. For coated vision glass, comply with requirements for Condition C (other coated glass).
 4. Fabrication Tolerances:
 - a. Optical Distortion Tolerance: Using a LightSentry measurement system or equal, measure each pane of monolithic heat strengthened glass against the following criteria and reject those that do not comply:
 - 1) Roller Wave Criteria: Maximum 0.004 inches at center and 0.008 inches at edges from peak to valley.
 - 2) Millidiopter Criteria: Over 90 percent of glass surface, plus or minus 120 A overall, or the highest overall measurement from the approved mock-up that is less than plus or minus 120 A. Whichever is less.
 - b. Overall Bow and Warp Tolerance: Examine each pane of heat-treated glass to detect lights which exceed half of the maximum bow and warp tolerances in any direction as listed in ASTM C1048, Table 2 and reject those that do not comply.
 5. Orientation: Orient roller wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 - a. If width of glass units indicated on Drawings exceeds fabrication limits, orientate roller wave distortion in a consistent direction for the work.

2.2 MATERIALS

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
 - 1. Minimum Glass Thickness for Exterior Lites: Minimum 6 mm.
 - 2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

- B. Strength: Where annealed float glass is indicated, provide annealed float glass, heat strengthened float glass, or fully tempered float glass necessary to comply with requirements. Where heat strengthened float glass is indicated, provide heat strengthened float glass or fully tempered float glass as necessary to comply with requirements. Where fully tempered float glass is indicated, provide fully tempered float glass.

- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AGC Glass Company North America, Inc.
 - 2. Cardinal Glass Industries.
 - 3. Cristacurva.
 - 4. Guardian Glass; SunGuard.
 - 5. JE Berkowitz, LP.
 - 6. Oldcastle BuildingEnvelope.
 - 7. Pilkington North America.
 - 8. Schott North America, Inc.
 - 9. Vetrotech Saint-Gobain.
 - 10. Viracon, Inc.
 - 11. Vitro Architectural Glass.

- D. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

- E. Ultraclear Float Glass: ASTM C1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Krystal Klear; AGC Glass Company North America, Inc.
 - b. Ultrawhite; Guardian Industries Corp.
 - c. Optiwhite; Pilkington North America.
 - d. Diamant; Saint-Gobain Corporation.
 - e. Starphire; Virto Architectural Glass.
 - 2. Minimum Thickness: 6 mm.

- F. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.

- G. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Heat Soaking: After tempering, heat soak 100 percent of fabricated glass units to European Union Standard EN14179 to eliminate inclusion related glass breakage. Statistical heat soaking shall not be permitted.

- H. Heat Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

2.3 LAMINATED GLASS

- A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
 2. Glass Type: Clear laminated glass with two plies of heat strengthened float glass.
 3. Minimum Thickness of Each Glass Ply: 3 mm.
 4. Laminated Kind:
 - a. Kind LHS (two lites of heat strengthened flat glass.
 5. Interlayer Thickness: 0.060 (1.52 mm).
 6. Interlayer Color: Clear.
- B. Windborne Debris Impact Resistant Laminated Glass: Comply with requirements specified for laminated glass except laminate glass with interlayer to comply with interlayer manufacturer's written instructions.
1. Ionomeric polymer interlayer.
 2. Polyvinyl butyral interlayers reinforced with polyethylene terephthalate film.
 3. Cast in place and cured transparent resin interlayer.
 4. Cast in place and cured transparent resin interlayer reinforced with polyethylene terephthalate film.

2.4 INSULATING GLASS

- A. Insulating Glass Units: Factory assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190.
1. Sealing System: Dual seal, with polyisobutylene and silicone primary and secondary sealants.
 2. Desiccant: Molecular sieve or silica gel, or a blend of both.
 3. Air Space: 1/2 inch (13 mm) measured perpendicularly from surfaces of glass lites at unit edge.
- B. **Glass Type No. 1:** Insulating glass, hermetically sealed units made of 2 glass sheets separated with 1/2-inch air space, manufactured to meet or exceed the quality standards established by SIGMA, IGCC, ASTM C1036, ASTM E773, ASTM E774 and ANSI Z97.1.
1. Inside Glass: 1/4 inch clear tempered with a translucent sandblasted texture on the number 3 surface, Class I, Quality q3.
 2. Outside Glass: 1/4-inch tempered tinted Azurlite with low-E coating on the number 2 surface. Low-E coating to be Viracon Solar Screen 2000 type VE 7-2M. Class 2, Quality q3.
 3. Overall Thickness: 1 inch.
 4. Visible light transmittance: 56%.
 5. Shading coefficient: 0.32.
 6. U-value: 0.30 summer; 0.29 winter.
- C. **Glass Type No. 2:** Insulating glass, hermetically sealed units made of 2 glass sheets separated with 1/2-inch air space, manufactured to meet or exceed the quality standards established by SIGMA, IGCC, ASTM C1048, CPSC 16, and ANSI Z97.1.
1. Inside Glass: 1/4 inch clear tempered, Class I, Quality q3.
 2. Outside Glass: 1/4-inch tempered tinted Azurlite with low-E coating on the number 2 surface. Low-E coating to be Viracon Solar Screen 2000 type VE7-52. Class 2, Quality q3.
 3. Overall Thickness: 1 inch.

4. Visible light transmittance: 39%.
 5. Shading coefficient: 0.28.
 6. U-value: 0.34 summer; 0.32 winter.
- D. **Glass Type No. 3:** Insulating glass, hermetically sealed units made of 2 glass sheets separated with 1/2-inch air space, manufactured to meet, or exceed the quality standards established by SIGMA, IGCC, ASTM C1048, CPSC 16, and ANSI Z97.1.
1. Inside Glass: 1/4 inch clear tempered, Class I, Quality q3. Spandrel: fire-fused ceramic frit on number 4 surface; color to be selected from manufacturers full color range.
 2. Outside Glass: 1/4-inch tempered tinted Azurlite with low-E coating on the number 2 surface. Low-E coating to be Viracon Solar Screen 2000 type VE7-52. Class 2, Quality q3.
 3. Overall Thickness: 1 inch.
 4. Visible light transmittance: 39%.
 5. Shading coefficient: 0.28.
 6. U-value: 0.34 summer; 0.32 winter.
- E. **Glass Type No. 4:** Insulating glass, hermetically sealed units made of 2 glass sheets separated with 1/2-inch air space, manufactured to meet, or exceed the quality standards established by SIGMA, IGCC, ASTM C1048, CPSC 16, and ANSI Z97.1.
1. Inside Glass: 1/4 inch clear, Class I, Quality q3.
 2. Outside Glass: 1/4-inch tinted Azurlite with low-E coating on the number 2 surface. Low-E coating to be Viracon Solar Screen 2000 type VE7-52. Class 2, Quality q3.
 3. Overall Thickness: 1 inch.
 4. Visible light transmittance: 39%.
 5. Shading coefficient: 0.28.
 6. U-value: 0.34 summer; 0.32 winter.
- F. **Glass Type No. 5:** Insulating glass, hermetically sealed units made of 2 glass sheets separated with 1/2-inch air space, manufactured to meet or exceed the quality standards established by SIGMA, IGCC, ASTM C1048, CPSC 16, and ANSI Z97.1.
1. Inside Glass: 1/4 inch clear, Class I, Quality q3. Spandrel: fire-fused ceramic frit on number 4 surface.
 2. Outside Glass: 1/4-inch tinted Azurlite with low-E coating on the number 2 surface. Low-E coating to be Viracon Solar Screen 2000 type VE7-52. Class 2, Quality q3.
 3. Overall Thickness: 1 inch.
 4. Visible light transmittance: 39%.
 5. Shading coefficient: 0.28.
 6. U-value: 0.34 summer; 0.32 winter.

2.5 GLAZING SEALANTS

- A. **Compatibility:** Compatible with one another and with other materials they contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
1. **Suitability:** Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 2. **Colors of Exposed Glazing Sealants:** Black.

- B. Glazing Sealant:
 - 1. Neutral curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Dow Corning Corporation.
 - 2) GE Construction Sealants; Momentive Performance Materials Inc.
 - 3) May National Associates, Inc.; a subsidiary of Sika Corporation.
 - 4) Pecora Corporation.
 - 5) Sika Corporation.

2.6 GLAZING TAPES

- A. Back Bedding Mastic Glazing Tapes: Preformed, butyl based, 100 percent solids elastomeric tape; non-staining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
 - 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

- A. Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks:
 - 1. Neoprene with a Shore A durometer hardness of 85, plus or minus 5.
 - 2. Type recommended by sealant or glass manufacturer.
- D. Spacers:
 - 1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
 - 2. Type recommended by sealant or glass manufacturer.
- E. Edge Blocks:
 - 1. Neoprene with a Shore A durometer hardness per manufacturer's written instructions.
 - 2. Type recommended by sealant or glass manufacturer.

2.8 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed work.

3.3 GLAZING

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Tempered Safety Glazing:
 - 1. Do not cut, seam, nip or abrade tempered safety glass.
 - 2. Set tempered safety glass with tong marks completely concealed or in as inconspicuous a location as possible.
 - 3. Install tempered safety glass in hazardous locations:
 - a. Ingress and egress doors.
 - b. Operable or inoperable panels adjacent to a door in building and within same wall plane as door whose nearest vertical edge is within 24 inches (610 mm) of door in closed position and whose bottom edge is less than 60 inches (1370 mm) above floor or walking surface.
 - c. Fixed panels which have glazed area in excess of 9 sq. ft. and lowest edge is less than 18 inches (455 mm) above finished floor level or walking surface within 36 inches (915 mm) of such glazing where panels are not protected with horizontal member not less than 1-1/2 inch (38 mm) in width located between 24 inches (610 mm) and 36 inches (915 mm) above walking surface.
 - d. Other locations required by the Code.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets to protrude past face of glazing stops.

3.6 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION

SECTION 09 24 00 - PORTLAND CEMENT PLASTER

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Exterior portland cement.
- B. Related Sections:
 - 1. Section 09 96 56: Acrylic Coatings for plaster finish coat.

1.2 REFERENCES

- A. American Society for Testing and Materials:
 - 1. ASTM C 91 - Masonry Cement.
 - 2. ASTM C 150 - Portland Cement.
 - 3. ASTM C 206 - Finishing Hydrated Lime.
 - 4. ASTM C 631 - Bonding Compounds for Interior Plaster.
 - 5. ASTM C 897 - Aggregate for Job-Mixed Portland Cement-Based Plasters.
 - 6. ASTM C 926 - Application of Portland Cement-Based Plaster.
 - 7. ASTM E 119 - Test Method for Fire Test of Building Construction and Material.

1.3 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's descriptive literature, written recommendations, proportion mixes and installation instructions for each specified materials.
 - 1. Samples:
 - a. Submit manufacturer's standard colors for selection.
 - b. Submit 12" x 12" samples showing full range of colors, textures, and patterns available for each type of finish indicated.
- B. Certification: Manufacturer's certificate that each kind of aggregate that comply with requirements.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Minimum five years' experience applying similar Portland cement plaster finish systems; three significant project with similar finish plaster systems.
- B. Fire Resistance Ratings: Provide materials and installation identical to assemblies tested per ASTM E 119 by testing laboratories acceptable to authorities having jurisdiction.
- C. Mock-Up:
 - 1. Prepare minimum 5'-0" x 5'-0" area of each material and finish system required for Project.
 - 2. Show color, texture, and workmanship of finished work.
 - 3. Maintain sample area on Project site for duration of Project for comparison purposes. Sample panel may be incorporated into work provided it is acceptable to Architect and meets all requirements of Specifications.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

- D. Pre-Installation Conference:
 - 1. Prior to start of installation of finish plaster systems, meet at Project site with installers of related work, including mechanical and electrical.
 - 2. Review areas of potential interference and conflicts, coordinate layout and support provisions for interfacing work, and coordinate schedule with other trades.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to project site in original, unopened packages, containers or bundles identified with manufacturer's name and brand, type and grade of materials.
- B. Store materials inside under cover, above ground and away from sweating walls or other damp surfaces.

1.6 PROJECT/SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Cold Weather Requirements: Provide uniformly distributed heat, by using deflection or protective screen to prevent concentration of heat on plaster, and protection as required to protect each coat of plaster from freezing.
 - 2. Exterior Plaster: Protect plaster from freezing when ambient temperature is less than 32 deg F or when 40 deg. F or less and failing. Heat materials and provide temporary protection and heat as required by ACI 306.
 - 3. Interior Plaster: Maintain not less than 40 deg. F temperature in areas to be plastered for a period of not less than 48 hours prior to application, during application and thereafter.
 - 4. Warm Weather Requirements:
 - 5. Protect plaster against uneven and excessive evaporation, and from strong flows of dry air, both natural and artificial.
 - 6. Apply and cure plaster as required by climatic and job conditions to prevent dryout during cure period.
 - 7. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of techniques as required.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portland Cement: ASTM C 150, Type I, white Portland cement.
 - 1. Base Coat Cement: Type I or II.
 - 2. Finish Coat Cement: Type I, as required to match Architect's sample.
- B. Lime: ANSI/ASTM C 206, Type S.
- C. Aggregate: Graded in accordance with ANSI/ASTM C 897 for base coats and finish coat.
- D. Masonry Cement: ASTM C 91, Type N.
- E. Factory-Prepared Finish Coat: Manufacturer's packaged blend of portland cement, hydrated lime, and aggregate meeting requirements indicated above and compatible with base coat in finish color and texture approved by Architect.
- F. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 in. long, free of substances capable of affecting plaster sector of damaging plaster, metal lath, or accessories.

- G. Water: Clean, fresh, potable and free of organic matter which can affect plaster.
- H. Bonding Agent: ASTM C 631; type recommended for bonding plaster to concrete.

2.2 PROPORTIONS BY VOLUME

- A. Scratch Coat:
 - 1. 1-part Portland Cement.
 - 2. 1 to 2 parts Masonry Cement.
 - 3. 5 to 7 parts sand.
 - 4. 1 lb. fiber per sack of cement.
- B. Brown Coat:
 - 1. 1-part Portland Cement.
 - 2. 1 to 2 parts Masonry Cement.
 - 3. 6 to 9 parts sand.
- C. Finish Coat: Acrylic top coat as specified in Section 09 96 56.
- D. Finish Coat:
 - 1. 1-part Portland Cement.
 - 2. 3/4 to 1-1/2 parts hydrated lime.
 - 3. 5 to 7 parts sand.]]

2.3 MIXING

- A. Accurately proportion materials for each plaster batch with measuring devices of known volume, measurement by shovel will not be permitted.
- B. Mechanically mix plaster materials. Hand mixing will not be permitted. Clean mixer after each use.
- C. Size batches for complete use within maximum 3/4 hour after mixing.
- D. Do not use or re-temper partially hydrated Portland cement plaster.
- E. Do not use frozen, caked or lumpy materials.
- F. Use moist, loose sand in mix proportions.
- G. Withhold 10 percent of mixing water until mixing is almost complete, then add as needed to produce necessary consistency.
- H. Prepackaged Products: Mix in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and areas to be plastered are free of dust, loose particles, oil and other foreign matter which would affect bond of plaster coats.
- B. Examine construction, grounds, furring and lathing, and accessories to ensure finished plaster surfaces will be true to line, level and plumb without requiring additional thickness of plaster.

- C. Concrete:
 - 1. Verify surfaces are flat, honeycomb is filled flush, and surface is ready to receive work of this Section.
 - 2. Verify no bituminous, water repellent, or form release agents exist on concrete surface that are detrimental to plaster.

3.2 APPLICATION

- A. Apply plaster by trowel. Interrupt plaster only at junctions of plaster planes, at openings or at control joints.
- B. Nominal Plaster Thicknesses: ASTM C 926.
- C. Scratch Coat (Base Coat) Application:
 - 1. Apply scratch coat with sufficient material and pressure to form keys on metal lath.
 - 2. Scratch or cross rake rough surface and allow to set firm and hard.
 - 3. Apply plaster screeds to scratch coat prior to application of brown coat.
- D. Brown Coat (Second Coat) Application:
 - 1. Do not apply until after scratch coat has set and hardened, not less than 24 hours.
 - 2. Apply brown coat to first coat bringing out to ground flat to true surface and free of imperfections which would reflect in finish coat.
 - 3. Reconsolidate brown coat by floating and roughen to ensure bond with finish coat.
 - 4. Straighten to true surface with rod and darby without application of water.
 - 5. Scratch or cross rake and leave rough, ready to receive finish coat.
- E. Acrylic Finish Coat (Third Coat) Application:
 - 1. Apply in accordance with Section 09 96 56.
 - 2. Base coat and second coat shall be allowed to cure a minimum of 24 hours before application of finish coat and shall be clean and dry.
 - 3. Using a clean stainless-steel trowel, apply finish coat in a uniform thickness required by manufacturer to produce the desired textured finish. Placed material shall be floated using the type of tools and hand motions required to achieve texture matching approved samples.
 - 4. Apply finish coat using sufficient manpower and equipment to insure a continuous operation without cold joints or scaffolding lines.
- F. Water Curing:
 - 1. Follow procedures recommended by plaster manufacturer.
 - 2. Cure minimum 48 hours after all coats have set.
 - 3. Prevent premature dry-out.

3.3 TOLERANCES

- A. Maximum Deviation from True-to-Plane: 1/8" in 10'-0" as measured by straight edge placed at any location on surface.

3.4 ADJUSTING

- A. Upon completion, point-up plaster around trim and other locations where plaster meets dissimilar materials.
- B. Cut out and patch defective or damaged plaster.
- C. Match patch of defective or damaged plaster to existing work in form, texture and color.

3.5 CLEANING

- A. Remove plaster and protective materials from expansion beads, perimeter beads and adjacent surfaces.
- B. Remove stains from plaster surfaces that would adversely affect subsequent finishes.

3.6 PROTECTION

- A. Protect finished surfaces installed prior to plastering, maintain protection in place until completion of work.

END OF SECTION

SECTION 09 29 50 - GYPSUM BOARD SYSTEMS

PART 1 -- GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel framing and furring members to receive gypsum board.
2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.
3. Gypsum board screw-attached to steel framing, furring, and suspension system members.
4. Trim accessories.
5. Gypsum board screw-attached to gypsum board in double layer application to existing gypsum board where shown on construction Drawings.
6. Gypsum board bonded adhesively to interior concrete or masonry substrates.
7. Tile Cement backer board for application of tile interior stone.
8. Taped and sanded joint treatments.
9. Acoustical insulation and sealants, and accessories.

1.2 REFERENCES

A. American National Standards Institute

1. ANSI A118.9 – Test Methods and Specifications for Cementitious Backer Units.

B. American Society for Testing and Materials:

1. ASTM A 641 - Zinc-Coated (Galvanized) Carbon Steel Wire.
2. ASTM A 653/653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
3. ASTM C 11 - Definitions of Terms Relating to Gypsum and Related Building Materials and Systems.
4. ASTM C 475 - Joint Treatment Materials for Gypsum Wallboard Construction.
5. ASTM C 645 - Non-load Bearing Steel Studs, Runners, and Rigid Furring channels for Screw Application of Gypsum Board.
6. ASTM C 665 - Insulation Blankets, Thermal Fiber, for Ambient Temperatures.
7. ASTM C 754 - Installation of Framing Members to Receive Screw-Attached Gypsum Wallboard, Backing Board, or Water-Resistant Backing Board.
8. ASTM C 840 - Application and Finishing of Gypsum Board.
9. ASTM C 919 - Use of Sealants in Acoustical Application.
10. ASTM C 1002 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.
11. ASTM C 1047 - Accessories for Gypsum Wallboard and Gypsum Veneer Board.
12. ASTM C 1178 – Standard Specification for Coated Glass Mat Water Resistant Gypsum Backing Board.
13. ASTM C 1396 – Standard Specification for Gypsum Board.
14. ASTM C 1658 – Standard Specification for Glass Mat Gypsum Panels
15. ASTM D 3273 – Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environment Chamber.
16. ASTM D 3274 - Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Fungal or Algal Growth, or Soil and Dirt Accumulation
17. ASTM E 84 - Surface Burning Characteristics of Building Materials.
18. ASTM E 90 - Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
19. ASTM E 413 - Classification for Rating Sound Insulation

20. ASTM E 488 - Strength of Anchors and Concrete and Masonry Elements.
21. ASTM E 119 - Fire Tests of Building Construction and Materials.
22. ASTM E 1190 - Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members

C. Gypsum Association:

1. GA-214 – Recommended Levels of Gypsum Board Finish.
2. GA-216 - Recommended Specifications for Application and Finishing of Gypsum Board.
3. GA-226 - Application of Gypsum Board to Form Curved Surfaces.
4. GA-600 - Fire Resistance Design Manual.
5. GA-605 – Proprietary Gypsum Panel Products for Use in UL Classified Systems

1.3 DEFINITIONS

A. Gypsum Board Construction Terminology:

1. Refer to ASTM C 11 and GA 505 for definitions of terms for gypsum board construction not otherwise defined in this section or other reference standards.
2. Refer to ASTM C 475 for definition and terminology for finishing gypsum board.
3. Joint Tape: A strip of paper reinforcing material designed to be embedded in the joint compound.

1.4 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's product specifications and installation instructions, including data as may be required to show compliance with these specifications for each type of product specified.

1.5 INFORMATIONAL SUBMITTALS

A. Certificates:

1. Furnish manufacturer's certification that materials meet or exceed Specification requirements.
2. Furnish certification from independent testing laboratory indicating compliance with fire rating

1.6 QUALITY ASSURANCE

- A. Erector Qualifications: Minimum three years successful experience on comparable light-gage metal framing projects.
- B. Regulatory Requirements: Fire rated systems shall be listed and labeled by UL or other recognized testing organization acceptable to authorities having jurisdiction and with building code in effect for project.
- C. Mock-Ups:
1. Construct 100 sq.ft. of actual wall surface. Finish field sample for each type of joint and finish application. Simulate finished lighting conditions for review of in-place work.
 2. Request review by Architect. Remove field samples not accepted by Architect.
 3. Accepted field sample may [not] be used as project standard.]

1.7 PROJECT CONDITIONS

A. Environmental Requirements: Minimum room temperatures:

1. Maintain not less than 40 deg. F for non-adhesive attachment of gypsum board framing.

2. Maintain not less than 50 deg. F for 48 hours prior to application and continuously thereafter until drying is complete for adhesive attachment and finishing of gypsum board.
- B. Do not install interior products until installation areas are enclosed and protected from the weather.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 1. Indications that panels are wet, or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.8 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

PART 2 -- PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: Provide materials and construction indicated by reference to GA 600 file numbers (systems) or UL design designations identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. Provide fire-resistance-rated assemblies equivalent to those indicated on Drawings.
- C. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- D. Provide STC-rated assemblies equivalent to those indicated on Drawings.

2.2 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 1. Metal Framing:
 - a. Allied Studco.
 - b. AllSteel & Gypsum Products, Inc.
 - c. CEMCO.
 - d. ClarkDietrich Building Systems, Inc.
 - e. Formetal Co. Inc. (The).
 - f. MarinoWARE.
 - g. Quail Run Building Materials, Inc.
 - h. SCAFCO Corporation.
 - i. Southeastern Stud & Components, Inc.
 - j. Steel Network, Inc. (The).
 - k. United Steel Manufacturing.
 2. Grid Suspension Systems:
 - a. Armstrong World Industries, Inc.

- b. CertainTeed Corp.
- c. Chicago Metallic Corporation.
- d. USG Corporation.
- 3. Gypsum Board:
 - a. American Gypsum Company
 - b. CertainTeed Corp.
 - c. Georgia-Pacific Corporation, Gypsum Division.
 - d. National Gypsum Company.
 - e. USG Corporation.
- 4. Trim and Accessories:
 - a. Fry Reglet Company.
 - b. National Gypsum Company.
 - c. Pittcon Industries Inc.
 - d. Gordon, Inc.

2.3 METAL FRAMING

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized unless otherwise indicated.
- B. Steel Studs and Tracks: ASTM C 645, sizes as shown, fabricated from nominal 20 or 25 gage steel materials.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
 - 1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 - 2. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - b. Steel Network Inc. (The); VertiTrack VTD Series.
 - c. Superior Metal Trim; Superior Flex Track System (SFT).
 - d. The System by Metal-Lite Corporation.
 - 3. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) CEMCO; FAS Track.
 - 2) ClarkDietrich Building Systems; BlazeFrame Fire Stop Deflection Track.
 - 3) Fire Trak Corp.; Fire Trak [attached to studs with Fire Trak Slip Clip.
 - 4) Metal-Lite, Inc.; The System.
- D. Cold-Rolled Channels: ASTM C 645, 16 gage.
 - 1. 2 inches deep, 590 lbs. per 1000 ft.
 - 2. 1-1/2 inches deep, 475 lbs per 1000 ft.
 - 3. 3/4 inches deep, 300 lbs per 1000 ft.

- E. Rigid Furring Channels: ASTM C 645, 7/8 inch by 2-9/16-inch, 25 gauge, hat shaped channels.
- F. Resilient Furring Channels: Manufacturer's standard product fabricated to form 1/2-inch-deep channel of the following configuration:
 - 1. Single-Leg Configuration: 25 gauge, 1/2" x 2-1/2", with face connected to a single flange by a single slotted leg.
 - 2. Double-Leg Configuration: 25 gauge, 7/8" deep hat shaped channel with 1-1/2" inch face connected to flanges by double slotted or expanded metal legs.
- G. Z-Furring Members: Manufacturer's standard 25-gauge zee-shaped furring members with slotted and non-slotted web with a face flange of 1-1/2-inch, wall-attachment flange of 7/8", and a depth required to fit insulation thickness indicated.
- H. Backerplates: 18 gauge, unless noted otherwise on the Drawings, galvanized steel; 6" minimum width.

2.4 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Hanger Attachments to Concrete:
 - 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
 - a. Type: Post-installed, chemical or expansion anchor.
 - 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch- wide flanges.
 - 1. Depth: As indicated on Drawings.
- E. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
- F. Steel Studs and Runners: ASTM C 645.
 - 1. Minimum Base-Metal Thickness: 0.025 inch.
 - 2. Depth: As indicated on Drawings.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - 1. Minimum Base-Metal Thickness: 0.033 inch.
- H. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
 - 1. Configuration: Asymmetrical or hat shaped.
- I. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. CertainTeed Corp.; Drywall Grid System.
 - c. Chicago Metallic Corporation; Drywall Grid System.
 - d. USG Corporation; Drywall Suspension System.

2.5 GYPSUM BOARD MATERIALS

- A. General: Provide gypsum board in thickness indicated, or if not indicated in thickness to comply with ASTM C 840 for application and support spacing indicated.
- B. Gypsum Board: ASTM C 1396 with tapered edges.
 1. Type: Type X for fire-resistance-rated assemblies.
 2. Thickness: 5/8 inch, unless otherwise indicated].
 3. Thickness: 1/2 inch where indicated.
- C. Moisture- and Mold Resistant Gypsum Board: ASTM C 1396 or 1658, with moisture- and mold resistant core and surfaces.
 1. Products: Products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Gypsum Company, M-Block Wallboard
 - b. Georgia-Pacific Gypsum LLC; DensArmour Plus.
 - c. National Gypsum Company; XP Wallboard
 - d. USG Corporation; Mold Tough Gypsum Panels.
 2. Core: 5/8-inch, Type X.
 3. Core: 5/8-inch, regular type.
 4. Core: 1/2-inch, regular type.
 5. Long Edges: Tapered.
 6. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- D. Exterior Gypsum Soffit Board: ASTM C 1396 with edges.
 1. Type/Thickness: Regular, 1/2 inch thick.
 2. Type/Thickness: Type X, 5/8 inch thick.
- E. Cementitious Tile Backer Board (Cement Tile Backer Board): ANSI A118.9 and ASTM C 1288 or C 1325, with core of portland cement, and both faces coated with a high density portland cement coating or a vinyl-coated woven glass fiber mesh.
 1. Mold Resistance: ASTM D 3273, score of 10.
 2. Thickness: [1/2] 5/8 inch.
 3. Acceptable Products:
 - a. Custom Building Products; Wonderboard.
 - b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
 - c. National Gypsum Company, Permabase Cement Board.
 - d. USG Corporation; DUROCK Cement Board.

2.6 TRIM

- A. General: Provide steel corner beads, edge trim, and control/expansion joints which comply with ASTM C 1047 with hot-dipped galvanized finish in accordance with ASTM A 653, G 30 or heavier coating.

- B. Corner Beads:
 - 1. "Dur-A-Bead Bi, 103"; USG Corporation.
 - 2. "Wallboard Corner Bead" Gold Bond Building Products.

- C. Edge Trim:
 - 1. Type "J":
 - a. "Series 200-A"; USG Corporation.
 - b. No. 100 Wallboard Casing; Gold Bond Building Products.
 - 2. Type "L":
 - a. "Series 200-B"; USG Corporation.
 - b. "No. 200 Wallboard Casing"; Gold Bond Building Products.

- D. Control Expansion Joint: "Sheetrock Zinc Control Joint No. 093", USG Corporation.
 - 1. Fire-Rated Control Joint Backer: 25 ga., ASTM A 653 hot-dipped galvanized, ASTM C 645 flat steel strap backer plates with an affixed cured intumescent strip to maintain fire ratings behind control joints in fire-rated partitions.
 - a. Acceptable Product: BlazeFrame "CJB" (Control Joint Backer).

2.7 JOINT TREATMENT MATERIALS

- A. Joint Tape: Paper reinforcing tape complying with ASTM C 475.

- B. Joint Compound: Adhesives complying with ASTM C 475:
 - 1. First Coat:
 - a. Sheetrock Durabond 210 Setting-Type Joint Compound; USG Corporation.
 - b. Proform Quick Set 210 Setting Compound; National Gypsum Company.
 - 2. Second Coat:
 - a. Sheetrock Durabond 90 Setting-Type Joint Compound; USG Corporation.
 - b. Proform Quick Set 90 Setting Compound; National Gypsum Company.
 - 3. Third Coat:
 - a. Sheetrock All Purpose Joint Compound Ready-Mixed; USG Corporation.
 - b. Proform All Purpose Joint Compound Ready-Mixed; National Gypsum Company.
 - 4. Fourth Coat:
 - a. Sheetrock Brand Lightweight All Purpose Joint Compound Ready-Mixed; USG Corporation.
 - b. Proform Lite Joint Compound Ready Mixed; National Gypsum Company.

2.8 MISCELLANEOUS MATERIALS

- A. Laminating Adhesive: Special adhesive or joint compound for laminating gypsum board recommended by manufacturer of gypsum board panels to suit application.

- B. Gypsum Board Screws: ASTM C 1002.
 - 1. Type G: Used for fastening gypsum board to gypsum board.
 - 2. Type S: Used for fastening of gypsum board to steel framing members.

- C. Metal Framing to Structure-Screws: Power driver screw, complying with ASTM C 1002, fasteners shall withstand 190-pound single shear resistance; 200-pound bearing force when driver through structural head or base; without exceeding allowable design stress in runner, fastener, or structural support.

- D. Metal Framing to Concrete Structure-Nails: No. 8 concrete stub nails, case harder, 3/4" long.

- E. Water-Resistant Sealant: USG Corporation Sheetrock Brand W/R Sealant.

- F. Adhesive: Drywall Contact Adhesive manufactured by 3-M Company.

2.9 ACOUSTICAL MATERIALS

- A. Acoustical Sealant:
 - 1. Acrylic latex, skinning type.
 - 2. Acceptable Products:
 - a. "Hilti CP 506 Smoke and Acoustic Sealant", Hilti North America.
 - b. "Tremco Acoustical Sealant", Tremco, Inc.
 - c. "Sheetrock Acoustical Sealant", USG Corporation.
 - d. "QuietSeal Pro", QuietRock.
- B. Electrical Outlet Putty Pads: Preformed moldable putty pad formulated to maintain the performance of acoustically rated wall assemblies by sealing penetrations including common electrical outlets boxes, phone outlet boxes, electrical switches, HVAC duct, and plumbing hook ups.
 - 1. Acceptable Products:
 - a. "ATS Acoustics Putty Pads", ATS Acoustics.
 - b. "Acoustical Putty Pads", The Soundproofing Company Inc.
 - c. "QuietPutty", QuietRock.
- C. Acoustical Insulation: Unfaced glass or slag mineral fiber blanket complying with ASTM C 665, Type 1, with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; and passing ASTM E 136 for combustion characteristics.
 - 1. "Thermafiber Sound Attenuation Blankets", USG Corporation.
 - 2. "Sound Attenuation Batt Insulation", Owens-Corning Fiberglas Corp.
 - 3. "Acoustical Blanket", Knauf Fiber Glass.
 - 4. "Sound Control Batts", CertainTeed Corp.
 - 5. "Johns Manville Sound Control Batts", Johns Manville Building Products.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and adjoining construction for compliance with requirements for installation tolerances and other conditions affecting performance of gypsum board construction.

3.2 PREPARATION

- A. Ceiling Anchorages: Coordinate installation of ceiling suspension system with installation of overhead structural systems to ensure that inserts and other structural anchorage provisions have been installed.
- B. Before sprayed-on fireproofing is applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed-on fireproofing. Where offset anchor plates are required provide continuous units fastened to building structure not more than 24 inches o.c. and to ceiling runners.
- C. After sprayed-on fireproofing has been applied, remove only as much fireproofing as needed to complete installation of drywall construction. Protect fireproofing that remains from damage.

3.3 INSTALLATION OF STEEL FRAMING, GENERAL:

- A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and ASTM C 840.
- B. Install supplementary framing, blocking, and bracing at terminations in the work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and similar construction.
- C. Isolate steel framing, ceilings, and walls, from building structure to prevent transfer of loading imposed by structural movement, to comply with details shown on Drawings.
- D. Do not bridge building expansion and control joints with steel framing or furring members; independently frame both sides of joints with framing or furring members.

3.4 METAL STUD INSTALLATION

- A. Install steel studs in sizes to withstand lateral design loadings of 5 psf. for maximum heights of 27'-0" with deflection not to exceed $L/240$ of wall height with stud spacing as indicated on Drawings, but not less than 16 inches center-to-center.
 - 1. For stud heights above 27' refer to sizes indicated on the Drawings.
- B. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
- C. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
- D. Frame Door Openings: Install two 20-gauge minimum studs at each jamb, extend one stud at each jamb through suspended ceiling and attach to underside of structure above, and one additional stud not more than 6 inches from jamb studs. Attach studs to door frame anchor clips. Install runners track section at head, for cripple studs, and secure to jamb studs.
- E. Frame Openings: Identical to that required for door openings except that one jamb stud is not required to extend to structure above and install framing below sills of openings to match framing above door heads.

3.5 SUSPENSION SYSTEM INSTALLATION

- A. Install suspension system components in sizes and at spacings indicated, but not greater than spacings required by ASTM C 754 or below for assembly types indicated.
 - 1. Hangers: 48 inches o.c.
 - 2. Carrying Channels (Main Runners): 48 inches o.c.
 - 3. Furring Channels (Furring Members): 16 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24" past each end of openings.

- D. Suspend hangers from building structure as follows:
1. Install hangers' plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 2. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 3. For exterior soffits provide cross-bracing and additional framing required to resist wind-uplift.
 4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 5. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by ASTM C 754.
 6. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 7. Do not attach hangers to steel roof deck.
 8. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 9. Do not attach hangers to concrete decks with powder-actuated fasteners.
 10. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- E. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Where sprinkler heads, diffusers, and speakers are arranged in alignment, variation from exact alignment shall not vary more than 1/2" either side of centerline through various element openings.
- H. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.6 ACOUSTICAL ACCESSORIES INSTALLATION

- A. Place acoustical insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.
- B. Install acoustical sealant within partitions in accordance with manufacturer's instructions.

3.7 GYPSUM BOARD INSTALLATION

- A. General:
1. Install gypsum board in accordance with ASTM C 840, GA-201, GA-216, GA-600 and manufacturers written instructions.
 2. Install moisture- and mold-resistant gypsum board on the inside surface of all exterior walls and regular gypsum board at all interior partitions except where tile backer board is required as a substrate for tile.
 3. Install ceiling boards across framing in the manner which minimizes the number of end-butt joints, and which avoids end joints in the central area of each ceiling. Stagger end joints at least 24 inches.

4. Install wall/partition boards in manner which minimizes the number of end-butt joints or avoids them entirely where possible.
 5. Wall/Partition Board Joints:
 - a. Butt boards together with light contact at edges and ends with not more than 1/16-inch open space between boards.
 - b. Position boards so that like edges abut.
 - c. Stagger vertical joints over different studs on opposite sides of partitions.
 6. Sound-Rated Construction: Seal construction at perimeters, control and expansion joints, opening and penetrations with acoustical sealant complying with ASTM C 919 and manufacturers written recommendations for rating specified.
 7. Remove and replace any gypsum board that develops signs of moisture or mold damage throughout the duration of construction.
- B. Single Layer Gypsum Board:
1. On ceilings apply gypsum board prior to wall/partition board installation.
 2. On partitions/walls apply gypsum board vertically (parallel to framing), unless otherwise indicated, and provide sheet lengths which will minimize end joints.
 3. On partitions/walls 8'-1" or less in height and high wall areas over 15'-0" in height apply gypsum board horizontally (perpendicular to framing) with end joints staggered over studs; use maximum length sheets possible to minimize end joints.
 4. On partitions/walls with thin-set ceramic tile and similar rigid applied wall finishes install gypsum board as follows:
 - a. In "dry" locations at toilet rooms and other areas install tile backer board to comply with ASTM C 840.
 - b. In "wet" locations at showers, tubs, and similar areas install cement backer boards and treat joints according to manufacturer's written recommendations.
 - c. Where stone is wall finish, install cement backer board and treat joints according to manufacturer's written recommendations.
- C. Double Layer Gypsum Board:
1. General: Install gypsum board for base layer and gypsum board for face layer.
 2. On ceilings apply base layer, at right angles to supports, prior to application of base layer on walls/partitions; apply face layers in same sequence. Offset joints between layers at least 10 inches.
 3. On partitions/walls apply base layer and face layers vertically (parallel to framing) with joints of base layer over supports and face layer joints offset at least 10 inches with base layer joints.
- D. Fastening Methods - Single Layer:
1. Fasten with screws.
- E. Fastening Methods - Double Layer:
1. Fasten both base layers and face layers separately to supports with screws.
 2. Fasten base layers with screws and face layer with adhesive and supplementary fasteners. Permitted at non-fire-rated assemblies only.
 3. Fasten base layers to wood supports with nails and face layer with adhesive and supplementary fasteners.
- F. Exterior Soffits and Ceilings: Install gypsum soffit board perpendicular to supports, with end joints staggered over supports. Install with 1/4-inch open space where boards abut other construction.
1. Fasten with cadmium-plated screws, or with galvanized or aluminum nails.

- G. Direct-Bonding to Substrate: Where gypsum board is indicated to be directly adhered to a substrate (other than studs, joists, furring members or base layer of gypsum board), comply with gypsum board manufacturer's recommendations, and temporarily brace or fasten gypsum board until fastening adhesive has set.

3.8 TRIM INSTALLATION

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Corner Beads: Installed at outside corners.
- C. Edge Trim: Installed where gypsum board would be left exposed or semi-exposed.
1. Install "J" bead where drywall construction is tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
 2. Install "L" bead where edge trim can only be installed after gypsum board is installed.
- D. Control Joints: Joints shall be installed to meet fire requirements of wall.
1. Walls/Partitions: Install control joints:
 - a. Vertically:
 - 1) at 30'-0" on center and no further than 10'-0" from corners of walls.
 - 2) at both corners of openings in wall planes, both above and/or below opening, where width of opening is 6'-0" or greater, or where ratio of width to height of wall plane above and/or below opening exceeds 4:1.
 - 3) at other locations indicated on Drawings
 - 4) Horizontally: at all spliced joints of vertical studs.
 2. Ceilings: Install control joints at 30'-0" on center each direction and where wings of "A", "L", "O", "U", and "T" shaped ceiling areas or furr-down areas are joined, or as indicated on Drawings.

3.9 FINISHING

- A. General: Comply with ASTM C 840 and GA 214.
- B. Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
1. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
 2. Apply joint treatment in coats and sand between coats and after last coat with #120 grit or finer sandpaper or #200 grit or finer mesh cloth.
 3. Feather coats onto adjoining surfaces so that maximum camber is 1/32" [1/16"] using a 6-inch-wide tool for the 1st and 2nd coats and a 12-inch-wide tool for the 3rd coat.
- C. Finishing Water-Resistant Gypsum Board: Comply with ASTM C 840 and manufacturer written instructions.
- D. Finishing Tile Backer Board: Comply with ASTM C 840 and manufacturer's written instructions.
- E. Finishing Cement Backer Board: Finish according to manufacturer's written instructions.
- F. Joint Sanding: Sand joints with 150 grit or finer sandpaper or 220 grit or finer mesh cloth.

- G. Levels of Gypsum Board Finish:
1. Level 0: No taping, finishing or accessories required.
 2. Level 1:
 - a. Joints: Tape set in joint compound.
 - b. Interior Angles: Tape set in joint compound.
 - c. Surface: Tool marks and ridges acceptable. Surface free of excess joint compound.
 3. Level 2:
 - a. Joints: Tape embedded in joint compound and wiped with a joint knife, leaving a thin coat of compound over tape.
 - b. Interior Angles: Tape embedded in joint compound and wiped with a joint knife, leaving a thin coat of compound over tape.
 - c. Accessories: Shall be covered to one separate coat of joint compound.
 - d. Fasteners: Shall be covered by one separate coat of joint compound.
 - e. Surface: Surface shall be free of excess joint compound. Tool marks and ridges acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.
 4. Level 3:
 - a. Joints: Taped as in Level 2, then covered with one separate coat of joint compound.
 - b. Interior Angles: Taped as in Level 2, then covered with one separate coat of joint compound.
 - c. Accessories: Shall be covered by two separate coats of joint compound.
 - d. Fasteners: Shall be covered by two separate coats of joint compound.
 - e. Surface: Joint compound shall be smooth and free of tool marks and ridges.
 5. Level 4:
 - a. Joints: Taped as in Level 2, then covered with two separate coats of joint compound.
 - b. Interior Angles: Taped as in Level 2, then covered with one separate coat of joint compound.
 - c. Accessories: Shall be covered by three separate coats of joint compound.
 - d. Fasteners: Shall be covered by three separate coats of joint compound.
 - e. Surface: Joint compound shall be smooth and free of tool marks and ridges.
 6. Level 5:
 - a. Joints: Taped as in Level 2, then covered with two separate coats of joint compound.
 - b. Interior Angles: Taped as in Level 2, then covered with one separate coat of joint compound.
 - c. Accessories: Shall be covered by three separate coats of joint compound.
 - d. Fasteners: Shall be covered by three separate coats of joint compound.
 - e. Surface: A thin skin coat of joint compound, or a material manufactured especially for this purpose, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges.

3.10 SCHEDULES

- A. Levels of Gypsum Board Finishing:
1. Level 0: Provide in areas for temporary construction or whenever the final decoration has not been determined or in other areas not normally open to view; do not use in areas where fire and smoke code are required.
 2. Level 1: Provide in plenum areas above ceilings, in attics, in areas where the assembly would generally be concealed, or in building service corridors and other areas not normally open to view.
 3. Level 2: Provide where water resistant gypsum backing board or cement backer board is used as a substrate for tile or stone.
 4. Level 3: Provide in areas where heavy grade wall coverings are to be applied as the final decoration.

5. Level 4: Provide in areas that are to receive flat, satin or semi-gloss paint.
6. Level 5: Provide in areas that are to receive gloss or semi-gloss paint in areas flooded with artificial or natural lighting.

B. Remove any texture from windows, door and door frames, and other adjoining construction.]

3.11 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8" in 10'-0" in any direction.

END OF SECTION

SECTION 09 30 00 - TILE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Porcelain tile.
 2. Glazed wall tile.
 3. Tile backing panels.
 4. Waterproof membrane.
 5. Crack isolation membrane.
 6. Threshold.
 7. Metal edge strips.

1.2 DEFINITIONS

- A. Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1, ANSI A137.2, and ANSI A137.3 apply to the work.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, ANSI A108.17, and ANSI A108.19 which are contained in its Specifications for Installation of Ceramic Tile.
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.
- E. High Performance Tile Grout: Factory prepared grouting material mixture of cement and other ingredients, including a redispersible latex/polymer powder, to which only water is added at the jobsite, or a liquid latex additive.
- F. Improved Modified Dry Set Mortar (Thinset): Modified Dry Set Mortar with a minimum bond strength of 400 psi to impervious ceramic tile.
- G. Large and Heavy Tile (LHT): Any tile material weighing 5 lbs./sq. ft. or greater, or a tile with a least horizontal dimension of 15 inches or more.
- H. Modified Dry Set Mortar for Large and Heavy Tile (LHT): Also referenced as medium bed mortar, is a modified dry set mortar formulated to have a bond coat thickness between 3/32 inch (2.4 mm) and 1/2 inch (13 mm) after tile embedment and declared as an "LHT" setting material by the manufacturer based on these characteristics.
- I. Modified Dry Set Mortar (Thinset): A factory prepared setting material mixture of cement and other ingredients, including a redispersible latex/polymer powder, to which only water is added at the jobsite, or a liquid latex additive.

1.3 ACTION SUBMITTALS

- A. Product Data: Technical data for each type tile, mortar and grout, under tile membranes, and installation methods.
- B. Shop Drawings: Indicate locations of each type of tile and tile pattern. Show layout, patterns, color arrangements, widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples:
 - 1. Size: Minimum, but not fewer than four tiles.
 - 2. Full size units of each type of trim and accessory.
 - 3. Metal edge strips in 6-inch (150 mm) lengths.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit data for Installer.
- B. Master Grade Certificates: Submit certificates for each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: Submit certificates for each type of product stating grade, kind, and identification mark.
- D. Product Test Reports: Submit report for tile setting and grouting products and certified porcelain tile.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer having minimum 5 years documented experience who is trained and certified in the substrate preparation and installation of tile.
- B. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
 - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
 - 2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.
- D. Source Limitations for Other Products: Obtain each of the following specified products from a single manufacturer:
 - 1. Waterproof and crack isolation membrane.
 - 2. Cementitious backer units.
 - 3. Metal edge strips.

- E. Mockups: Build mockups to verify selections and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build a 5-foot square mockup of each type of floor tile installation where directed by Architect.
 - 2. Build 5-foot square mockup of each type of wall tile installation where directed by Architect.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.
- F. Preinstallation Conference: Conduct conference at site.
 - 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.6 COORDINATION

- A. Sequence tile installation with work to minimize possibility of damage and soiling during remainder of construction period.
- B. Install tile and accessories after other finishing operations, including painting, are completed.
- C. Coordinate installation of tile with base cabinets and permanent items that have the potential of being reconfigured or moved in the future.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.
- B. Maintain temperatures at 50 degrees F or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.
- C. Critical Lighting: Install tile after permanent lighting is installed for maximum opportunity to reduce undesirable shadows.
 - 1. Where permanent lighting cannot be installed prior to tile installation, provide temporary lighting mimicking permanent lighting effects prior to the installation of tile. In addition, use specialized installation techniques joints to minimize undesirable shadows.

1.9 WARRANTY

- A. Total System Warranty: Written warranty signed by manufacturer and installer in which the manufacturer agrees to provide labor and tile setting materials (including mortar, grout, and waterproof/crack isolation membrane materials) that do not comply with requirements, that are determined defective due to manufacturing defects, and will not break down or deteriorate under normal usage within the specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
 - 2. Warranty Condition: Installation requires the use of manufacturer approved products for a total system.
 - 3. Exclusion: Cracking due to structural movement or excessive deflection is excluded.
- B. Installer Warranty: Written warranty signed by Installer in which Installer agrees to warrant its work.
 - 1. Warranty Period: Three years from the date of Substantial Completion.
 - 2. Warranty includes removing and reinstalling tile, mortar, grout, and waterproofing/crack isolation membranes, and related accessories.

1.10 EXTRA MATERIAL

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, referenced ANSI standards, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and specified requirements.
- C. Dynamic Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with values determined by testing identical products per ANSI A 326.3: Minimum 0.42 DCOF.
- D. Load Bearing Performance: For ceramic tile installed on walkway surfaces, provide installations rated for loadbearing performance level based on testing assemblies according to ASTM C 627 that are representative of those indicated:
 - 1. Extra Heavy: Passes cycles 1 through 14.
 - 2. Heavy: Passes cycles 1 through 12.
 - 3. Moderate: Passes cycles 1 through 10.
 - 4. Light: Passes cycles 1 through 6.

- E. Accessibility Requirements: Comply with applicable requirements.
 - 1. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) 2010.
 - 2. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
 - 3. Florida Accessibility Code for Building Construction.

2.2 TILE PRODUCTS

- A. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- B. Mounting: For factory mounted tile, provide back or edge mounted tile assemblies as standard with manufacturer unless otherwise indicated.
- C. Basis of Design: Indicated in Finish Schedule, see drawings; subject to compliance with requirements, provide products by the following:
- D. Manufacturers: Subject to compliance with requirements, provide tile by one of the following:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Olean; a division of Dal-Tile Corporation – Ceramic Tile.
 - b. Laufen - Porcelain Tile.
- E. Tile: Porcelain tile.
 - 1. Certification: Tile certified by the Porcelain Tile Certification Agency.
 - 2. Face Size: 11-13/16 inches by 11-13/16 inches (300 mm by 300 mm).
 - 3. Face Size Variation: Rectified.
 - 4. Thickness: 1/4 inch (6.4 mm).
 - 5. Face: As indicated.
 - 6. Dynamic Coefficient of Friction: Not less than 0.42.
 - 7. Tile Color and Pattern: Selected by Architect.
 - 8. Grout Color: Selected by Architect.
 - 9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 inches to 1/4-inch (12.7 to 6.4 mm) across nominal 4 inch (100 mm) dimension.
- F. Wall Tile: Glazed wall tile.
 - 1. Module Size: 6 inches by 6 inches (152 mm by 152 mm).
 - 2. Face Size Variation: Rectified.
 - 3. Thickness: 5/16 inch (8 mm).
 - 4. Face: Plain with modified square edges.
 - 5. Finish: Per Finish Schedule, see drawings..
 - 6. Tile Color and Pattern: As indicated on drawings..
 - 7. Grout Color: Selected by Architect.

8. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes selected from standard shapes:
 - a. Coved Base for Thinset Mortar Installations: Straight, module size 6 inches by 6 inches (152 mm by 152 mm).
 - b. Internal Coved Corners: Field butted square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.

2.3 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, Type A, in maximum lengths available to minimize end to end butt joints.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C-Cure.
 - b. Custom Building Products.
 - c. Georgia-Pacific Gypsum LLC.
 - d. USG Corporation.
 2. Thickness: 5/8 inch (15.9 mm), unless indicated otherwise..

2.4 WATERPROOF/ANTIFRACTURE MEMBRANE

- A. Provide waterproof, crack isolation membrane complying with ANSI A118.10 for waterproofing membranes, ANSI A118.12 for crack isolation membrane, and recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fluid Applied Membrane: Load bearing waterproofing/crack isolation membrane consisting of antimicrobial, self-curing liquid latex rubber polymer forming a flexible, seamless membrane that bonds directly to the substrate. Provide membrane approved by IAPMO for use in showers and shower pans.
 1. Basis of Design: Hydroban Waterproof Membrane by Laticrete International: Subject to compliance with requirements, provide basis of design or comparable systems by one of the following:
 - a. Hydraflex Waterproofing Crack Isolation Membrane; Bostik, Inc.
 - b. RedGard Waterproofing and Crack Prevention Membrane; Custom Building Products.
 - c. TEC Hydraflex or TEC Waterproofing and Crack Prevention Membrane TA-418; H.B. Fuller Construction Products Inc. / TEC.
 - d. HydroBan; Laticrete, LLC.
 2. Cured Thickness: Approximately 0.030 inch (0.8 mm).

2.5 WATERPROOF MEMBRANE

- A. Waterproof membrane complying with ANSI A118.10 and recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fabric Reinforced, Fluid Applied Membrane: System consisting of liquid latex rubber or elastomeric polymer and continuous fabric reinforcement.

1. Basis of Design: Laticrete 9235 Subject to compliance with requirements, provide products by one of the following:
 - a. Custom Building Products.
 - b. H.B. Fuller Construction Products Inc. / TEC.
 - c. Laticrete International, LLC.

2.6 SETTING MATERIALS

- A. Improved Modified Dry Set Mortar (Thinset): ANSI A118.15.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Custom Building Products.
 - b. H.B. Fuller Construction Products Inc. / TEC.
 - c. Laticrete International, LLC.
 - d. Mapei Corporation.
 2. Provide prepackaged, dry mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.15.

2.7 GROUT MATERIALS

- A. High Performance Tile Grout: ANSI A118.7.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Custom Building Products.
 - b. H.B. Fuller Construction Products Inc. / TEC.
 - c. Laticrete International, LLC.
 - d. Mapei Corporation.
 2. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid latex form for addition to prepackaged dry grout mix.

2.8 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex modified, portland cement-based formulation provided or approved by manufacturer of tile setting materials for installations indicated.
- B. Metal Edge Strips: Angle or L-shaped, height to match tile and setting bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; exposed edge material to match existing.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Blanke Corporation.
 - b. Ceramic Tool Company, Inc.
 - c. Schluter Systems L.P.
- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

- D. Floor Sealer: Manufacturer recommended product for sealing grout joints and that does not change color or appearance of grout.

2.9 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile setting materials, including curing compounds and substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Remove coatings, including curing compounds, and other substances containing soap, wax, oil, or silicone and are incompatible with tile setting materials by using concrete grinder, drum sander, or polishing machine equipped with heavy duty wire brush.
- C. Provide concrete substrates for tile floors installed with dry set or latex portland cement mortars complying with flatness tolerances specified in referenced ANSI A108 series of tile installation standards for installations indicated.

1. Use trowelable leveling and patching compounds per tile setting material manufacturer's written instructions to fill cracks, holes, and depressions.
 2. Remove protrusions, bumps, and ridges by sanding or grinding.
- D. Prepare substrates to receive waterproofing/crack suppressant membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
- E. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION

- A. Tile Backing Panels: Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.
- B. Waterproofing/Crack Suppressant Membrane: Install waterproofing to comply with ANSI A108.13 and ANSI A108.17 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
1. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.
 2. Allow crack isolation membrane to cure before installing tile or setting materials over it.
- C. Tile: Comply with TCNA Handbook for Ceramic, Glass, and Stone Tile Installation for TCNA installation methods specified in tile installation schedules. Comply with applicable requirements of the ANSI A118.3 Specifications for Installation of Ceramic Tile referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
1. Comply with procedures in the ANSI A118 series for tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors in wet areas.
 - b. Tile floors consisting of tiles 8 inches by 8 inches (200 mm by 200 mm) or larger.
 - c. Tile floors consisting of rib backed tiles.
 2. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
 3. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
 4. Provide trim shapes where necessary to eliminate exposed tile edges.
- D. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
- E. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
1. Glazed Wall Tile: 1/8 inch (3.2 mm).
 2. Porcelain Tile: 1/4 inch (6.4 mm).

- F. Expansion Joints: Provide expansion joints and other sealant filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw cut joints after installing tiles.
1. Install control and expansion joints in accordance with TCNA EJ171.
 2. Keep expansion and control joints free of adhesives and grout. Install backer rod and sealant in accordance with Section 079200.
 3. Fill joint around plumbing fixtures with sanitary sealants in accordance with Section 079200.
 4. Where joints occur in concrete substrates, locate joints in tile surfaces directly above.
 5. Install control joints where tile abuts restraining surfaces including perimeter walls, curbs, columns, wall corners and directly over cold joints and control joints in structural surfaces conforming to architectural details. Install control joint in floors not exceeding 20 feet (6.1 m) on center. Rake or cut control joints through setting bed to supporting slab or structure
- G. Floor Tile: Install tile to comply with requirements, referenced TCNA installation methods, and ANSI A108 series of tile installation standards.
1. Back Buttering: For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
 - a. Tile floors composed of tiles 8 inches by 8 inches (203 mm by 203 mm) or larger.
 - b. Tile floors composed of rib backed tiles.
 2. Interior Floor Installation, Concrete Subfloor:
 - a. Ceramic Tile Installation: TCNA F125-Full; thinset mortar on crack isolation membrane.
 - 1) Ceramic Tile Type: Per Finish Schedule, see drawings.
 - 2) Thinset Mortar: Improved modified dry set mortar.
 - 3) Grout: High performance sanded grout.
- H. Wall Tile: Install types of tile designated for wall installations to comply with requirements, including referenced TCNA installation methods and ANSI setting bed standards.
1. Back Buttering: For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
 - a. Exterior tile wall installations.
 - b. Tile wall installations in wet areas, including laundries and swimming pools.
 - c. Tile installed with chemical resistant mortars and grouts.
 - d. Tile wall installations composed of tiles 8 by 8 inches (203 mm by 203 mm) or larger.
 2. Interior Wall Installations, Metal Studs or Furring:
 - a. Ceramic Tile Installation: TCNA W244C or TCNA W244F; thinset mortar on cementitious backer units.
 - 1) Ceramic Tile Type: Per Finish Schedule, see drawings.
 - 2) Thinset Mortar: Improved modified dry set mortar.
 - 3) Grout: High performance sanded grout.
 - b. Ceramic Tile Installation: TCNA W245 or TCNA W248; thinset mortar on glass mat, water resistant gypsum backer board.
 - 1) Ceramic Tile Type: Per Finish Schedule, see drawings.
 - 2) Thinset Mortar: Improved modified dry set mortar.
 - 3) Grout: High performance sanded grout.

- I. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align base and wall joints.
- J. Place tile joints uniform in width, and of the minimum size recommended by tile manufacturer, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar or excess grout.
 - 1. Pattern and joint sizes shall follow tile manufacturer's recommendation unless otherwise directed by Architect.
- K. Sound tile after setting. Replace hollow sounding units.
- L. Grouting: Allow tile to set for minimum of 48 hours prior to grouting.
 - 1. Grout tile joints.
 - 2. Before grouting, tiles must be firmly set, paper and glue removed from face of mounted tiles, and spacers, strings, ropes, or pegs removed.
 - 3. Use caution when grouting to prevent damaging or scratching surface of installed tiles.
 - 4. Install grout with uniform color in accordance with manufacturer's recommendations and in accordance with ANSI 108.10. Pack joints full, free of pinholes, voids or low spots, before mortar takes initial set.
 - 5. Finish cushion edge tile even to depth of cushion. Finish square edge tile flush with surface.
- M. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

3.4 EXPANSION AND CONTROL JOINTS

- A. Keep expansion and control joints free of adhesive or grout. Install backer rod and sealant in joints.
- B. Fill joints around toilet fixtures with sanitary sealant specified in Section 079200.
- C. Install control joints where tile abuts restraining surfaces such as perimeter walls, curbs, columns, wall corners and directly over cold joints and control joints in structural surfaces conforming to architectural details. Rake or cut control joints through setting bed to supporting slab or structure.
- D. Install control and expansion joints in accordance with TCNA Handbook Method No. EJ171.
- E. Floor Sealer: Apply floor sealer to [grout joints in tile floors according to floor sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.5 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use cleaners recommended by

tile and grout manufacturers and after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.6 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Acoustical ceiling panels and suspension system.
 2. Perimeter trim.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data for each ceiling panel and gird component with installation instructions indicating special procedures, and perimeter conditions requiring special attention.
- B. Samples: Submit 12 inches by 12 inches (300 mm by 300 mm) samples illustrating material and finish of acoustical units; submit 12 inch (300 mm) long sample of each suspension system main runner, cross runner, edge trim, and retention clips.
1. Acoustical Panels: Set of 12 inches by 12 inches (300 mm by 300 mm) Samples of each type, color, pattern, and texture.
 2. Exposed Suspension System Members, Moldings, and Trim: Set of 12 inch (300 mm) long Samples of each type, finish, and color.
- C. Certificate: Submit manufacturer's certification that suspension system is capable of supporting light fixtures, grilles and acoustical panels.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Ceiling suspension system members.
 2. Structural members to which suspension systems will be attached.
 3. Method of attaching hangers to building structure.
 - a. Furnish layouts for cast in place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
 4. Carrying channels or other supplemental support for hanger wire attachment where conditions do not permit installation of hanger wires at required spacing.
 5. Size and location of initial access modules for acoustical panels.
 6. Items penetrating finished ceiling and ceiling-mounted items including the following:
 - a. Lighting fixtures.
 - b. Diffusers.
 - c. Grilles.
 - d. Speakers.
 - e. Sprinklers.
 - f. Access panels.
 - g. Perimeter moldings.
 7. Show operation of hinged and sliding components covered by or adjacent to
- B. Product Test Reports: Submit for each acoustical panel ceiling, for tests performed by manufacturer.
- C. Evaluation Reports: Submit ICC-ES report for each acoustical panel ceiling suspension system.

- D. Field quality control reports.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Grid Manufacturer: Entity having minimum 5 years documented experience who specializes in manufacturing ceiling grids.
2. Acoustical Unit Manufacturer: Entity having minimum 5 years documented experience who specializes in manufacturing acoustical units.
3. Installer: Entity having minimum 5 years documented experience who employs trained and experienced installers.

B. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
2. Suspension System: Obtain each type through one source from a single manufacturer.

- C. Preinstallation Conference: Conduct conference at site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to site and store in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

- B. Coordinate layout and installation of acoustical ceiling units and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire suppression system components (if any) and partition system (if any).

1.7 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full size panels equal to 2 percent of quantity installed.
2. Suspension System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Acoustical Panel Standard: Provide ceiling panels complying with ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- B. Surface Burning Characteristics: Ceiling panels with surface burning characteristics complying with IBC Chapter 8 and ASTM E 1264 for Class A materials determined by testing identical products in accordance with ASTM E 84:
 - 1. Flame Spread Index: Class A according to ASTM E 1264.
 - 2. Smoke Developed Index: 50 or less.

2.2 ACOUSTICAL PANELS

- A. Manufacturer: Subject to compliance with requirements, provide ceiling panels and grid systems by one of the following:
 - 1. Acoustic Ceiling Panel:
 - a. Armstrong World Industries, Inc.
- B. Classification: Standard and fire resistance rated panels.
- C. Acoustical Panel: **ACT 1.**
 - 1. Product: Ultima 1912 Beveled.
 - 2. Nominal Size: 24 inch by 24 inch by 5/8 inch (610 mm by 610 mm by 15 mm).
 - 3. Composition: Wet formed mineral fiber, ASTM E 1264, Class A.
 - 4. Finish: Factory applied vinyl latex paint.
 - 5. Color: White.
 - 6. Ceiling Attenuation Class: 35 db.
 - 7. Noise Reduction Coefficient: 0.75.
 - 8. Light Reflectance: LR-1, over 80 percent.
 - 9. Edge: Tegular.
 - 10. Pattern: Type IV, Form 2, E.
- D. Antimicrobial Treatment: Broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

2.3 METAL SUSPENSION SYSTEM

- A. Manufacturer: Subject to compliance with requirements, provide ceiling panels and grid systems by one of the following:
 - 1. Concealed and Exposed Suspension Grid:
 - a. Armstrong World Industries, Inc.
- B. Metal Suspension System Standard: Provide direct hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.
 - 1. High Humidity Finish: Where indicated, provide coating tested and classified for severe environment performance according to ASTM C 635/C 635M.
- C. Standard Exposed Tee Grid - Ceiling Grid Type 1: ASTM C 635, non-fire-rated.
 - 1. Structural Classification: Intermediate duty system.
 - 2. End Condition of Cross Runners: Override (stepped) or butt edge type.

3. Face Design: Flat, flush.
 4. Cap Material: Commercial quality cold rolled steel with galvanized coating.
 5. Face Flange Width: 9/16 inch.
 6. Exposed Finish: Baked on enamel, white satin finish matching ceiling panel color.
 7. Products: Subject to compliance with requirements, provide products of one of the following:
 - a. Suprafine by Armstrong World Industries.
- D. Rough Suspension: Galvanized steel carrying channels and hangers, sized and type to suit application and to rigidly secure complete acoustic unit ceiling system, with maximum deflection of L/360.
- E. Grid Accessories: Stabilizer bars, furring clips, splices, retention clips, and edge moldings as required to complete and compliment suspended ceiling grid system.
- F. Perimeter Trim: Extruded aluminum alloy 6063 trim channel, 6 inch (150 mm) wide face with 3/4 inch (19 mm) horizontal legs, straight or curved sections with special bosses formed for attachment to the tee bar connection clip or hanging clip; commercial quality, extruded aluminum, factory applied baked polyester paint.
1. Acceptable Product:
 - a. Axiom by Armstrong.
 - b. Compásso Elite by USG.

2.4 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1 Direct Hung unless otherwise indicated. Comply with seismic design requirements.
1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, determined by testing according to ASTM E 488/E 488M or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Type: Post-installed expansion or Post-installed bonded anchors.
 - b. Corrosion Protection: Carbon steel components zinc plated according to ASTM B 633, Class SC 1 (mild) service condition.
 2. Power Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.
- B. Wire Hangers, Braces, and Ties: Provide wires:
1. Zinc Coated, Carbon Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 2. Stainless Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
 3. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1 Direct Hung) will be less than yield stress of wire, but not less than 0.106-inch (2.69 mm) diameter wire.
- C. Flat Hangers: Mild steel, zinc coated or protected with rust inhibitive paint.
- D. Angle Hangers: Angles with legs not less than 7/8-inch (22 mm) wide; formed with 0.04 inch (1 mm) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16 inch (8 mm) diameter bolts.

2.5 METAL EDGE MOLDINGS AND TRIM

- A. Roll Formed, Sheet Metal Edge Moldings and Trim: Type and profile necessary for edges and penetrations that comply with design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
 - 1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
 - 2. For lay in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 - 3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut for compliance with requirements that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less than half width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.
- B. Exposed Grid Suspension System: Suspend ceiling hangers from building's structural members:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 3. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 4. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger

- involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast in place hanger inserts, post-installed mechanical or adhesive anchors, or power actuated fasteners that extend through forms into concrete.
 6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 7. Do not attach hangers to steel deck tabs.
 8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 9. Space hangers not more than 48 inches (1220 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
 10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Edge Moldings: Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension system runners to be square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Form expansion joints to accommodate plus/minus 1-inch (25 mm) movement. Maintain visual closure.
- F. Acoustical Panels: Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
1. Arrange directionally patterned acoustical panels:
 - a. As indicated on reflected ceiling plans.
 2. For square edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
 3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 4. Where round obstructions occur, provide preformed closers to match edge molding.
- 3.4 ERECTION TOLERANCES
- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), noncumulative.
 - B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), noncumulative.
- 3.5 FIELD QUALITY CONTROL
- A. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion, but no panels have been installed. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results

for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.

1. Within each test area, testing agency will select one of every 10 power actuated fasteners and post-installed anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every two post-installed anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

B. Acoustical panel ceiling hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 61 05 - MOISTURE VAPOR EMISSION AND ALKALINITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
1. Water vapor reduction system on new and existing concrete slabs where necessary to obtain a minimum moisture vapor emissions rate of 75 percent maximum for moisture sensitive flooring schedule to receive carpet, resinous flooring, or moisture sensitive flooring.

1.2 UNIT PRICES

- A. Unit Price: Work of this section is affected by unit prices specified in Section 012200:
1. Unit Price No. # 096105-01 Areas Receiving Carpet Tile: Unit price per square foot.
 2. Unit Price No. #: 096505-02 Areas Receiving Resilient floor Coverings: Unit price per square foot.

1.3 DEFINITIONS

- A. MVE: Moisture vapor emission.
- B. MVER: Moisture vapor emission rate.

1.4 ACTION SUBMITTALS

- A. Product Data: Technical data for each type of product used in moisture vapor emission (MVE) control system.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Schedule: Submit schedule for identifying each floor area to receive moisture vapor emission and alkalinity control system. Use same room label and numbering designations indicated on Drawings.
1. Distinguish between those areas required to receive cementitious surfacing over moisture vapor emission and alkalinity control system and those areas where not required.
- B. Qualification Data: Submit data for installer.
- C. Product Test Reports:
1. Submit test reports performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
 2. Preinstallation Moisture Vapor Field Test Reports: For each area receiving resilient floor covering, and carpet tile, submit test result reports for vapor and moisture testing and alkalinity and adhesion testing for new and existing concrete substrates.
- D. Preconstruction Test Reports: Submit test reports for alkalinity, calcium chloride, and relative humidity of concrete slabs for each area receiving floor covering.

- E. Warranty: Submit for warranty for vapor emission control coating system and certificate of underwriter's coverage of manufacturer's warranty.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Entity having minimum five years documented experience in the manufacturer of MVE control system and who employs factory trained personnel available for consultation and site inspection.
 - 1. The water vapor emission reduction system must be specifically formulated and marketed for water vapor emission reduction and alkalinity control without change of system design for a minimum period of 10 years.
- B. Installer Qualifications: Entity having minimum 5 years documented experience in the installation of MVE control systems who is an authorized representative and is trained and approved by manufacturer.
- C. Testing Agency Qualifications: Moisture and pH testing shall be performed by an International Concrete Repair Institute (ICRI), Certified Concrete Slab Moisture Testing Technician – Grade 1.
- D. Preinstallation Testing Service: At least 28 days after placement of concrete and prior to floor covering installation, Owner will engage a qualified independent testing agency to perform the following tests on floor areas to receive moisture vapor emission and alkalinity control system:
 - 1. Calcium chloride testing per ASTM F 1869.
 - 2. Relative humidity testing per ASTM F 2170.
 - 3. Alkalinity testing per ASTM F 710.
- E. Preinstallation Conference: Conduct conference at site. Review methods and procedures related to installation including, but not limited to, the following:
 - 1. Review substrate conditions, moisture and pH test results, manufacturer's installation instructions, and warranty requirements.
 - 2. Document proceedings, including required corrective measures.

1.7 COORDINATION

- A. Coordinate testing agency to test concrete slabs no sooner than one week or more than 5 weeks prior to scheduled flooring installation.
 - 1. Apply treatment to areas with moisture vapor emission or relative humidity rates which exceed floor covering manufacturer's written limits, as determined by ASTM F 1869 and ASTM F 2170 testing.
- B. Coordinate testing with installation of floor coverings. Ensure flooring installation complies with MVE control system manufacturer's warranty requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating directions for storage and mixing with other components.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Comply with MVE control system manufacturer's written instructions for substrate and ambient temperatures, humidity, ventilation, and other conditions affecting system installation.
1. Store system components in a temperature controlled environment and protected from weather and at ambient temperature of not less than 65 degrees F (18 degrees C) and not more than 85 degrees F (29.4 degrees C) at least 48 hours before use.
 2. Maintain ambient temperature and relative humidity in installation areas within range recommended in writing by MVE control system manufacturer, but not less than 65 degrees F (18 degrees C) or more than 85 degrees F (29.4 degrees C) and not less than 40 or more than 60 percent relative humidity, for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.
 3. Install MVE control systems where concrete surface temperatures will remain a minimum of 5 degrees F (3 degrees C) higher than the dew point for ambient temperature and relative humidity conditions in installation areas for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.

1.10 WARRANTY

- A. System Warranty: Written warranty signed by manufacturer in which the manufacturer agrees to repair or replace components of treatment system, hydraulic cementitious underlayment, floor covering materials, including primer and adhesives, and installation labor for same period resulting from moisture vapor emission related failure that fail in materials or workmanship within specified warranty period.
1. Moisture Vapor Emissions Reduction Rate: Warranty shall warrant the reduction of moisture vapor emissions from a maximum of 25 pounds per 1000 sq. ft./24 hours to no more than 3 pounds per 1000 sq. ft./24 hours determined by the Calcium Chloride Test Method ASTM F1869 and 100% RH using the Relative Humidity Method ASTM F2170.
 - a. System will not fail due to a manufacturing defect and shall prevent flooring damage and bond failure caused by vapor emissions from concrete substrate.
 2. [Total System Warranty includes the use of a manufacturer's products listed as a total system.]
 3. Warranty Period: 10 years from date of Substantial Completion.
- B. Installation Warranty: Written warranty signed by installer in which installer agrees to repair or replace MVE installation that fail in workmanship within specified warranty period.
1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. MVE Control System Capabilities: Capable of suppressing MVE without failure where installed on concrete that exhibits the following conditions:
1. MVER: Maximum 25 lb of water/1000 sq. ft. (11.34 kg of water/92.9 sq. m) when tested according to ASTM F 1869.

2. Relative Humidity: Maximum 90 percent when tested according to ASTM F 2170 using in situ probes.
- B. Water-Vapor Transmission: Through MVE control system, maximum 0.06 perm (3.45 ng/Pa x s x sq. m) when tested according to ASTM E 96/E 96M.
- C. Tensile Bond Strength: For MVE control system, greater than 200 psi (1.38 MPa) with failure in the concrete according to ASTM D 7234.
- D. Surface Alkalinity: ASTM 710, pH between 7.0 and 8.5.

2.2 CONTROL SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products manufactured by one of the following:
 1. MVE Barrier Treatment:
 - a. Ardex Engineered Cements, Inc.; MC ULTRA Moisture Control System.
 - b. BASF; MasterTop VB 240FS.
 - c. Custom Building Products, Tech MVC Moisture Vapor and Alkalinity Barrier.
 - d. Laticrete SuperCap; Moisture Vapor Control.
 - e. Maxxon; Aquafin Vaportight Coat series.
 - f. USG: Durock Brand RH-100 Moisture Vapor Reducer.
 - B. System Description: Multicomponent or single component, fluid applied penetrants or coatings intended to seal or stabilize internal humidity by restricting excessive moisture and pH (alkalinity), and to mechanically regulate permeability and suppress the volume of moisture reaching concrete surfaces, for compliance with subsequent floor covering manufacturer's written limitations.
 1. Determine application methods by site conditions, presence of subslab vapor barriers for slabs on grade, concrete mix design and contaminants, age of concrete substrate, results of ASTM F1869 calcium chloride testing, if required, and finish floor covering manufacturer's recommendations.
 - C. MVE and Alkalinity Control System: ASTM F 3010 qualified two component, fluid applied penetrants or coatings intended to seal or stabilize internal humidity by restricting excessive moisture and pH (alkalinity), and to mechanically regulate permeability and suppress the volume of moisture reaching concrete surfaces, for compliance with subsequent floor covering manufacturer's written limitations.
 1. Physical Properties:
 - a. Water Vapor Transmission: ASTM E 96; Minimum 94% reduction under laboratory conditions
 - b. Alkali Resistance: ASTM D 1308; Pass, up to pH of 14
 - c. Adhesion Strength: ASTM D 4541; 500 psi (100% Concrete Adhesive Failure)
 - d. Relative Humidity: Resists up to 100% Relative Humidity as measured by ASTM F 2170.
 2. Substrate Primer: Provide MVE control system manufacturer's concrete substrate primer if required for system indicated by substrate conditions.
 3. Cementitious Underlayment Primer: If required for subsequent installation of cementitious underlayment products, provide MVE control system manufacturer's primer to ensure adhesion of products to MVE control system.

- D. Accessories:
1. Patching and Leveling Material: Moisture, mildew, and alkali resistant portland cement product recommended in writing by MVE control system manufacturer and with minimum of 3000 psi (20.68-MPa) compressive strength after 28 days when tested according to ASTM C 109/C 109M.
 2. Crack Filling Material: Resin based material recommended in writing by MVE control system manufacturer for sealing concrete substrate crack repair.
 3. Cementitious Underlayment: As recommended by control system manufacturer, self-leveling compound applied to areas receiving resilient or wood flooring. Cement must bond with subsequent floor coverings and adhesives.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for maximum moisture content, installation tolerances, and conditions affecting performance of the work.
- B. Prepare written report listing conditions detrimental to performance.
- C. Proceed with installation after correcting unsatisfactory conditions. Commencement of installation of system indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Preinstallation Testing:
1. Testing Agency: Owner will engage a qualified testing agency to perform tests.
 2. Surface Alkalinity Testing: Perform pH testing according to ASTM F 710. Install MVE control system in areas where pH readings are less than 7.0 and in areas where pH readings are greater than 8.5.
 3. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Install MVE control system in locations where concrete substrate MVER exceeds 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Internal Relative Humidity Test: Using in situ probes, ASTM F 2170. Install MVE control system in locations where concrete substrates exhibit relative humidity level greater than 75 percent.
 4. Tensile Bond Strength Testing: For typical locations indicated to receive installation of MVE control system, install minimum 100-sq. ft. (9.29-sq. m) area of MVE control system to prepared concrete substrate and test according to ASTM D 7234.
 - a. Proceed with installation where tensile bond strength is greater than 200 psi (1.38 MPa) with failure in the concrete.
- B. Concrete Substrates: Prepare and clean substrates according to MVE control system manufacturer's written instructions to ensure adhesion of system to concrete.
1. Remove coatings and substances incompatible with MVE control system and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by MVE control system manufacturer. Do not use solvents.

2. When required by manufacturer, provide concrete surface profile complying with ICRI 310.2R CSP 3 by shot blasting using apparatus that abrades the concrete surface with shot, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 3. After shot blasting, repair damaged and deteriorated concrete according to MVE control system manufacturer's written instructions.
 4. Protect substrate voids and joints to prevent resins from flowing into or leaking through them.
 5. Fill surface depressions and irregularities with patching and leveling material.
 6. Fill surface cracks, grooves, control joints, and other nonmoving joints with crack filling material.
 7. Allow concrete to dry, undisturbed, for period recommended in writing by MVE control system manufacturer after surface preparation, but not less than 24 hours.
 8. Remove dirt, debris, or existing sealant from cracks and joints. Treat dynamic joints with coating by applying a layer into the joint to completely coat walls of the cavity. After curing, fill joint with backer rod while leaving joint top open for sealant treatment.
 9. Prior to installation of MVE control systems, broom sweep and vacuum prepared concrete.
- C. Protect walls, floor openings, electrical openings, door frames, and obstructions during installation.

3.3 INSTALLATION

- A. Apply MVE and alkalinity control system in accordance with ASTM F 3010 and manufacturer's written instructions to produce a uniform, monolithic surface free of surface deficiencies such as pin holes, fish eyes, and voids.
 1. Install primers as required to comply with manufacturer's written instructions.
- B. Do not apply MVE control system across substrate expansion, isolation, and moving joints.
- C. Apply system, including component coats if any, in thickness recommended in writing by MVE control system manufacturer for MVER indicated by preinstallation testing.
- D. Cure MVE control system components according to manufacturer's written instructions. Prevent contamination or other damage during installation and curing processes.
- E. After curing, examine MVE control system for surface deficiencies. Repair surface deficiencies according to manufacturer's written instructions.
- F. MVE Cementitious Underlayment: Apply cementitious surfacing over cured membrane in areas to receive tile carpet, and resilient flooring, or other moisture sensitive flooring to facilitate adhesive bond.
 1. Apply at minimum thickness of 1/8 inch (3 mm).

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform installation inspections.
- B. Installation Inspections: Inspect substrate preparation and installation of system components to ensure compliance with manufacturer's written instructions and to ensure that a complete MVE control system is installed without deficiencies.

1. Verify surface preparation meets requirements.
2. Verify component coats and complete MVE control system film thickness comply with manufacturer's written instructions.
3. Verify MVE control system components and installation areas that evidence deficiencies are repaired according to manufacturer's written instructions.

C. MVE control system will be considered defective if it does not pass inspections.

3.5 PROTECTION

- A. Protect MVE control system from damage, wear, dirt, dust, and contaminants before floor covering installation. Use protective methods and materials, including temporary coverings, recommended in writing by MVE control system manufacturer.
- B. Do not allow subsequent preinstallation examination and testing for floor covering installation to damage, puncture, or compromise the MVE control system membrane.

END OF SECTION

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Requirements including but not limited to:
 - 1. Resilient base.
 - 2. Resilient accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data, installation instructions, and maintenance procedures.
- B. Samples: For resilient accessories, submit samples not less than 12 inches (300 mm) long, of each resilient accessory color and pattern specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit data for Installer.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient base and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 degrees F (10 degrees C) or more than 85 degrees F (29 degrees C). Store floor tiles on flat surfaces.

1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 degrees F (21 degrees C) or more than 85 degrees F (29 degrees C), in spaces to receive flooring during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.

1.6 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Base: Minimum 10 linear feet for each 500 linear feet (150 linear m) or fraction thereof for each different type and color installed.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - 1. Rubber Base:
 - a. Johnsonite; A Tarkett Company.

- B. Thermoset Rubber Base ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
 - 1. Style and Location:
 - a. Straight: Provide in areas with carpet.
 - b. Cove: Provide in areas with resilient flooring.
 - c. Butt to: Provide in areas indicated.
 - 2. Thickness: 0.125 inch (3.2 mm).
 - 3. Height: 4 inches (102 mm)
 - 4. Lengths: Coils in 100-foot lengths. Field cut to size.
 - 5. Outside Corners: Preformed
 - 6. Inside Corners: Job formed or preformed.
 - 7. Colors: See Finish Schedule on drawings, to match existing.

- C. Rubber Molding Accessory:
 - 1. Carpet edge for glue down applications.
 - 2. Nosing for carpet.
 - 3. Nosing for resilient flooring.
 - 4. Reducer strip for resilient flooring.
 - 5. Joiner for tile and carpet.
 - 6. Transition strips.
 - 7. Profile and Dimensions: As required.
 - 8. Locations: Provide rubber molding accessories in areas indicated.
 - 9. Colors and Patterns: See Finish Schedule on drawings, to match existing

- D. Installation Materials:
 - 1. Trowelable Leveling and Patching Compounds: Latex modified, portland cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
 - 2. Adhesives: Water resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

- E. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.
- B. Proceed with installation after correcting unsatisfactory conditions. Installation of resilient flooring and accessories indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to resilient accessory manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare horizontal and vertical surfaces according to ASTM F 710.
 - 1. Verify substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and substances incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.

3.3 INSTALLATION

- A. Resilient Base: Comply with manufacturer's written instructions for installing resilient base. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
1. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
 2. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 3. Do not stretch resilient base during installation.
 4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
 5. Preformed Corners: Install preformed corners before installing straight pieces.
 6. Job Formed Corners:
 - a. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
 - b. Form without producing discoloration (whitening) at bends.
 - c. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
 - 1) Cope or miter corners to minimize open joints.
- B. Preformed Cove Base: Comply with manufacturer's written instructions.
1. Dry fit base. Cut and fit material to required lengths, miter cut inside and outside corners.
 2. Dry fit and cut metal cove cap prior to base installation.
 3. Scribe glue line on walls and floor at edge of base material. Apply adhesive in full spread (100% coverage on two surfaces) for full length of base material. Apply base to wall surface straight and level.
 4. Slide cove cap behind base material.
 5. Hand roll base material onto wall and floor surface, and remove bumps, ripples, and fishmouths. Remove excess adhesive.
- C. Resilient Accessories: Comply with manufacturer's written instructions for installing resilient accessories.
1. Resilient Stair Accessories: Use stair tread nose filler to fill nosing substrates that do not conform to tread contours. Tightly adhere to substrates throughout length of each piece.
 - a. For treads installed as separate, equal-length units, install to produce a flush joint between units.
 2. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning resilient accessories.
- B. Perform cleaning operations immediately after completing flooring installation:
1. Remove adhesive and other blemishes from exposed surfaces.

END OF SECTION

SECTION 09 65 19 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid vinyl floor tile (LVT).

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data, installation instructions, and maintenance procedures for each product specified for each type of product.
- B. Shop Drawings: Submit for each type of resilient flooring. Include floor covering layouts, edges, columns, doorways, enclosing partitions, built in furniture, cabinets, and cutouts.
 - 1. Show details of special patterns.
- C. Samples: Submit full size units of each color and pattern of floor tile required showing full range of variations anticipated.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit data for Installer.
- B. Product Test Reports:
 - 1. Submit test result for vapor and moisture testing.
 - 2. Submit test reports for alkalinity and adhesion testing.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Submit data for each type of floor tile to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Entity having minimum 5 years documented experience who employs trained or certified by manufacturer for required installation techniques and are competent in techniques required for resilient flooring.
 - 1. Engage an installer who employs workers trained or certified by resilient flooring manufacturer for installation techniques required.
- B. Source Limitations:
 - 1. Tile: Obtain floor products of same type and color or finish from one source or producer. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
 - 2. Setting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Coordinate mockups in this Section with mockups specified in other Sections.

- a. Size: Minimum 100 sq. ft. (9.3 sq. m) for each type, color, and pattern in locations directed by Architect.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 degrees F (10 degrees C) or more than 90 degrees F (32 degrees C). Store floor tiles on flat surfaces.

1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 degrees F (21 degrees C) or more than 95 degrees F (35 degrees C), in spaces to receive floor tile during the following periods:
 1. 48 hours before installation.
 2. During installation.
 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 degrees F (13 degrees C) or more than 95 degrees F (35 degrees C).
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

1.8 EXTRA MATERIALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire Test Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. Accessibility Requirements: Comply with applicable requirements.
 1. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) 2010.
 2. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.

2.2 VINYL COMPOSITION FLOOR TILE

- A. Manufacturers [LVT]: Subject to compliance with requirements, provide products by the following:
 - 1. Interface.
 - a. Level Set Collection LVT – Textured Wood Grains and Stones:
 - 1) LVT-1: A00403 – Grey Dune, to match existing.
- B. Tile Standard: ASTM F 1700, Class 3, printed film vinyl tile.
- C. Wearing Surface: Smooth.
- D. Thickness: 4.5 mm.
- E. Size: 9.845 inches by 39.38 inches (250 mm by 1,000 mm).
- F. Colors and Patterns: Ashlar.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex modified, portland cement based or blended hydraulic cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
- C. Floor Polish: Provide protective, liquid floor polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.
 - 1. Verify finishes of substrates comply with specified tolerances and requirements and substrates are free of cracks, ridges, depressions, scale, and foreign deposits that interfere with adhesion of floor tile.
- B. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and substances incompatible with adhesives and contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.

3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m) [1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
 5. Bond Test: Bond 3 feet by 3-feet (1 m by 1 m) panels spaced 50 feet (16.7 m) apart throughout subfloor area. After moisture test proves floor acceptably dry, install panels using adhesive. If panels are securely bonded after 72 hours, subfloor is sufficiently clean of foreign materials for satisfactory installation of resilient flooring.
 6. Perform additional moisture and vapor tests recommended by manufacturer. If substrates fail to meet manufacturers recommended moisture content, remediate moisture. Proceed with floor covering installation after substrates past testing.
- C. Moisture Remediation: Provide moisture vapor emissions control system specified in Section 09 61 05 should the moisture test results indicated the concrete substrate fails to obtain the minimum moisture vapor emissions rate required by the flooring covering manufacturer.
- D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- E. Do not install floor tiles until materials are the same temperature as installation space.
 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- F. Immediately before installation, sweep and vacuum clean substrates covered by resilient floor tile.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 1. Lay tiles square with room axis, if no pattern is indicated on drawings.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or nonpermanent marking device.

- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp op surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Sealers and Finish Coats: Remove soil, visible adhesive, and surface blemishes from resilient terrazzo floor tile surfaces before applying liquid cleaners, sealers, and finish products.
 - 1. Sealer: Apply two base coats of liquid sealer.
 - 2. Finish: Apply two coats of liquid floor finish.
- E. Cover floor tile until Substantial Completion.

END OF SECTION

SECTION 09 68 13 - CARPET TILE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes modular carpet tile.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data for each type of carpet tile including manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 1. Include manufacturer's written installation recommendations for each type of substrate.
- B. Shop Drawings: Indicate dimensions of carpet areas showing starting points, walls, or partitions, fixed built in equipment, including:
 - 1. Columns, doorways, enclosing walls or partitions, and locations where cutouts are required in carpet tiles.
 - 2. Carpet tile type, color, and dye lot.
 - 3. Type of subfloor.
 - 4. Type of installation.
 - 5. Pattern of installation.
 - 6. Pattern type, location, and direction.
 - 7. Type, color, and location of insets and borders.
 - 8. Type, color, and location of edge, transition, and other accessory strips.
 - 9. Transition details to other flooring materials.
- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet Tile: Full size Sample.
 - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12 inch (300 mm) long Samples.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports:
 - 1. Submit reports for carpet for tests performed by a qualified testing agency.
 - 2. Test results for vapor and moisture testing.
 - 3. Test results for alkalinity and adhesion testing.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Submit data for carpet tiles to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet tile, including cleaning and stain removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer having minimum 5 years documented experience, who is certified by the International Certified Floorcovering Installers Association.
- B. Preinstallation Conference: Conduct conference at site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI Carpet Installation Standard.
- B. Deliver and store materials at site in original factory packaging and containers. Store materials flat, above ground, in well ventilated area protected from weather, moisture, soiling, humidity, and extreme temperature.

1.7 FIELD CONDITIONS

- A. Comply with CRI Carpet Installation Standard for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.8 WARRANTY

- A. Written warranty signed by manufacturer in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, the following:
 - a. More than 10 percent edge raveling, snags, and runs.
 - b. Dimensional instability.
 - c. Excess static discharge.
 - d. Loss of tuft-bind strength.
 - e. Loss of face fiber.
 - f. Delamination.
 - 3. Warranty Period: 15 years from date of Substantial Completion.

1.9 MAINTENANCE MATERIALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet Tile: Full size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Finish surfaces to specified tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface receiving carpet or carpet tile:
 - 1. Specified overall values (SOV):
 - a. Flatness: F_F 25.
 - b. Levelness: F_L 20.
 - 2. Minimum local values (MLV):
 - a. Flatness: F_F 17.
 - b. Levelness: F_L 15.
- B. Fire Test Response Characteristics: Provide products with the critical radiant flux classification determined by testing identical products in accordance with ASTM E 648. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 CARPET TILE

- A. Basis of Design: Indicated in Finish Schedule.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Interface, Inc.
- C. Carpet Tile, Type 1:
 - 1. Face Construction: Tufted Texture Loop.
 - 2. Face Fiber: BCF Nylon Type 6.
 - 3. Color System: 100% Solution Dyed.
 - 4. Stitches: 26 per inch.
 - 5. Pile Density: 6,039 oz. per cu. yd. +/- 10%.
 - 6. Pile Height: 4.0 mm +/- 0.5 mm.
 - 7. Total Thickness: 8.5 mm +/- 0.5 mm.
 - 8. Total Weight: _____ oz. per sq. yd.
 - 9. Primary Backing: Non-woven; broadloom backing system consisting of two layers of thermoplastic vinyl composite material, reinforced with fiberglass.
 - 10. Secondary Backing: _____
 - 11. Color: See Finish Schedule on drawings, to match existing.
 - 12. Size: 50 cm by 50 cm..
 - 13. Performance Characteristics:
 - a. Antimicrobial:
 - b. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
 - c. Smoke Density: Maximum 450, ASTM E 662.
 - d. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.
 - e. Dry Breaking Strength: Not less than 100 lbf (445 N) according to ASTM D 2646.
 - f. Delamination: Not less than 2.5 lbf/in. according to ASTM D 3936.
 - g. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
 - h. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
 - i. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
 - j. Colorfastness to Light: Not less than 4 according to AATCC 16, Option E.

D. Applied Treatments:

1. Soil Resistance Treatment: Standard treatment.
2. Antimicrobial Treatment: Standard treatment that protects carpet tiles:
 - a. Antimicrobial Activity: Not less than 2 mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex modified, hydraulic cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water resistant, mildew resistant, non-staining, pressure sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

- A. Comply with CRI Carpet Installation Standards, ASTM F710 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Concrete Slabs: Verify slab finishes comply with requirements specified in Section 033000 and that surfaces are free of cracks, ridges, depressions, scale, curing compounds, sealers, hardeners, and foreign deposits.
 1. Alkalinity and Adhesion Testing: Perform tests recommended by carpet tile manufacturer. Proceed with installation after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 2. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m) and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation after substrates have maximum moisture vapor emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
 - c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

3. Perform additional vapor and moisture tests recommended by manufacturer. If substrates fail to meet manufacturers recommended moisture content, remediate moisture. Proceed with floor covering installation after substrates past testing.
- C. Moisture Remediation: Provide moisture vapor emissions control system specified in Section 09 61 05 should the moisture test results indicated the concrete substrate fails to obtain the minimum moisture vapor emissions rate required by the flooring covering manufacturer.
- D. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.
- E. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- F. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. Comply with CRI Carpet Installation Standard, Section 18 Modular Carpet and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Comply with manufacturer's recommended method for glue down; install every tile with full spread, releasable, pressure sensitive adhesive.
- C. Maintain dye lot integrity. Do not mix dye lots in same area.
- D. Maintain pile direction patterns recommended in writing by carpet tile manufacturer.
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, non-staining marking device.
- H. Install pattern parallel to walls and borders.
- I. Edge Trim: Install edge strips where carpet terminates at other floor coverings and at carpet bases in accordance with manufacturer's recommendations.
 1. Use full length pieces butted tightly to vertical surfaces. Where splicing cannot be avoided, butt ends tight and flush.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 2. Remove yarns that protrude from carpet tile surface.
 3. Vacuum carpet tile using commercial machine with face beater element.
- B. Protect installed carpet tile to comply with CRI Carpet Installation Standard, Section 20 Protecting Indoor Installations.
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

SECTION 09 91 13 - EXTERIOR FIELD PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Surface preparation and the field application of paint systems.
1. Concrete.
 2. Fiber cement board.
 3. Clay masonry.
 4. Concrete masonry units (CMUs).
 5. Steel and iron.
 6. Galvanized metal.
 7. Aluminum (not anodized or otherwise coated).
 8. Wood.
 9. Portland cement plaster (stucco).
 10. Gypsum board.
 11. Cotton or canvas insulation covering.
 12. Bituminous coated surfaces.

1.2 DEFINITIONS

- A. Standard coating terms defined in ASTM D 16 apply.
1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85 degrees meter.
 2. Eggshell refers to low sheen finish with a gloss range between 20 and 35 when measured at a 60 degrees meter.
 3. Semigloss refers to medium sheen finish with a gloss range between 35 and 70 when measured at a 60 degrees meter.
 4. Full gloss refers to high sheen finish with a gloss range more than 70 when measured at a 60 degrees meter.

1.3 ACTION SUBMITTALS

- A. Product Data: Technical data and product information for block fillers, primers, paints, and coatings, including label analysis and instructions for handling, storing, surface preparation, and application for each paint and coating system.
1. For field painting of factory primed metal products and fabrications, submit technical data for each type of paint product, surface preparation requirements, and application instructions.
 2. Indicate manufacturer's instructions for special surface preparation procedures and substrate conditions requiring special attention.
 3. Product List: Provide inclusive list of required coating systems and materials. Indicate each material and cross reference specific coatings, finish system, and application. Identify each material by manufacturer's catalog number, series, and general classification. Use same designations indicated in Finish Schedules.
- B. Samples: Submit aged (minimum seven days) paint samples for each type of paint system and each color and gloss of topcoat.

1. Provide stepped samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
2. Provide list of material and application for each coat of each sample. Label each sample as to location and application.
3. Submit samples on substrates for review of color and texture:
 - a. Concrete: Two 4 inch (50 mm) square samples for each color and finish.
 - b. Concrete Masonry: Two 4 inch by 8-inch (100 mm by 200 mm) samples of masonry, with mortar joint in the center, for each finish and color.
 - c. Painted Wood: Two 12 inch (305 mm) square samples of each color and material on hardboard.
 - d. Ferrous and Nonferrous Metals: Two 4 inch (100 mm) square samples of flat metal and two 8 inch (200 mm) long samples of solid metal for each color and finish.

1.4 INFORMATIONAL SUBMITTALS

- A. Quality Control Submittals: Furnish certificates from manufacturer that products supplied comply with VOC content limits and emission in accordance with local, state, and federal regulations and sustainability limit requirements.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with Federal and local toxicity and air quality regulations and with Federal requirements on content of for heavy metals including but not limited to: lead and mercury. Do not use solvents in paint products that contribute to air pollution.
- B. Applicator Qualifications: Entity having minimum 5 years documented experience in applying paints and coatings similar in material, design, and extent to those indicated.
- C. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.
- D. Coordination of Work: Coordinate field finishing of shop primed metals are provided to ensure compatibility of total systems for various substrates.
- E. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Container Labels: Include manufacturer's name, type of paint, brand name, lot number and date of manufacturer, brand code, coverage rate, surface preparation, instructions for mixing and reducing drying time, cleanup requirements, color designation, and application instructions.
- B. Store materials not in use in tightly covered containers in well ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F (7 degrees C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Do not thin or add water to water-based paints, including water-based alkyls.
- B. Weather Conditions:
 - 1. Apply paints when temperature of surfaces to receive paint and ambient air temperatures are between 50 degrees F and 95 degrees F (10 degrees C and 35 degrees C).
 - 2. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.
 - 3. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (35 degrees C) for exterior, or as indicated by manufacturer's Product Data Sheet.
- C. Apply solvent thinned paints when temperatures of surfaces to receive paint and surrounding air are between 45 degrees F. and 95 degrees F (7 degrees F and 35 degrees C).
 - 1. Minimum Application Temperature for Varnish Finishes: 65 degrees F (18 degrees C) for interior or exterior, unless required otherwise by manufacturer's instructions.
- D. Painting may continue during inclement weather if surfaces and areas to receive paint and coatings are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.
- E. Provide lighting level of 80-foot candles (860 lx) measured mid-height at substrate surface.
- F. Labels: Do not paint over Underwriters Laboratories, Factory Mutual, other code required labels, or equipment name, identification, performance rating, or nomenclature plates.

1.8 EXTRA MATERIALS

- A. Furnish extra materials from the same product run, matching products installed and packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: Minimum 1 gal. (3.8 L) of each material and color applied. In addition to manufacturer's label, identify each container with color, type, texture, and room location.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Performance and Durability:
1. ASTM D 16 Standard Test Method for Load Testing Refractory Shapes at High Temperatures.
 2. ASTM D 2486 Standard Test Method for Scrub Resistance of Interior Wall Paint.
 3. ASTM D 2805 Standard Test Method for Hiding Power of Paints by Reflectometry.
 4. ASTM D 4828 Standard Test Method for Practical Washability of Organic Coatings.

2.2 MATERIALS

- A. Basis of Specifications: Subject to compliance with requirements, provide first quality, 100% acrylic, commercial or industrial products by The Sherwin-Williams Company, or of one of the specified manufacturers listed below:
1. Benjamin Moore & Co.
 2. Devco High Performance Coatings.
 3. Kelly-Moore Paint Company Inc.
 4. Pittsburgh Paints.
 5. Dunn-Edwards Corporation.
 6. Vista Paint Corporation.
- B. Residential products are not permitted.
- C. Material Compatibility:
1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- D. Accessories: Linseed oil, shellac, turpentine, paint thinners, and similar materials not specifically indicated but necessary to achieve the finishes specified for commercial quality.
- E. Patching Materials: Latex filler compatible with paint systems.
- F. Fastener Head Cover Materials: Latex filler.
- G. Colors: Indicated in Finish Schedule, see drawings, to match existing. Anticipate twenty thirty percent of surface area will be painted with deep tones.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.

- B. Test substrates after repairing and cleaning substrates but prior to application of paint and coatings.
 - 1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Concrete: 12 percent.
 - b. Fiber Cement Board: 12 percent.
 - c. Masonry (Clay and CMUs): 12 percent.
 - d. Wood: 15 percent.
 - e. Portland Cement Plaster: 12 percent.
 - f. Gypsum Board: 12 percent.
 - 2. Test cementitious substrates and plaster cement/stucco for alkalinity (pH).
- C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
- D. Exterior Gypsum Board Substrates: Verify joints are properly taped and finishing compound is sanded smooth.
- E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
 - 1. Verify previously painted surfaces can be stripped to bare substrate, repaired if necessary, and prepared to receive new paint or coating system consisting of primer and two top coats at a minimum.
 - a. Note: When previously painted surfaces have failed to accept new paint systems, determine cause of failure and take corrective measures to ensure each surface accepts new paint or coating system. Failure of new paint system is not permitted.
 - 2. Shop Primed Metals: Inspect shop primed metals to determine if primer is in condition to receive and is compatible with topcoats.
- F. Commence paint and coating application after correcting unsatisfactory conditions and surfaces are dry. Application of coating indicates applicator's acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
- B. Coordination of Work:
 - 1. Pre-primed Substrates: Inspect existing conditions in which primers are factory applied to ensure compatibility of the total system for each substrate. Notify Architect of anticipated problems when using the materials specified over factory primed or pre-primed substrates.
 - 2. Existing Painted Surfaces: Inspect previously painted surfaces to ensure compatibility of the existing paints with new paint system for each substrate. Notify Architect of anticipated problems.
 - 3. Repair defects and clean surfaces affecting bond with paint system. Remove existing paints exhibiting loose surface defects showing signs of rust, scale, or delamination.
 - 4. Seal marks which may bleed through surface finishes.
 - 5. Touch up shop primer or previously painted surfaces prior to application of topcoats.
- C. Surface Cleaning: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each substrate condition. Provide barrier coats over incompatible primers or

remove and reprime. If removal is impractical or impossible because of size or weight of item, provide surface applied protection before surface preparation and painting

1. Before applying paint or surface treatments, clean substrates of substances that impair bond of the various coatings. Remove oil and grease before cleaning. Schedule cleaning and painting so dust and contaminants from the cleaning process will not fall on wet, newly painted surfaces.
2. Remove in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, protect items before surface preparation and painting.
 - a. After completing painting operations, reinstall removed items. Remove surface applied protection from in place items.
3. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
4. Seal marks which may bleed through surface finishes with shellac. Provide barrier coats over incompatible primers or remove and reprime.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

D. Cementitious Substrates: Remove release agents, curing compounds, efflorescence, chalk, dust, dirt, grease, oils, release agents, mold, mildew, and existing paint. Roughen as necessary to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

1. Use abrasive blast cleaning methods if recommended by paint manufacturer.
2. Do not paint surfaces if moisture content or alkalinity of surfaces exceeds that permitted in manufacturer's written instructions.
 - a. Determine alkalinity and moisture content of surfaces by performing appropriate pH testing. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct condition prior to application of paint.
 - b. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m).
 - c. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation after substrates have obtained percent relative humidity level recommended by paint manufacturer.
 - d. Perform additional moisture tests when recommended by manufacturer. Proceed with installation when moisture content complies with that permitted in manufacturer's written instructions.
 - e. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to thoroughly dry.
3. Clean concrete decks and floors to receive paint or coating with a 5 percent solution of muriatic acid or etching cleaner. Flush floors with clean water to remove acid; neutralize with ammonia, rinse, allow to dry; vacuum before painting.

E. Ferrous Metals: Remove rust, loose mill scale, and shop primer. Clean ungalvanized ferrous metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.

1. SSPC-SP 6/NACE No. 3: Blast steel surfaces clean as recommended by paint system manufacturer.

- F. Shop Primed Ferrous Metal Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop primed surfaces.
 - 1. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
 - 2. Touch up bare areas and damaged shop applied prime coats. Wire brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.
- G. Galvanized Ferrous Metal Substrates: Clean galvanized surfaces with nonpetroleum based solvents leaving surface free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- H. Aluminum Substrates: Remove surface oxidation with acid etch and solvent washing. Remove oil, grease, surface oxidation, and contaminants in accordance with SSPC SP-1 Solvent Cleaning. Apply etching primer immediately following cleaning.
- I. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- J. Wood Substrates: Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - 1. Sand surfaces that will be exposed to view, and dust off.
 - 2. Prime, stain, or seal wood to be painted. Prime edges, ends, faces, undersides, and back sides of wood, as applicable.
 - 3. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- K. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.
- L. Mildew and Mold Removal: Remove mildew and mold by high power washing (pressure range of 1500 to 4000 psi) with solution of trisodium phosphate and bleach. If substrate is too soft for high power washing, scrub substrate with solution. Rinse with clean water and allow surface to dry.
- M. Protective Coverings: Provide protections for duration of the work, including covering furnishings and decorative items. Protect and mask adjacent finishes and components against damage, marking, overpainting, and injury. Clean and repair or replace damage caused by painting.
- N. Renovated Surfaces: Clean surface free of loose dirt and dust. Except at gypsum board surfaces, remove existing paint and coatings to bare substrate and prepare substrates to receive new paint system. Test substrate to verify it will bond with primer and receive new paint system without failure. If test fails, clean surface to base substrate and apply barrier coat. Retest to verify surface will accept new paint system.
 - 1. Remove surface film preventing proper adhesion and bond.
 - 2. Wash glossy paint with a solution of sal soda and rinse thoroughly.

3. Remove loose, blistered, and defective paint and varnish; smooth edges with sandpaper.
 4. Clean corroded iron and steel surfaces.
 5. Repair and blend into portland cement plaster.
 6. Prime bare surfaces.
 7. Tone varnished surfaces with stain bringing to uniform color.
 8. If existing surfaces cannot be put in acceptable condition for finishing by customary cleaning, sanding, and puttying operations, notify Owner and do not proceed until correcting unsatisfactory conditions.
- O. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair. Sand taped joints and repaired defects smooth.
- P. Plaster/Stucco Substrates: Remove contaminants, release agents, curing compounds, efflorescence, chalk, mold, mildew, and similar deterrents. Spot patch existing plaster to eliminate blisters, buckles, excessive crazing, and to check cracking, dryouts, efflorescence, sweat outs, and similar defects the prevent plaster from bonding with paint or coatings. Sand or texture repair or patch to match adjacent finish and to remove trowel marks and arrises.
1. Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
 2. Deep Cracks: Clean out and fill deep cracks with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
 3. Do not paint surfaces if moisture content or alkalinity of surfaces exceeds that permitted in manufacturer's written instructions. Test for alkali using litmus paper.
 4. Allow patching and repair compounds to set and cure before painting.
- Q. Exterior Insulation and Finish System: Remove oil, grease, and contaminants from acrylic top coat. Fill hairline cracks, small holes, and imperfections.
- R. Pipe Covering and Insulation: Remove loose, foreign, and objectionable material before applying sealing coat.
- S. Barrier Coat: Provide barrier coats over incompatible primers or remove and reprime. Notify Owner in writing of anticipated problems using specified finish coat material over previously coated substrates.
- T. Paint and Coating Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 3. Do not use thinners for water-based paints.
 4. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.
- U. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply compatible sealer or primer.

- V. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- W. Wood and Metal Doors: Seal top and bottom edges with primer.

3.3 APPLICATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
 - 1. The term exposed surfaces includes areas visible when permanent or built in fixtures, grilles, convector covers, covers for finned tube radiation, and similar components are in place. Extend coatings in these areas to maintain system integrity and provide desired protection.
 - 2. Provide finish coats compatible with primers.
 - 3. Use applicators and techniques suited for paint and substrate indicated.
 - 4. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat.
 - 5. Paint exposed surfaces. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces.
 - a. Field painting of exposed surfaces include bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory applied final finish.
 - b. Areas visible when permanent or built in fixtures, grilles, convector covers, covers for finned tube radiation, and similar components are in place.
 - c. Extend coatings in areas, as required, to maintain system integrity and provide desired protection.
 - 6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 - 7. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 8. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 9. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or surface imperfections. Cut in sharp lines and color breaks.
 - 10. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 11. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 12. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
 - 13. Sand lightly between each succeeding enamel or varnish coat.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or substrate conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Minimum Coating Thickness: Apply paint materials to dry film thickness indicated in pain schedule but no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.
1. Measure film thickness on magnetic surfaces by use of Elcometer thickness gauge and on nonmagnetic surfaces by pit gauge or Tooke Gauge.
- F. Application: Apply first coat to surfaces that have been cleaned, pretreated, or prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
 2. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished after removing rust and scale and priming or touching up surface sand if acceptable to topcoat manufacturers.
 3. If undercoats, stains, or conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.
 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried and cured to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.
- G. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
1. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
 2. Prime and paint uninsulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, heat exchangers, tanks, ductwork, conduit, switchgear, and paintable insulation except where items are prefinished.
 3. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
 4. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
 5. Color code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated. Color band and identify with flow arrows, names, and numbering.
 6. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
 7. Concealed Members: Wherever steel and metal parts to receive paint are built into and concealed by construction, paint as specified for exposed parts so finish painting is complete before members are concealed.
 8. Paint the following work where exposed to view:
 - a. Equipment, including panelboards and switch gear.

- b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or paintable jacket material.
9. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.
- H. Items not to Receive Paint: Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
- I. Electrostatic Spray Painting: Apply coating electrostatically to finished surfaces, free from runs, sags, visible overlaps, holidays, craters, pinholes, and other defects detrimental to protective and decorative qualities of coating.
- 1. Thickness of Coatings: 1.5 to 2.0 mils dry film thickness. Measure dry film thickness with magnetic gauge.
 - 2. Use application techniques, equipment, materials, and preparation procedures recommended by manufacturer.
- J. Block Fillers: Apply block fillers to concrete masonry block at rate to ensure complete coverage with pores filled.
- K. Prime Coats: Before applying finish coats, apply prime coat, recommended by manufacturer, to material required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or defects due to insufficient sealing.
- L. Finish Coats: Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance without bleed through.
- 1. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or surface imperfections is not acceptable.
- M. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.
- N. Touch Up: Touch up marred, scraped, and blemished areas of surfaces which were factory primed or previously coated.
- 1. Prepare and touch up scratches, abrasions, and blemishes and remove foreign matter before proceeding with succeeding coats.
 - 2. Touch up marred, scraped, and blemished areas of factory primed or previously coated surfaces.
 - 3. Feather touch up coating overlapping minimum 2 inches onto adjacent unblemished areas producing smooth, uniform surface.

4. As soon after erection and installation as possible, touch up fasteners, welded surfaces and surroundings, field connections, and areas on which shop coat has been abraded or damaged with specified primer before corrosion and other damage occurs from exposure.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. Clean Up: At end of each day, remove rubbish, empty cans, rags, and other discarded materials from site. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- B. Protections: Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.
- D. At completion of painting activities, touch up and restore damaged or defaced painted surfaces.
- E. Provide *Wet Paint* signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work. After related work is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.6 PAINT AND COATING SCHEDULE

- A. Exterior Paint Schedule:
Ferrous Metal: 3 coat system, Eggshell finish
Primer: DFT Maximum 5.0 mils
VOC: 150 g/l
% Solids, Volume: 46%
% Solids, Weight: 61%
First Coat: DFT Maximum 4.0 mils
VOC: 50 g/l.
% Solids, Volume: 42%
% Solids, Weight: 55%
Second Coat: DFT Maximum 4.0 mils
VOC: 50 g/l.
% Solids, Volume: 42%
% Solids, Weight: 55%
Primer: Pro Industrial DTM Acrylic Primer/Finish B66W1

First Coat: Pro Industrial DTM Acrylic B66-1200 Series or Pro Industrial Acrylic B66-660 Series

Second Coat: Pro Industrial DTM Acrylic B66-1200 Series or Pro Industrial Acrylic B66-660 Series

Ferrous Metal: 3 coat system, Semigloss finish

Primer: DFT Maximum 5.0 mils

VOC: 150 g/l

% Solids, Volume: 46%

% Solids, Weight: 61%

First Coat: DFT Minimum 4.0 mils

VOC: 50 g/l.

% Solids, Volume: 40%

% Solids, Weight: 51%

Second Coat: DFT Minimum 4.0 mils

VOC: 50 g/l.

% Solids, Volume: 40%

% Solids, Weight: 51%

Primer: Pro Industrial DTM Acrylic Primer/Finish B66W1

First Coat: Pro Industrial B66-650 Series

Second Coat: Pro Industrial B66-650 Series

Galvanized Metal Trim: 3 coat system, Semigloss finish:

Primer: DFT Maximum 5.0 mils

VOC: 150 g/l

% Solids, Volume: 46%

% Solids, Weight: 61%

First Coat: DFT Minimum 4.0 mils

VOC: 50 g/l.

% Solids, Volume: 40%

% Solids, Weight: 51%

Second Coat: DFT Minimum 4.0 mils

VOC: 50 g/l.

% Solids, Volume: 40%

% Solids, Weight: 51%

Primer: Pro Industrial DTM Acrylic Primer/Finish B66W1

First Coat: Pro Industrial DTM Acrylic B66-1100 Series

Second Coat: Pro Industrial DTM B66-1100 Series

Nonferrous (Aluminum) and Galvanized Metal: 3 coat system, Eggshell Finish:

Primer: DFT Maximum 5.0 mils

VOC: 150 g/l

% Solids, Volume: 46%

% Solids, Weight: 61%

First Coat: DFT Minimum 4.0 mils

VOC: 50 g/l.

% Solids, Volume: 40%

% Solids, Weight: 51%

Second Coat: DFT Minimum 4.0 mils

VOC: 50 g/l.

% Solids, Volume: 40%

% Solids, Weight: 51%

Primer: Pro Industrial DTM Acrylic Primer/Finish B66W1

First Coat: Pro Industrial DTM B66-1200 Series or Pro Industrial Acrylic B66-660 Series

Second Coat: Pro Industrial DTM B66-1200 Series or Pro Industrial Acrylic B66-660 Series

Nonferrous (Aluminum) and Galvanized Metal: 3 coat system, Semigloss Finish:

Primer: DFT Maximum 5.0 mils

VOC: 150 g/l

% Solids, Volume: 46%

% Solids, Weight: 61%

First Coat: DFT Minimum 4.0 mils

VOC: 50 g/l.

% Solids, Volume: 40%

% Solids, Weight: 51%

Second Coat: DFT Minimum 4.0 mils

VOC: 50 g/l.

% Solids, Volume: 40%

% Solids, Weight: 51%

Primer: Pro Industrial DTM Acrylic Primer/Finish B66W1

First Coat: Pro Industrial DTM B66-1100 Series

Second Coat: Pro Industrial DTM B66-1100 Series

Plaster (Stucco), Cementitious Surface: 3 Coat System, Eggshell Finish:

Primer: DFT Minimum 3.2 mils

VOC: 50 g/l

% Solids, Volume: 41%

% Solids, Weight: 55%

First Coat: DFT Minimum 4.0 mils

VOC: 50 g/l.

% Solids, Volume: 40%

% Solids, Weight: 51%

Second Coat: DFT Minimum 4.0 mils

VOC: 50 g/l.

% Solids, Volume: 40%

% Solids, Weight: 51%

Primer: Loxon Concrete and Masonry Primer/Sealer A24W8300 Series

First Coat: Pro Industrial Acrylic B66-660 Series

Second Coat: Pro Industrial Acrylic B66-660 Series

Plaster (Stucco), Cementitious Surface: 3 Coat System, Semigloss:

Primer: DFT Minimum 3.2 mils

VOC: 50 g/l

% Solids, Volume: 41%

% Solids, Weight: 55%

First Coat: DFT Minimum 4.0 mils

VOC: 50 g/l.

% Solids, Volume: 35%

% Solids, Weight: 45%

Second Coat: DFT Minimum 4.0 mils

VOC: 50 g/l.

% Solids, Volume: 35%

% Solids, Weight: 45%

Primer: Loxon Concrete and Masonry Primer/Sealer A24W8300 Series

First Coat: Pro Industrial Acrylic Semigloss B66-650

Second Coat: Pro Industrial Acrylic Semigloss B66-650

Masonry, CMU: 3 Coat System, Eggshell Finish:

Block Filler: DFT Minimum 18 mils

VOC: 50 g/l

% Solids, Volume: 53%

% Solids, Weight: 73%

Primer: DFT Minimum 3.2 mils

VOC: 50 g/l

% Solids, Volume: 41%

% Solids, Weight: 55%

First Coat: DFT Minimum 4.0 mils

VOC: 50 g/l.

% Solids, Volume: 35%

% Solids, Weight: 45%

Second Coat: DFT Minimum 4.0 mils

VOC: 50 g/l.

% Solids, Volume: 35%

% Solids, Weight: 45%

Block Filler: Heavy Duty Block Filler B42W46 Series

Primer: Loxon Concrete and Masonry Primer/Sealer A24W8300 Series

First Coat: Pro Industrial Acrylic B66-660 Series

Second Coat: Pro Industrial Acrylic B66-660 Series

Masonry, CMU: 3 Coat System, Semigloss:

Block Filler: DFT Minimum 18 mils

VOC: 50 g/l

% Solids, Volume: 53%

% Solids, Weight: 73%

Primer: DFT Minimum 3.2 mils

VOC: 50 g/l

% Solids, Volume: 41%

% Solids, Weight: 55%

First Coat: DFT Minimum 4.0 mils

VOC: 50 g/l.

% Solids, Volume: 35%

% Solids, Weight: 45%

Second Coat: DFT Minimum 4.0 mils

VOC: 50 g/l.

% Solids, Volume: 35%

% Solids, Weight: 45%

Block Filler: Heavy Duty Block Filler B42W46 Series

Primer: Loxon Concrete and Masonry Primer/Sealer A24W8300 Series

First Coat: Pro Industrial Acrylic Semigloss B66-650

Second Coat: Pro Industrial Acrylic Semigloss B66-650

Exterior Insulation and Finish System, Acrylic Coating: 3 Coat System, Semigloss:

Block Filler: DFT Minimum 18 mils

VOC: 50 g/l
% Solids, Volume: 53%
% Solids, Weight: 73%
Primer: DFT Minimum 3.2 mils
VOC: 50 g/l
% Solids, Volume: 41%
% Solids, Weight: 55%
First Coat: DFT Minimum 4.0 mils
VOC: 50 g/l.
% Solids, Volume: 35%
% Solids, Weight: 45%
Second Coat: DFT Minimum 4.0 mils
VOC: 50 g/l.
% Solids, Volume: 35%
% Solids, Weight: 45%
Primer: Loxon Concrete and Masonry Primer/Sealer A24W8300 Series
First Coat: Pro Industrial Acrylic Semigloss B66-650
Second Coat: Pro Industrial Acrylic Semigloss B66-650

Wood, Plywood, Siding, Trim: 3 Coat System, Semigloss:

Primer: DFT Minimum 1.4 mils
VOC: 77 g/l
% Solids, Volume: 36%
% Solids, Weight: 52%
First Coat: DFT Minimum 4.0 mils
VOC: 50 g/l.
% Solids, Volume: 35%
% Solids, Weight: 45%
Second Coat: DFT Minimum 4.0 mils
VOC: 50 g/l.
% Solids, Volume: 35%
% Solids, Weight: 45%
Primer: Exterior Latex Primer B42 series
First Coat: Pro Industrial Acrylic Semigloss B66-650
Second Coat: Pro Industrial Acrylic Semigloss B66-650

Plywood: 3 Coat System, Semigloss:

Primer: DFT Minimum 1.4 mils
VOC: 77 g/l
% Solids, Volume: 36%
% Solids, Weight: 52%
First Coat: DFT Minimum 4.0 mils
VOC: 50 g/l.
% Solids, Volume: 40%
% Solids, Weight: 51%
Second Coat: DFT Minimum 4.0 mils
VOC: 50 g/l.
% Solids, Volume: 40%
% Solids, Weight: 51%
Primer: Exterior Latex Primer B42 series
First Coat: Pro Industrial Acrylic B66-660 Series

Second Coat: Pro Industrial Acrylic B66-660 Series

END OF SECTION

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: surface preparation and the application of paint systems on interior substrates.
1. Concrete.
 2. Concrete masonry units (CMUs).
 3. Steel.
 4. Galvanized metal.
 5. Aluminum (not anodized or otherwise coated).
 6. Wood.
 7. Gypsum board.
 8. ASJ insulation covering.

1.2 DEFINITIONS

- A. Standard coating terms defined in ASTM D 16 apply.
- B. Gloss Factors: Values of various degrees of luster when tested in accordance with ASTM D 523 shall comply with following:
1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85 degrees meter.
 2. Eggshell refers to low sheen finish with a gloss range between 20 and 35 when measured at a 60 degrees meter.
 3. Semigloss refers to medium sheen finish with a gloss range between 35 and 70 when measured at a 60 degrees meter.
 4. Full gloss refers to high sheen finish with a gloss range more than 70 when measured at a 60 degrees meter.

1.3 ACTION SUBMITTALS

- A. Product Data: Technical data and product information for block fillers, primers, paints, and coatings, including label analysis and instructions for handling, storing, surface preparation, and application for each paint and coating system.
1. For field painting of factory primed metal products and fabrications, submit technical data for each type of paint product, surface preparation requirements, and application instructions.
 2. Indicate manufacturer's instructions for special surface preparation procedures and substrate conditions requiring special attention.
 3. Product List: Provide inclusive list of required coating materials. Indicate each material and cross reference specific coatings, finish system, and application. Identify each material by manufacturer's catalog number, series, and general classification. Use same designations indicated in Finish Schedules.
- B. Samples: Submit aged (minimum seven day old) paint samples for each type of paint system and each color and gloss of topcoat.

1. Provide stepped samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
 2. Provide list of material and application for each coat of each sample. Label each sample as to location and application.
 3. Submit samples on substrates for review of color and texture:
 - a. Concrete: Two 4 inch (50 mm) square samples for each color and finish.
 - b. Concrete Masonry: Two 4 inch by 8-inch (100 mm by 200 mm) samples of masonry, with mortar joint in the center, for each finish and color.
 - c. Painted Wood: Two 12 inch (305 mm) square samples of each color and material on hardboard.
 - d. Ferrous and Nonferrous Metals: Two 4 inch (100 mm) square samples of flat metal and two 8 inch (200 mm) long samples of solid metal for each color and finish.
- C. Product List: Cross reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 INFORMATIONAL SUBMITTALS

- A. Quality Control Submittals: Furnish certificates from manufacturer that products supplied comply with VOC content limits and emission in accordance with local, state, and federal regulations and sustainability limit requirements.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with Federal and local toxicity and air quality regulations and with Federal requirements on content of for heavy metals including but not limited to: lead and mercury. Do not use solvents in paint products that contribute to air pollution.
- B. Applicator Qualifications: Entity having minimum 5 years documented experience in applying paints and coatings similar in material, design, and extent to those indicated.
- C. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.
- D. Coordination of Work: Coordinate field finishing of shop primed metals are provided to ensure compatibility of total systems for various substrates.
- E. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Container Labels: Include manufacturer's name, type of paint, brand name, lot number and date of manufacturer, brand code, coverage rate, surface preparation, instructions for mixing and reducing drying time, cleanup requirements, color designation, and application instructions.
- B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F (7 degrees C).
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Do not thin or add water to water-based paints, including water-based alkyds.
- B. Weather Conditions:
 1. Apply paints when temperature of surfaces to be painted and ambient air temperatures are between 50 degrees F and 95 degrees F (10 degrees C and 35 degrees C).
 2. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.
 3. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (35 degrees C) for exterior, unless otherwise indicated by manufacturer's Product Data Sheet.
- C. Apply solvent thinned paints when temperatures of surfaces to receive paint and surrounding air are between 45 degrees F. and 95 degrees F (7 degrees F and 35 degrees C).
 1. Minimum Application Temperature for Varnish Finishes: 65 degrees F (18 degrees C) for interior or exterior, unless required otherwise by manufacturer's instructions.
- D. Painting may continue during inclement weather if surfaces and areas to receive paint and coatings are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.
- E. Provide lighting level of 80-foot candles (860 lx) measured mid-height at substrate surface.
- F. Labels: Do not paint over Underwriters Laboratories, Factory Mutual, other code required labels, or equipment name, identification, performance rating, or nomenclature plates.

1.8 EXTRA MATERIALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Provide two one-gallon containers of each color, type, and surface texture.
 2. In addition to manufacturer's label, identify each container with color, type, texture, and room location.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Performance and Durability:
1. ASTM D 16 Standard Test Method for Load Testing Refractory Shapes at High Temperatures.
 2. ASTM D 2486 Standard Test Method for Scrub Resistance of Interior Wall Paint.
 3. ASTM D 2805 Standard Test Method for Hiding Power of Paints by Reflectometry.
 4. ASTM D 4828 Standard Test Method for Practical Washability of Organic Coatings.
- B. Chemical Components of Field Applied Interior Paints and Coatings: Provide topcoat paints and anticorrosive and antirust paints applied to ferrous metals that comply with chemical restrictions; these requirements do not apply to paints and coatings applied in a fabrication or finishing shop:
1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 2. Restricted Components: Paints and coatings shall not contain components restricted by the EPA; which may include, but not be limited to, the following:
 - a. Acrolein.
 - b. Acrylonitrile.
 - c. Antimony.
 - d. Benzene.
 - e. Butyl benzyl phthalate.
 - f. Cadmium.
 - g. Di (2-ethylhexyl) phthalate.
 - h. Di-n-butyl phthalate.
 - i. Di-n-octyl phthalate.
 - j. 1,2-dichlorobenzene.
 - k. Diethyl phthalate.
 - l. Dimethyl phthalate.
 - m. Ethylbenzene.
 - n. Formaldehyde.
 - o. Hexavalent chromium.
 - p. Isophorone.
 - q. Lead.
 - r. Mercury.
 - s. Methyl ethyl ketone.
 - t. Methyl isobutyl ketone.
 - u. Methylene chloride.
 - v. Naphthalene.
 - w. Toluene (methylbenzene).
 - x. 1,1,1-trichloroethane.
 - y. Vinyl chloride.
- C. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 50 g/L.
 3. Dry-Fog Coatings: 150 g/L.

4. Primers, Sealers, and Undercoaters: 100 g/L.
5. Rust-Preventive Coatings: 100 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Shellacs, Clear: 730 g/L.
9. Shellacs, Pigmented: 550 g/L.

2.2 MATERIALS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide specified commercial and industrial product by Sherwin-Williams Company (The); or a comparable product by one of the following:
 1. Benjamin Moore & Co.
 2. Devco High Performance Coatings.
 3. Kelly-Moore Paint Company Inc.
 4. PPG Paints.
 5. Dunn-Edwards Corporation.
 6. Vista Paint Corporation.
- B. Note: Residential paint products are not permitted.
- C. Material Compatibility:
 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- D. Accessories: Linseed oil, shellac, turpentine, paint thinners, and similar materials not specifically indicated but necessary to achieve the finishes specified for commercial quality.
- E. Patching Materials: Latex filler compatible with paint systems.
- F. Fastener Head Cover Materials: Latex filler.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Fiber Cement Board: 12 percent.
 - 3. Masonry (Clay and CMUs): 12 percent.
 - 4. Wood: 15 percent.
 - 5. Gypsum Board: 12 percent.
 - 6. Plaster: 12 percent.
- C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
- D. Gypsum Board Substrates: Verify joints are properly taped and finishing compound is sanded smooth.
- E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
 - 1. Verify previously painted surfaces can be stripped to bare substrate, repaired if necessary, and prepared to receive new paint or coating system consisting of primer and two top coats at a minimum.
 - a. Note: When previously painted surfaces have failed to accept new paint systems, determine cause of failure and take corrective measures to ensure each surface accepts new paint or coating system. Failure of new paint system is not permitted.
 - 2. Shop Primed Metals: Inspect shop primed metals to determine if primer is in condition to receive and is compatible with topcoats.
- F. Commence paint and coating application after correcting unsatisfactory conditions and surfaces are dry. Application of coating indicates applicator's acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
- B. Coordination of Work:
 - 1. Pre-primed Substrates: Inspect existing conditions in which primers are factory applied to ensure compatibility of the total system for each substrate. Notify Architect of anticipated problems when using the materials specified over factory primed or pre-primed substrates.
 - 2. Existing Painted Surfaces: Inspect previously painted surfaces to ensure compatibility of the existing paints with new paint system for each substrate. Notify Architect of anticipated problems.
 - 3. Correct defects and clean surfaces affecting bond with paint system. Remove existing paints exhibiting loose surface defects showing signs of rust, scale, or delamination.
 - 4. Seal marks which may bleed through surface finishes.
 - 5. Touch up shop primer or previously painted surfaces prior to application of topcoats.

6. Hollow metal shop primer is not an acceptable paint primer. Hollow metal shall be primed per this Section.
- C. Surface Cleaning and Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each substrate condition. Provide barrier coats over incompatible primers or remove and reprime. If removal is impractical or impossible because of size or weight of item, provide surface applied protection before surface preparation and painting
1. Before applying paint or surface treatments, clean substrates of substances that impair bond of the various coatings. Remove oil and grease before cleaning. Schedule cleaning and painting so dust and contaminants from the cleaning process will not fall on wet, newly painted surfaces.
 2. Remove hardware, covers, plates, and similar items in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface applied protection before surface preparation and painting.
 - a. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface applied protection.
 3. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
 4. Seal marks which may bleed through surface finishes with shellac.
 5. Provide barrier coats over incompatible primers or remove and reprime.
 6. Correct defects and clean surfaces which affect the work.
 7. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- D. Cementitious Substrates: Remove release agents, curing compounds, efflorescence, chalk, dust, dirt, grease, oils, release agents, mold, mildew, and existing paint. Roughen as necessary to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
1. Use abrasive blast cleaning methods if recommended by paint manufacturer.
 2. Do not paint surfaces if moisture content or alkalinity of surfaces exceeds that permitted in manufacturer's written instructions.
 - a. Determine alkalinity and moisture content of surfaces by performing appropriate pH testing. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct condition prior to application of paint.
 - b. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m).
 - c. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation after substrates have obtained percent relative humidity level recommended by paint manufacturer.
 - d. Perform additional moisture tests when recommended by manufacturer. Proceed with installation when moisture content complies with that permitted in manufacturer's written instructions.
 - e. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to thoroughly dry.
 3. Clean concrete floors to receive paint or coating with a 5 percent solution of muriatic acid or etching cleaner. Flush floors with clean water to remove acid; neutralize with ammonia, rinse, allow to dry; vacuum before painting.

- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Ferrous Metals: Remove rust, loose mill scale, and shop primer. Clean ungalvanized ferrous metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.
 - 1. SSPC-SP 6/NACE No. 3: Blast steel surfaces clean as recommended by paint system manufacturer.
- G. Shop Primed Ferrous Metal Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop primed surfaces.
 - 1. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
 - 2. Touch up bare areas and damaged shop applied prime coats. Wire brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.
- H. Galvanized Ferrous Metal Substrates: Clean galvanized surfaces with nonpetroleum based solvents leaving surface free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove surface oxidation with acid etch and solvent washing. Remove oil, grease, surface oxidation, and contaminants in accordance with SSPC SP-1 Solvent Cleaning. Apply etching primer immediately following cleaning.
- J. Wood Substrates:
 - 1. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime, stain, or seal wood to be painted. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
 - 4. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
 - 5. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- K. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.
- L. Protective Coverings: Provide protections for duration of the work, including covering furnishings and decorative items. Protect and mask adjacent finishes and components against damage, marking, overpainting, and injury. Clean and repair or replace damage caused by painting.
- M. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

- N. Plaster/Stucco Substrates: Remove contaminants, release agents, curing compounds, efflorescence, chalk, mold, mildew, and similar deterrents. Spot patch existing plaster to eliminate blisters, buckles, excessive crazing, and to check cracking, dryouts, efflorescence, sweat outs, and similar defects to prevent plaster from bonding with paint or coatings. Sand or texture repair or patch to match adjacent finish and to remove trowel marks and arrises.
1. Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
 2. Deep Cracks: Clean out and fill deep cracks with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
 3. Do not paint surfaces if moisture content or alkalinity of surfaces exceeds that permitted in manufacturer's written instructions. Test for alkali using litmus paper.
 4. Allow patching and repair compounds to set and cure before painting.
- O. Pipe Covering and Insulation: Remove loose, foreign, and objectionable material before applying sealing coat.
- P. Preparation of Substrates for Wallcovering: Prime and seal substrate with release coat in accordance with wallcovering manufacturer's recommendations for substrate.
1. Assure compatibility with product of wall covering manufacturer.
 2. Fill indentations in substrate and prime with opaque white primer before applying release coat.
 3. Apply release coat in accordance with manufacturer's recommendations.
- Q. Barrier Coat: Provide barrier coats over incompatible primers or remove and reprime. Notify Owner in writing of anticipated problems using specified finish coat material over previously coated substrates.
- R. Paint and Coating Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 3. Do not use thinners for water-based paints.
 4. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.
- S. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- T. Wood and Metal Doors: Seal top and bottom edges with primer.

3.3 APPLICATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
1. The term exposed surfaces includes areas visible when permanent or built in fixtures, grilles, convactor covers, covers for finned tube radiation, and similar components are in

- place. Extend coatings in these areas to maintain system integrity and provide desired protection.
2. Provide finish coats compatible with primers.
 3. Use applicators and techniques suited for paint and substrate indicated.
 4. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 5. Paint exposed surfaces. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces.
 - a. Field painting of exposed surfaces include bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory applied final finish.
 - b. Areas visible when permanent or built in fixtures, grilles, convector covers, covers for finned tube radiation, and similar components are in place.
 - c. Extend coatings in areas, as required, to maintain system integrity and provide desired protection.
 - d. Finish doors on tops, bottoms, and side edges the same as exterior faces.
 6. Paint interior surfaces of ducts with a flat, non-specular black paint where visible through registers or grilles.
 7. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 8. rating, or nomenclature plates.
 9. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or surface imperfections. Cut in sharp lines and color breaks.
 10. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 11. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 12. Sand lightly between each succeeding enamel or varnish coat.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Minimum Coating Thickness: Apply paint materials to dry film thickness indicated in paint schedule but no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.
 1. Measure film thickness on magnetic surfaces by use of Elcometer thickness gauge and on nonmagnetic surfaces by pit gauge or Tooke Gauge.
- F. Application: Apply first coat to surfaces that have been cleaned, pretreated, or prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
 2. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished after removing rust and scale and priming or touching up surface sand if acceptable to topcoat manufacturers.
 3. If undercoats, stains, or conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.
 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried and cured to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.
- G. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
1. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
 2. Prime and paint uninsulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, heat exchangers, tanks, ductwork, conduit, switchgear, and paintable insulation except where items are prefinished.
 3. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
 4. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
 5. Color code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated. Color band and identify with flow arrows, names, and numbering.
 6. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
 7. Concealed Members: Wherever steel and metal parts to receive paint are built into and concealed by construction, paint as specified for exposed parts so finish painting is complete before members are concealed.
 8. Paint the following work where exposed to view:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or paintable jacket material.
 9. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.

- d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
10. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.
- H. Items not to Receive Paint: Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
- I. Electrostatic Spray Painting: Apply coating electrostatically to finished surfaces, free from runs, sags, visible overlaps, holidays, craters, pinholes and other defects detrimental to protective and decorative qualities of coating.
1. Thickness of Coatings: 1.5 to 2.0 mils dry film thickness. Measure dry film thickness with magnetic gauge.
 2. Use application techniques, equipment, materials, and preparation procedures recommended by manufacturer.
- J. Block Fillers: Apply block fillers to concrete masonry block at rate to ensure complete coverage with pores filled.
- K. Prime Coats: Before applying finish coats, apply prime coat, recommended by manufacturer, to material required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or defects due to insufficient sealing.
1. Provide prime coat, by this Section, over hollow metal door and frame factory primer.
- L. Finish Coats: Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance without bleed through.
1. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or surface imperfections is not acceptable.
 2. Transparent (Clear) Finishes: Use multiple coats to produce glass smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections. Provide satin finish for final coats.
- M. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.
- N. Touch Up: Touch up marred, scraped, and blemished areas of surfaces which were factory primed or previously coated.
1. Prepare and touch up scratches, abrasions, and blemishes and remove foreign matter before proceeding with succeeding coats.
 2. Touch up marred, scraped, and blemished areas of factory primed or previously coated surfaces.

3. Feather touch up coating overlapping minimum 2 inches onto adjacent unblemished areas producing smooth, uniform surface.
4. As soon after erection and installation as possible, touch up fasteners, welded surfaces and surroundings, field connections, and areas on which shop coat has been abraded or damaged with specified primer before corrosion and other damage occurs from exposure.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. Clean Up: At end of each day, remove rubbish, empty cans, rags, and other discarded materials from site. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- B. Protections: Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.
- D. At completion of painting activities, touch up and restore damaged or defaced painted surfaces.
- E. Provide *Wet Paint* signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work. After related work is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.6 INTERIOR PAINT AND COATING SCHEDULE

- A. Concrete and Masonry (Other than Concrete Masonry Units):
 1. Finish: Semi-Gloss latex enamel; primer and two finish coats.
 2. Primer:
 - a. S-W: ProMar 200 Zero VOC Interior Latex Primer B28W2600 (0 g/L VOC), 1.5 mils dft minimum.
 - b. KM: 971 Acry-Plex Low VOC Interior PVA Primer/Sealer (2 g/L VOC) 1.5-2.0 mils dft.
 - c. Moore: Super Spec Masonry 100% Acrylic Primer, N066, 1.0 mils dft.
 - d. PPG: 4-603 Perma-Crete Interior/Exterior Alkali Resistant Primers (86 g/L VOC), 1.2 – 1.5 mils dft.
 3. Finish Coats:
 - a. S-W: ProMar 400 Interior Zero VOC Latex Semi-Gloss Enamel B31-4600 (<50 g/L VOC), 1.3 mils dft/coat minimum.

- b. KM1050 KM Premium Professional Low VOC Interior Acrylic Semi-Gloss Enamel (2 g/L VOC) 1.2-2.5 mils dft/coat
 - c. Moore: Ultra Spec 500 Interior Latex Semi-Gloss Finish, 0 VOC, N539, 1.8 mils dft.
 - d. PPG: 6-500 Series Speedhide Interior Semi-Gloss Acrylic Latex (42 g/L VOC), 1.4 mils dft/coat minimum.
- B. Concrete and Masonry (Other than Concrete Masonry Units):
- 1. Finish: Satin latex enamel; primer and two finish coats.
 - 2. Primer:
 - a. KM: 971 Acry-Plex Low VOC Interior PVA Primer/Sealer (2 g/L VOC) 1.5-2.0 mils dft
 - b. Moore: Super Spec Masonry 100% Acrylic Primer, N066, 1.0 mils dft.
 - c. PPG: 4-603 Perma-Crete Interior/Exterior Alkali Resistant Primers (86 g/L VOV), 1.2 – 1/5 mils dft.
 - d. S-W: ProMar 200 Zero VOC Interior Latex Primer B28W2600 (0 g/L VOC), 1.5 mils dft minimum.
 - 3. Finish Coats:
 - a. KM1010 KM Premium Professional Low VOC Interior Eggshell Enamel (2 g/L VOC) 1.2-2.5 mils dft/coat.
 - b. Moore: Ultra Spec 500 Interior Eggshell Finish, N538, 0 VOC, 1.8 mils dft
 - c. PPG: 6-411 Series Speedhide Interior Enamel Eggshell Latex (44 g/L VOC), 1.5 – 1.7 mils dft/coat minimum.
 - d. S-W: ProMar 400 Interior Zero VOC Latex Eg-Shel B20-4600 (<50 g/L VOC), 1.3 mils dft/coat minimum.
- C. Concrete Floors (Paint Coatings)
- 1. Finish: Acrylic Satin; primer and two finish coats,
 - 2. Primer:
 - a. S-W: Per Manufacturer’s recommendations.
 - 3. Finish Coats:
 - a. S-W: ArmorSeal 8100 Water Based Epoxy Floor Coating B70V8100 Series (<50 g/L VOC), 2.0 – 5.0 mils dft/coat.
- D. Concrete Masonry Units (Block Filler):
- 1. Finish: Semi-gloss latex enamel; block filler and two finish coats.
 - 2. Block Filler:
 - a. KM: 521 Fill & Prime Acrylic Block Filler (50 g/L VOC) 9.3-11.6 mils dft.
 - b. Moore: Super Spec Masonry Interior/ Exterior Hi- Build Block Filler, 206, 8.5-11.4 mils dft.
 - c. PPG: 6-15 Speedhide Interior/Exterior Acrylic Masonry Block Filler (48 g/L VOC), 7.20 – 14.40 mils dft.
 - d. S-W: B42W150 Pro Industrial Heavy-Duty Block Filler (100 g/L VOC), 10.5 mils dft minimum. [B25W25 Series PrepRite Block Filler (45 g/L VOC), 8.0 mils dft minimum.]
 - 3. Finish Coats:
 - a. KM1050 KM Premium Professional Low VOC Interior Semi-Gloss Enamel. (<2 g/L VOC) 1.2-2.5 mils dft/coat.
 - b. Moore: Ultra Spec 500 Latex Interior Semi- Gloss Finish, 0 VOC, N539, 1.8 mils dft/coat

- c. PPG: 6-500 Series Speedhide Interior Semi-Gloss Acrylic Latex (42 g/L VOC), 1.4 mils dft/coat minimum.
 - d. S-W: ProMar 400 Interior Zero VOC Latex Semi-Gloss Enamel B31-4600 (<50 g/L VOC), 1.3 mils dft/coat minimum.
- E. Concrete Masonry Units (Block Filler):
 1. Finish: Satin latex enamel; block filler and two finish coats.
 2. Block Filler:
 - a. KM: 521 Fill & Prime Acrylic Block Filler (50 g/L VOC) 9.3-11.6 mils dft.
 - b. Moore: Super Spec Masonry Interior/ Exterior Hi- Build Block Filler, 206, 8.5-11.4 mils dft.
 - c. PPG: 6-15 Speedhide Interior/Exterior Acrylic Masonry Block Filler (48 g/L VOC), 7.20 – 14.40 mils dft.
 - d. S-W: B42W150, Pro Industrial Heavy-Duty Block Filler (100 g/L VOC), 10.5 mils dft minimum.
 3. Finish Coats:
 - a. KM1010 KM Premium Professional Low VOC Interior Eggshell Enamel (<2 g/L VOC) 1.2-2.5 mils dft/coat
 - b. Moore: Ultra Spec 500 Interior Latex Eggshell Finish, 0 VOC, N538, 1.8 mils dft/coat.
 - c. PPG: 6-411 Series Speedhide Interior Enamel Eggshell Latex (44 g/L VOC), 1.5 – 1.7 mils dft/coat minimum.
 - d. S-W: ProMar 400 Interior Zero VOC Latex Eg-Shel B20-4600 (<50 g/L VOC), 1.3 mils dft/coat minimum.
- F. Concrete Masonry Units (Primer):
 1. Finish: Semi-gloss latex enamel; primer and two finish.
 2. Primer:
 - a. KM: 971 Acry-Plex Low VOC Interior PVA Primer/Sealer (2 g/L VOC) 1.5 - 2.0 mils dft.
 - b. Moore: Sure Seal Latex Primer Sealer, 027, 1.3 mils dft.
 - c. PPG: 4-603 Perma-Crete Interior/Exterior Alkali Resistant Primer (86 g/L VOC, 1.2 – 1.5 mils dft.
 - d. S-W: Loxon Concrete Acrylic Primer A24W8300 (<50 g/L VOC), 3.2 mils dft minimum.
 3. Finish Coats:
 - a. KM1050 KM Premium Professional Low VOC Interior Semi-Gloss Enamel (2 g/L VOC) 1.2-2.5 mils dft /coat {KM495 Magnum Interior Latex Semi-Gloss (<50 g/L VOC) 1.6-2.3 mils dft}.
 - b. Moore: Ultra Spec 500 Interior Latex Eggshell Finish, 0 VOC, N538, 1.8 mils dft/coat.
 - c. PPG: 6-500 Series Speedhide Interior Semi-Gloss Acrylic Latex (42 g/L VOC), 1.4 mils dft/coat minimum.
 - d. S-W: ProMar 400 Interior Zero VOC Latex Semi-Gloss Enamel B31-4600 (<50 g/L VOC), 1.3 mils dft/coat minimum.
- G. Concrete Masonry Units (Primer):
 1. Finish: Satin latex enamel; primer and two finish.
 2. Primer:
 - a. KM: 971 Acry-Plex VOC Interior PVA Primer/Sealer (2 g/L VOC) 1.5 - 2.0 mils dft minimum.

- b. Moore: Sure Seal Latex Primer Sealer, 027, 1.3 mils dft.
 - c. PPG4-603 Perma-Crete Interior/Exterior Alkali Resistant Primer (86 g/L VOC0, 1.2 – 1.5 mils dft minimum.
 - d. S-W: Loxon Concrete Acrylic Primer LX2W50 (<50 g/L VOC), 3.2 mils dft minimum.
3. Finish Coats:
- a. KM1010 KM Premium Professional Low VOC Interior Eggshell Enamel (2 g/L VOC) 1.2-2.5 mils dft/coat.
 - b. Moore: Ultra Spec 500 Interior Latex Eggshell Finish, 0 VOC, N538, 1.8 mils dft/coat.
 - c. PPG: 6-411 Series Speedhide Interior Enamel Eggshell Latex (44g/L VOC), 1.5-1.7 mils dft/coat minimum.
 - d. S-W: ProMar 400 Interior Zero VOC Latex Eg-Shel B20-4600 (<50 g/L VOC), 1.3 mils dft/coat minimum.
- H. Cotton or Canvas Covering over Insulation:
- 1. Finish: Interior, flat, latex-based paint.
 - a. KM1005 KM Premium Professional Low VOC Interior Acrylic Flat Wall Paint (<2 g/L VOC) 1.2-2.5 mils dft
 - b. Moore: Ultra Spec 500 Interior Latex Primer, 0 VOC, N534, 1.8 mils dft/coat minimum.
 - c. PPG: 6-4110XI Speedhide zero Interior Flat Latex (0 g/L VOC), 1.8 mils dft/coat minimum.
 - d. S-W: ProMar 200 Zero VOC Interior Flat Paint B30-2600 (0 G/L VOC), 1.6 mils dft/coat minimum.
- I. Gypsum Board:
- 1. Finish: Lusterless (flat) latex; primer and two finish coats.
 - 2. Primer: NO SUBSTITUTIONS.
 - a. KM: 971 Acry-Plex Low VOC Interior PVA Primer/Sealer (2 g/L VOC), 2.0 mils dft minimum.
 - b. Moore: Ultra Spec 500 Waterborne Interior Primer Sealer N534, (0 g/L VOC), 1.8 mils dft minimum.
 - c. PPG: Speedhide Interior Latex Primer Sealer 6-2, (less than50 g/L VOC), 1.0 mils dft minimum.
 - d. S-W: ProMar 200 Zero VOC Interior Latex Primer B28W2600 (0 G/L VOC), 1.5 mils dft minimum.
 - 3. Finish Coats:
 - a. KM1005 KM Premium Professional Low VOC Interior Acrylic Flat Wall Paint (<2 g/L VOC) 1.5-2.5 mils dft
 - b. Moore: Ultra Spec 500 Interior Latex Flat Finish, N536, 11.8 mils dft/coat minimum.
 - c. PPG: 6-4110XI Speedhide zero Interior Flat Latex (0 g/L VOC), 1.8 mils dft/coat minimum.
 - d. S-W: ProMar 200 Zero VOC Interior Flat Paint B30-2600 (0 G/L VOC), 1.6 mils dft/coat minimum.
 - 4. Location: CEILINGS ONLY.
- J. Gypsum Board and Glass Reinforced Gypsum:
- 1. Finish: Semi-Gloss latex enamel; primer and two finish coats.
 - 2. Primer: NO SUBSTITUTIONS.

- a. KM: 971 Acry-Plex Interior Low VOC PVA Primer/Sealer (2 g/L VOC), 2.0 mils dft minimum.
 - b. Moore: Ultra Spec 500 Waterborne Interior Primer Sealer N534, (0 g/L VOC), 1.8 mils dft minimum.
 - c. PPG: Speedhide Interior Latex Primer Sealer 6-2, (less than 50 g/L VOC), 1.0 mils dft minimum.
 - d. S-W: ProMar 200 Zero VOC Interior Latex Primer B28W2600 (0 G/L VOC), 1.5 mils dft minimum.
3. Finish Coats:
- a. KM1050 KM Premium Professional Low VOC Interior Acrylic Semi-Gloss Enamel (<2 g/L VOC) 1.2-2.5 mils dft/coat.
 - b. Moore: Ultra Spec 500 Latex Interior Semi-Gloss Finish, 0 VOC, N539, 1.8 mils dft/coat minimum.
 - c. PPG: 6-500 Series Speedhide Interior Semi-Gloss Acrylic Latex (42 g/L VOC), 1.4 mils dft/coat minimum.
 - d. S-W: ProMar 400 Interior Zero VOC Latex Semi-Gloss Enamel B30-4600 (<50 g/L VOC), 1.3 mils dft/coat minimum.
- K. Gypsum Board and Glass Reinforced Gypsum:
1. Finish: Satin latex enamel; primer and two finish coats.
 2. Primer: NO SUBSTITUTIONS
 - a. KM: 971 Acry-Plex Low VOC Interior PVA Primer/Sealer (2 g/L VOC), 2.0 mils dft minimum.
 - b. Moore: Ultra Spec 500 Waterborne Interior Primer Sealer N534, (0 g/L VOC), 1.8 mils dft minimum.
 - c. PPG: Speedhide Interior Latex Primer Sealer 6-2, (less than 50 g/L VOC), 1.0 mils dft minimum.
 - d. S-W: ProMar 200 Zero VOC Interior Latex Primer B28W2600 (0 G/L VOC), 1.5 mils dft minimum.
 3. Finish Coats:
 - a. KM1010 KM Premium Professional Low VOC Interior Eggshell Enamel (<2 g/L VOC) 1.2-2.5 dft mils { KM492 Magnum Interior Eggshell Enamel (50 g/L VOC) 1.6 -2.4 mils dft }
 - b. Moore: Ultra Spec 500 Latex Interior Eggshell Finish, 0 VOC, N538, 1.8 mils dft/coat.
 - c. PPG: 6-411 Series Speedhide Interior Enamel Eggshell Latex (44 g/L VOC), 1.5 – 1.7 mils dft/coat minimum.
 - d. S-W: ProMar 400 Interior Zero VOC Latex Eg-Shel B20-4600 (<50 g/L VOC), 1.3 mils dft/coat minimum.
- L. Ferrous Metal:
1. Finish: Semi-Gloss latex enamel; primer and two finish coats.
 2. Primer:
 - a. Devco Coatings Devflex 4020PF DTM Primer & Finish (75 g/L VOC), 2.2 – 3.5 mils dft.
 - b. KM: 5725 DTM Acrylic Metal Primer (100 g/L VOC) 1.5 - 2.0 mils dft.
 - c. Moore: Super Spec HP Acrylic DTM Enamel, Semi-Gloss, P29, 1.5- 2.5 mils dft minimum.
 - d. PPG: 90-712 Series Pitt-Tech Interior/Exterior Primer/Finish DTM Industrial Enamel (123 g/L VOC), 2.0 – 3.0 mils dft.

- e. S-W: Pro Industrial Pro-Cryl Universal Acrylic Primer B66-310 (less than 100 g/L VOC), 2.0 – 4.0 mils dft.
 3. Finish Coats:
 - a. Devoe Coatings Devflex 4216HP Acrylic Semi-Gloss Enamel (less than 100 g/L VOC), 1.5 – 4.0 mils. dft/coat minimum.
 - b. KM1050 KM Premium Professional Low VOC Interior Acrylic Semi-Gloss Enamel (<2 g/L VOC) 1.5-2.5 dft mils.
 - c. Moore: Super Spec HP Acrylic DTM, Semi-Gloss, P29, 1.5- 2.5 mils dft minimum
 - d. PPG: 6-500 Series Speedhide Interior Semi-Gloss Acrylic Latex (42 g/L VOC), 1.4 mils dft/coat minimum.
 - e. S-W: ProMar 400 Interior Zero VOC Latex Semi-Gloss Enamel B31-4600 (<50 g/L VOC), 1.3 mils dft/coat minimum.
- M. Ferrous Metal:
1. Finish: Satin latex enamel; primer and two finish coats.
 2. Primer:
 - a. Devoe Coatings Devflex 4020PF DTM Primer & Finish (75 g/L VOC), 2.2 – 3.5 mils dft.
 - b. KM: 5725 DTM Acrylic Metal Primer (100 g/L VOC) 1.5 - 2.0 mils dft.
 - c. Moore: Super Spec HP Acrylic DTM, P 29, 1.5-2.5 mils dft /coat.
 - d. PPG: 90-712 Series Pitt-Tech Interior/Exterior Primer/Finish DTM Industrial Enamel (123 g/L VOC), 2.0 – 3.0 mils dft.
 - e. S-W: Pro Industrial Pro-Cryl Universal Acrylic Primer B66-310 (less than 100 g/L VOC), 2.0 – 4.0 mils dft.
 3. Finish Coats:
 - a. Devoe Coatings Devflex 4212HP Acrylic Eggshell Enamel (less than 100 g/L VOC), 1.5 – 4.0 mils. dft/coat.
 - b. KM1010 KM Premium Professional Low VOC Interior Eggshell Enamel (<2 g/L VOC) 1.2-2.5 mils dft {KM492 Magnum Interior Latex Eggshell Enamel (50 g/L VOC) 1.6-2.4 mils dft.}
 - c. Moore: Ultra Spec 500 Interior Latex Eggshell Finish, 0 VOC, N538, 1.8 mils dft/coat minimum.
 - d. PPG: 6-411 Series Speedhide Interior Enamel Eggshell Latex (44 g/L VOC), 1.5 – 1.7 mils dft/coat minimum.
 - e. S-W: ProMar 400 Interior Zero VOC Latex Semi-Gloss Enamel B31-4600 (<50 g/L VOC), 1.3 mils dft/coat minimum.
- N. Ferrous Metal – Doors, Frames, Guardrails, Handrails:
1. Finish: Semi-gloss, waterborne light industrial coating; primer and two finish coats.
 2. Primer:
 - a. Devoe, Devflex 4020 Direct to Metal Primer & Flat Finish (91 g/L VOC) 2.2 – 3.5 mils dft.
 - b. KM: 5725 DTM Acrylic Primer/Finish (less than 100 g/l) 1.6-2.0 mils dft.
 - c. Moore: Super Spec HP Acrylic DTM, Semi-Gloss, P 29, 1.5-2.5 mils dft / coat.
 - d. PPG: Pitt-Tech Plus, Int/Ext DTM Industrial Primer 90-912 (less than 90 g/L VOC) 2.0 – 4.0 mils dft.
 - e. S-W: Pro Industrial Pro-Cryl Universal Acrylic Primer B66-310 (less than 100 g/L VOC) 2.0 – 4.0 mils dft.
 3. Finish Coats:
 - a. Devoe High Performance Devflex 4216 High Performance WB Acrylic Semi-Gloss Enamel 4216L (less than 150 g/L VOC) 2.0 – 4.0 mils dft/coat.

- b. KM: 1685 DuraPoxy 100% Acrylic Semi-Gloss Enamel (50 g/L VOC) 1.5-2.3 mils dft.
 - c. Moore: Super Spec HP Acrylic DTM, Semi-Gloss, P 29, 1.5- 2.5 mils dft min/ coat.
 - d. PPG: Pitt-Glaze WB1, Pitt-Glaze WBI Int. Semi-Gloss Acrylic Epoxy 16-510 (less than 100 g/L VOC) 1.5 mils dft/coat minimum.
 - e. S-W: Pro Industrial Water Based Alkyd Urethane Enamel Semi-Gloss, B53-1150 Series (<50 g/L VOC) 1.4 – 1.7 mils dft.
- O. Ferrous Metal – Galvanized:
- 1. Finish: Semi-Gloss latex enamel; primer and two finish coats.
 - 2. Primer:
 - a. Devoe Coatings Devflex 4020 DTM Primer & Finish (75 g/L VOC), 2.2 – 3.5 mils dft.
 - b. KM: 5725 DTM Acrylic Metal Primer (100 g/L VOC) 1.5 - 2.0 mils dft.
 - c. Moore: Super Spec HP Acrylic DTM, Semi-Gloss, P 29, 1.5 -2.5 mils dft min.
 - d. PPG: 90-712 Series Pitt-Tech Interior/Exterior Primer/Finish DTM Industrial Enamel (123 g/L VOC), 2.0 – 3.0 mils dft.
 - e. S-W: Pro Industrial Pro-Cryl Universal Acrylic Primer B66-310 (less than 100 g/L VOC), 2.0 – 4.0 mils dft.
 - 3. Finish Coats:
 - a. Devoe Coatings Devflex 4216HP Acrylic Semi-Gloss Enamel (less than 100 g/L VOC), 1.5 – 4.0 mils. dft/coat.
 - b. KM1050 KM Premium Professional Low VOC Interior Acrylic Semi-Gloss Enamel (<2 g/L VOC) 1.2-2.5 mils dft {KM495 Magnum Interior Latex Semi-Gloss (50 g/L VOC) 1.6-2.3 mils dft}
 - c. Moore: Super Spec HP Acrylic DTM Semi-Gloss, P 29, 1.5- 2.5 mils dft/ coat.
 - d. PPG: 6-500 Series Speedhide Interior Semi-Gloss Acrylic Latex (42 g/L VOC), 1.4 mils dft/coat minimum.
 - e. S-W: ProMar 400 Interior Zero VOC Latex Semi-Gloss Enamel B31-4600 (<50 g/L VOC), 1.3 mils dft/coat minimum.
- P. Ferrous Metal – Galvanized:
- 1. Finish: Satin latex enamel; primer and two finish coats.
 - 2. Primer:
 - a. Devoe Coatings Devflex 4020PF DTM Primer & Finish (75 g/L VOC), 2.2 – 3.5 mils dft.
 - b. KM: 5725 DTM Acrylic Metal Primer (100 g/L VOC) 1.5 - 2.0 mils dft.
 - c. Moore: Super Spec HP Acrylic DTM, Semi-Gloss, P 29, 1.5 – 2.5 mils dft minimum
 - d. PPG: 90-712 Series Pitt-Tech Interior/Exterior Primer/Finish DTM Industrial Enamel (123 g/L VOC), 2.0 – 3.0 mils dft.
 - e. S-W: Pro Industrial Pro-Cryl Universal Acrylic Primer B66-310 (less than 100 g/L VOC), 2.0 – 4.0 mils dft.
 - 3. Finish Coats:
 - a. Devoe Coatings Devflex 4212HP Acrylic Eggshell Enamel (less than 100 g/L VOC), 1.5 – 4.0 mils. dft/coat.
 - b. KM1010 KM Premium Professional Low VOC Interior Eggshell Enamel (<2 g/L VOC) 1.2-2. mils dft. {KM492 Magnum Interior Latex Eggshell Enamel (50 g/L VOC) 1.6-2.3 mils dft.}
 - c. Moore: Ultra Spec 500 Latex Interior Eggshell Finish, 0 VOC, N538, 1.5-2.5 mils dft/ coat

- d. PPG: 6-411 Series Speedhide Interior Enamel Eggshell Latex (44 g/L VOC), 1.5 – 1.7 mils dft/coat minimum.
 - e. S-W: ProMar 400 Interior Zero VOC Latex Eg-Shel B20-4600 (<50 g/L VOC), 1.3 mils dft/coat minimum.
- Q. Galvanized Metal – Doors, Frames, Guardrails, Handrails:
- 1. Finish: Semi-gloss, waterborne light industrial coating; primer and two finish coats.
 - 2. Primer:
 - a. Devoe, Devflex 4020 Direct to Metal Primer & Flat Finish (91 g/L VOC) 2.2 – 3.5 mils dft.
 - b. KM: 5725 DTM Acrylic Primer/Finish (less than 100 g/l) 1.6-2.0 mils dft.
 - c. Moore: Super Spec HP Acrylic DTM Semi-Gloss, P 29, 1.5-2.5 mils dft.
 - d. PPG: Pitt-Tech Plus, Int/Ext DTM Industrial Primer 90-912 (less than 90 g/L VOC) 2.0 – 4.0 mils dft.
 - e. S-W: Pro Industrial Pro-Cryl Universal Acrylic Primer B66-310 (less than 100 g/L VOC) 2.0 – 4.0 mils dft.
 - 3. Finish Coats:
 - a. Devoe High Performance Devflex 4216 High Performance WB Acrylic Semi-Gloss Enamel 4216L (less than 150 g/L VOC) 2.0 – 4.0 mils dft/coat.
 - b. KM: 1685 DuraPoxy 100% Acrylic Semi-Gloss Enamel (less than 50 g/L VOC).
 - c. Moore: Super Spec HP Acrylic DTM Semi-Gloss, P 29, 1.5-2.5 mils dft/coat.
 - d. PPG: Pitt-Glaze WBI, Pitt-Glaze WBI Int. Semi-Gloss Acrylic Epoxy 16-510 (less than 150 g/L VOC) 1.5 mils dft/coat minimum.
 - e. S-W: Pro Industrial Water Based Alkyd Urethane Enamel Semi-Gloss, B53-1150 Series (<50 g/L VOC) 1.4 – 1.7 mils dft.
- R. Plaster:
- 1. Finish: Flat latex; primer and two finish coats.
 - 2. Primer:
 - a. KM: 971 LOW VOC Interior PVA Primer/Sealer (2 g/L VOC) 1.5 - 2.0 mils dft.
 - b. Moore: Ultra Spec 500 Latex Interior Primer, 0 VOC, N534- 1.8 mils dft.
 - c. PPG: 4-603 Perma-Crete Interior/Exterior Alkali Resistant Primer (86 g/L VOC), 1.2 – 1.5 mils dft.
 - d. S-W: ProMar 200 Zero VOC Interior Latex Primer B28W2600 (0 G/L VOC), 1.5 mils dft minimum.
 - 3. Finish Coats:
 - a. KM1005 KM Premium Professional Low VOC Interior Acrylic Flat Wall Paint (<2 g/L VOC) 1.5-2.0 mis dft.
 - b. Moore: Ultra Spec 500 Latex Interior Flat Finish, 0 VOC, N536, 1.8 mils dft/ coat
PPG: 6-4110XI Speedhide zero Interior Flat Latex (0 g/L VOC), 1.8 mils dft/coat minimum.
 - c. S-W: ProMar 200 Zero VOC Interior Flat Paint B30-2600 (0 G/L VOC), 1.6 mils dft/coat minimum.
 - 4. Location: CEILINGS ONLY
- S. Plaster:
- 1. Finish: Satin latex enamel; primer and two finish coats.
 - 2. Primer:
 - a. KM: 971 Acry-Plex Low VOC Interior PVA Primer/Sealer (2g/L VOC) 1.5 - 2.0 mils dft.
 - b. Moore: Ultra Spec 500 Latex Interior Primer, 0 VOC, N534- 1.8 mils dft.

- c. PPG: 4-603 Perma-Crete Interior/Exterior Alkali Resistant Primer (86 g/L VOC), 1.2 – 1.5 mils dft.
 - d. S-W: ProMar 200 Zero VOC Interior Latex Primer B28W2600 (0 G/L VOC), 1.5 mils dft minimum.
 - 3. Finish Coats:
 - a. KM1010 KM Premium Professional Low VOC Interior Eggshell Enamel (<2 g/L VOC) 1.2-2.5 mils dft. {KM492 Magnum Interior Eggshell Enamel (50 g/L VOC) 1.6-2.4 mils dft.}
 - b. Moore: Ultra Spec 500 Latex Interior Eggshell Finish, 0 VOC, N538, 1.8 mils dft/coat.
 - c. PPG: 6-411 Series Speedhide Interior Enamel Eggshell Latex (44 g/L VOC), 1.5 – 1.7 mils dft/coat minimum.
 - d. S-W: ProMar 400 Interior Zero VOC Latex Eg-Shel B20-4600 (<50 g/L VOC), 1.3 mils dft/coat minimum.
- T. Woodwork:
- 1. Finish: Semi-gloss waterborne acrylic enamel; primer and two finish coats.
 - 2. Primer:
 - a. KM: 973 Acry-Plex Low VOC Interior Wall Primer & Undercoat (2 g/L VOC) 1.5 - 2.0 mils dft.
 - b. Moore: Advance™Water-Reducible Alkyd Primer, 790 less than50 g/L /VOC), 1.4 mils dft
 - c. PPG: 17-921 Series Seal Grip Interior/Exterior 100% Acrylic Universal Primer/Sealer (89 g/L VOC), 1.2 – 1.5 mils dft.
 - d. S-W: Premium Wall & Wood Interior Latex Primer B28W8111 (41 g/L VOC), 1.8 mils dft minimum.
 - 3. Finish Coats:
 - a. KM: 1050 KM Professional Low VOC Interior Semi-Gloss Enamel (2 g/L VOC) 1.5- 2.5mils dft/coat.
 - b. Moore: Advance™ Water Reducible Alkyd Enamel, Satin Finish, 792 (less than50 g/L VOC), 1.4 mils dft/coat.
 - c. PPG: 6-500 Series Speedhide Interior Enamel Semi-Gloss Acrylic Latex (42 g/L VOC), 1.4 mils dft/coat.
 - d. S-W: ProMar 200 Zero VOC Interior Latex Semi-Gloss Enamel B31-2600 (0 G/L VOC), 1.6 mils dft/coat minimum.
- U. Woodwork:
- 1. Finish: Satin waterborne acrylic enamel; primer and two finish coats.
 - 2. Primer:
 - a. KM: 973 Acry-Plex Low VOC Interior Wall Primer & Undercoat (2 g/L VOC) 1.5 - 2.0 mils dft.
 - b. Moore: Advance™Water-Reducible Alkyd Primer, 790 less than50 g/L /VOC), 1.4 mils dft
 - c. PPG: 17-921 Series Seal Grip Interior/Exterior 100% Acrylic Universal Primer/Sealer (89 g/L VOC), 1.2 – 1.5 mils dft.
 - d. S-W: Premium Wall & Wood Interior Latex Primer B28W8111 (41 g/L VOC), 1.8 mils dft minimum.
 - 3. Finish Coats:
 - a. KM: 1010 KM Professional Low VOC Interior Eggshell Enamel (2 g/L VOC) 1.7 - 2.2 mils dft/coat.

- b. Moore: Advance™ Water Reducible Alkyd Enamel, Satin Finish, 792 (less than 50 g/L VOC), 1.4 mils dft/coat
- c. PPG: 6-411 Series Speedhide Interior Enamel Eggshell Latex (42 g/L VOC), 1.5 – 1.7 mils dft/coat.
- d. S-W: ProMar 200 Zero VOC Low Gloss Interior Latex Eg-Shel B41-2600 (0 g/L VOC), 1.6 mils dft/coat minimum.

V. Dry Fog Finish:

- 1. Finish: Flat acrylic latex dry fall; primer and two finish coats.
- 2. Primer: As recommended by finish coat paint manufacturer.
- 3. Finish Coats:
 - a. KM: 480 Dry Fog II Flat Latex Maintenance Paint (10 g/L VOC) 2.0 - 3.0 mils dft/coat.
 - b. Moore: Benjamin Moore Dry Fall Latex Flat, 395 (38 g/ L VOC), 1.9-2.4 mils dft/ coat.
 - c. PPG: 6-725XI Speedhide Interior Super Tech Dry-Fog Flat Latex (28 g/L VOC), 2.1 – 2.6 dft/coat.
 - d. S-W: Pro Industrial Waterborne Acrylic Dryfall Flat, B42W81 (<50 g/L VOC), 1.7 – 2.6 mils dft/coat.

END OF SECTION

SECTION 09 96 56 - ACRYLIC COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Surface preparation, including crack repair.
 - 2. Acrylic coatings applied cement plaster on exterior surfaces, including prime coats, if required, and finish coats.
- B. Related Sections:
 - 1. Section 09 24 00 - Portland Cement Plaster.

1.2 REFERENCES

- A. ASTM E 84 - Surface Burning Characteristics of Building Materials.

1.3 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions.
- B. Samples: Submit 12" x 12" samples of each type texture and color finish required.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Licensed by manufacturer and have at least five years of successful, documented experience with installation of specified products.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to job in original containers bearing manufacturer's name and brand.
- B. Keep materials dry; protect from weather. Store under cover, above ground and away from sweating walls or other damp surfaces.
- C. Protect materials from weather and temperatures less than 40 degrees F.

1.6 JOB CONDITIONS

- A. Ambient air temperatures shall be 40 degrees F or greater and rising at time of installation and shall remain at 40 degrees F or greater for at least 24 hours after application.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acrylic-Based Finish Coatings: Factory-mixed acrylic-emulsion coating systems, formulated with colorfast mineral pigments and fine aggregates; for use over portland cement plaster base coats.

- B. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Dryvit Systems, Inc.; Dryvit TAFS.
 - 2. Finestone, BASF Wall Systems, Inc.; PebbleTex.
 - 3. Parex, Inc., a brand of ParexLaHabra, Inc.; x.
 - 4. Senergy, BASF Wall Systems, Inc.; Senerflex.
 - 5. Sto Corp.; Powerwall Finish.
 - 6. SonoWall, BASF Wall Systems, Inc.; StuccoTex Finish.

- C. FINISH
 - 1. Texture: To match existing..
 - 2. Color: To match existing.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean and prime substrate as recommended by manufacturer.

3.2 INSTALLATION

- A. Apply finish coating and cure in accordance with manufacturer's written instructions.
- B. Apply finish coating during same operation to minimum attainable thickness consistent with uniform coverage, in thickness and texture to match acceptable samples.
- C. Apply and texture continually over wall surface to maintain wet edge.
- D. Work to corners or joints and do not allow material to set up within distinct wall or ceiling surface.

3.3 CLEANING

- A. Clean surrounding surfaces of debris and residue from work of this Section.

3.4 SCHEDULE

- A. Apply finish coat as third coat of cement plaster system specified in Section 09 24 00.

END OF SECTION

SECTION 10 14 00 - ROOM IDENTIFICATION SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Room identification signs.
 - 2. Signage graphics and logos.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data for each type of product including installation methods.
- B. Shop Drawings: Indicate fabrication and installation details and attachments to other work.
 - 1. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
 - 2. Show typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- C. Samples: Submit for each type of sign assembly showing all components and with required finish:
 - 1. Room identification Signs: Full size sample.
 - 2. Field Applied, Vinyl Character Signs: Full size Sample of characters on glass.
 - 3. Dimensional Characters: Full size sample of each type of dimensional character.
 - 4. Exposed Accessories: Full size sample of each accessory type.
- D. Product Schedule: Use same designations indicated on Drawings or specified.

1.3 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide products of each type by a single manufacturer.

1.4 COORDINATION

- A. Furnish templates for placement of sign anchorage devices embedded in permanent construction by others.

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by others by field measurements before fabrication, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Requirements: Comply with applicable requirements.

1. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) 2010.
2. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
3. 2012 Florida Accessibility Code for Building Construction.

2.2 SIGNAGE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Panel Signs:
 - a. Ace Sign Systems, Inc.
 - b. APCO Graphics, Inc.
 - c. ASI Sign Systems, Inc.
 - d. Best Sign Systems, Inc.
 - e. Fossil Industries, Inc.
 - f. InPro Corporation (IPC).
 - g. Mohawk Sign Systems.
 - h. Nelson-Harkins Industries.
 - i. Seton Identification Products.
 - j. Vista System.
 - k. Vomar Products, Inc.
 - B. Room Identification Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles:
 1. Basis of Design: Indicated on Drawings.
 2. Laminated Sheet Sign: Photopolymer face sheet with raised graphics laminated to acrylic backing sheet to produce composite sheet.
 - a. Composite Thickness: 0.25 inch (6.35 mm).
 - b. Surface Applied, Flat Graphics: Applied paint.
 - c. Subsurface Graphics: Snap-in interchangeable insert beneath removable face sheet.
 - d. Color(s): As selected by Architect from manufacturer's full range.
 3. Sign Panel Perimeter: Finish edges smooth.
 - a. Edge Condition Square cut.
 4. Mounting: two face tape.
 5. Flatness Tolerance: Sign shall remain flat or uniformly curved under installed conditions as indicated on Drawings and within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.

2.3 PANEL SIGN MATERIALS

- A. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

2.4 FABRICATION

- A. Provide sign assemblies according to requirements indicated.
1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 2. Conceal connections if possible; otherwise, locate connections in an inconspicuous location.

- B. Surface Engraved Graphics: Machine engrave characters and other graphic devices into indicated sign surface to produce precisely formed copy, incised to uniform depth.
- C. Subsurface Applied Graphics: Apply graphics to back face of clear face sheet material to produce precisely formed image. Image shall be free of rough edges.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the work.
- B. Verify sign support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

- A. Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify sign surfaces are clean and free of materials or debris that would impair installation.
- B. Accessible Signage: Install in locations on walls in accordance with ADAAG and accessibility standards.
- C. Mounting Methods:
 - 1. Two Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

SECTION 10 26 12 - WALL PROTECTION

1.1 SUMMARY

- A. Section Includes:
 - 1. Stainless steel corner guards.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data indicating physical dimensions, features, mounting method with measurements, anchorage details, and rough in measurements; indicate procedures and perimeter conditions requiring special attention.
- B. Shop Drawings: Submit plans, elevations, sections, and attachment details.
- C. Samples: Submit 12 inches (300 mm) long showing joinery, corners, field splices and exposed finish.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Submit data including recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions for cleaning materials and methods that are detrimental to plastic finishes and performance

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain protection products of each type from single source from single manufacturer.

1.5 COORDINATION

- A. Coordinate work with wall or partition sections for installation of concealed blocking or anchor devices.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store wall protection in original undamaged packages and containers inside well ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - 1. Store corner guard covers in a vertical position.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame Spread Index: 25 or less.
 - 2. Smoke Developed Index: 450 or less.

- B. Corner Panels: Resist lateral impact force of 100 lbs. (45.36 kg) at any point without damage or permanent set.
- C. Installed Component Assembly: Resist lateral force of 75 lbs. (34kg) at any point without damage or permanent set.

2.2 MATERIALS

- A. Surface Mounted, Metal Corner Guards: Fabricated as one piece from formed or extruded metal with formed edges; with 90 degree or 135 degree turn to match wall condition.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arden Architectural Specialties.
 - b. Construction Specialties, Inc.
 - c. InPro Corporation (IPC).
 - d. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - e. Korogard Wall Protection Systems; a division of RJF International Corporation.
 - f. Pawling Corporation.
 - g. WallGuard.
 - 2. Material: Stainless steel sheet, Type 304.
 - a. Thickness: Minimum 0.0500 inch (1.3 mm).
 - b. Finish: Directional satin, No. 4.
 - 3. Wing Size: 3-inches, unless noted otherwise.
 - 4. Corner Radius: Indicated on Drawings.
 - 5. Mounting: Adhesive.
- B. Fasteners: Nonmagnetic stainless steel or noncorrosive metal screws, bolts, and fasteners compatible with items being fastened.
- C. Adhesive: Recommended by manufacturer.

2.3 FABRICATION

- A. Fabricate according to requirements indicated for design, performance, dimensions, and member sizes, including thickness of components.
- B. Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.
- C. Predrill holes for attachment.

2.4 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas for compliance with requirements for installation tolerances, fire rating, and conditions affecting performance of the work.
- B. Verify location of blocking, grounds, and solid backing installed in the locations required for secure attachment of support fasteners.
 - 1. For wall protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall protection.
- B. Prior to installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. Install wall according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished work.
- B. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and accessories required for a complete installation.
 - 1. Provide anchoring devices and suitable locations to withstand imposed loads.

3.4 CLEANING

- A. Immediately after completion of installation, clean wall protection using soapy water. Rinse soap and wipe clean with smooth dry cloth.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

SECTION 10 28 00 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Washroom accessories.
 - 2. Warm air dryers.
 - 3. Childcare accessories.
 - 4. Underlavatory guards.
 - 5. Custodial accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data including construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 1. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 2. Include electrical characteristics.
- B. Product Schedule: Schedule indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify accessories using designations indicated.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Submit data for accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain toilet accessories from single source from single manufacturer.

1.5 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the work.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver inserts and rough in frames at project site at appropriate time for building in. Provide templates and rough in measurements as required.
- B. Pack accessories individually to protect accessory and its finish.

- C. Remove damaged materials from the site.

1.7 WARRANTY

- A. Mirrors: Written warranty signed by manufacturer in which manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 TOILET ROOM ACCESSORIES

- A. Basis of Design: Indicated on Drawings. Subject to compliance with requirements, provide basis of design accessories or comparable by one of the following:
 - 1. American Specialties, Inc. (ASI)
 - 2. Bobrick Washroom Equipment Co.
 - 3. Bradley Corporation.
 - 4. GAMCO Specialty Accessories; a division of Bobrick.
 - 5. Gatco, inc.
 - 6. World Dryer.
- B. Grab Bars:
 - 1. Material: 1-1/2-inch (38 mm) diameter stainless steel, Type 304 stainless steel, brushed satin finish, with peened gripping surface.
 - 2. Mounting: Concealed plates, without exposed fasteners; concealed anchor kit for type of wall.
 - 3. Acceptable Products:
 - 24-inch (610 mm) Units:
 - 1) B-5806 x 24 by Bobrick.
 - 2) ASI 3701-24.
 - 3) Bradley 832-2-001-24.
 - 42-inch (1070 mm) Units:
 - 4) B-5806 x 42 by Bobrick.
 - 5) ASI 3701-42.
 - 6) Bradley 832-2-001-42.
- C. Combination Paper Towel Dispenser and Waste Receptacle:
 - 1. Material: Type 304 stainless steel, satin finish.
 - 2. Construction: Welded, stainless steel door piano hinge, two tumbler locks.
 - 3. Mounting: Recessed.
 - 4. Receptacle: Removable, 12-gallon plastic container.
 - 5. Acceptable Products:
 - B-3961 by Bobrick, Basis-of-Design.

- D. Toilet Tissue Dispenser :
1. Material: Type 304 stainless steel, satin finish.
 2. Construction: Seamless flange, no mitered corners, one tumbler lock on door.
 3. Mounting: Surface.
 4. Capacity: Two standard toilet paper rolls.
 5. Products: Subject to compliance with requirements, provide one of the following:
 - a. B-2888 by Bobrick
 - b. ASI 0030
 - c. Bradley 5402.
- E. Toilet Seat Cover Dispenser:
1. Material: Type 304 stainless steel, satin finish.
 2. Construction: One-piece seamless flanges, stainless steel door piano hinges; tumbler lock.
 3. Mounting: Surface.
 4. Capacity: 250 paper toilet seat covers.
 5. Acceptable Products:
B-221 by Bobrick.
ASI 20477-SM.
Bradley 5831.
- F. Framed Mirrors:
1. Material: One piece, roll formed tilted stainless-steel angle frame, 3/4 inch by 3/4 inch (19 mm by 19 mm), Type 304 stainless steel, brushed satin finish.
 2. Mirror: 1/4 inch (6 mm) thick float glass mirror electrolytically copper plated; 15-year warranty.
 3. Size: 24-inches by 36-inches, unless noted otherwise.
 4. Mounting: Theft resistant, concealed wall hangers.
 5. Acceptable Products:
Bobrick Series B-293.
ASI 0600.
Bradley 781.
- G. Clothes Hook:
1. Material: One-piece, brass casting with nickel plated finish.
 2. Hook: 3-1/2-inch (88 mm) projection.
 3. Mounting: Surface.
 4. Acceptable Products:
Bobrick Series B-211.
- H. Door Bumper:
1. Base: Type 304 stainless steel, polished finish.
 2. Post: Black nylon.
 3. Bumper: Black neoprene.
 4. Acceptable Products:
B-687 by Bobrick.
ASI 0719.
Bradley 9144.
- I. Shelf with Mop and Broom Holders:
1. Material: Stainless steel, satin finish.

2. Construction: 8 inches (200 mm) deep with four mop holders, three rag hooks and wet rag rod.
 3. Mounting: Surface.
 4. Acceptable Products:
B-224 x 36 inch by Bobrick.
ASI 1315-4.
Bradley 9984.
- J. Automatic Paper Towel (Roll) Dispenser:
1. Description: Automatic motion sensing mechanism with user-adjustable delay and paper towel length; battery powered.
 2. Mounting: Recessed.
 3. Minimum Capacity: 8 inch (203 mm) wide, 800 foot (244 m) long roll.
 4. Material and Finish: Stainless steel, No. 4 finish (satin).
 5. Lockset: Keyed tumbler type.
 6. Acceptable Products:
Basis-of-Design: B-3974 by Bobrick, accommodates 800-foot roll, 12-gal. waste receptacle.
- K. Liquid Soap Dispenser:
1. Description: Designed for dispensing soap in liquid or lotion form.
 2. Mounting: Deck mounted on lavatory.
 3. Capacity: 34 oz.
 4. Materials: Vandal-resistant locking cover and free-turning spout; corrosion-resistant, bright-polished spout, cover and escutcheon; high-impact-resistant ABS body and shank; shatter-resistant polyethylene container.
- L. Combination Feminine Napkin/Tampon Dispenser:
1. Type: Sanitary napkin and tampon.
 2. Mounting: Fully recessed, designed for 4-inch (100 mm) wall depth.
 3. Capacity: 30/20.
 4. Operation: Single coin (25 cents).
 5. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).
 6. Lockset: Tumbler type with separate lock and key for coin box.
 7. Products: Subject to compliance with requirements, provide one of the following:
 - a. B-352 by Bobrick
 - b. ASI 0464
 - c. Bradley 4017-10.]
- M. Sanitary Napkin Disposal Unit:
1. Mounting: Surface mounted.
 2. Door or Cover: Self closing, disposal opening cover and hinged face panel with tumbler lockset.
 3. Receptacle: Removable.
 4. Material and Finish: Stainless steel, No. 4 finish (satin).
 5. Products: Subject to compliance with requirements, provide one of the following:
 - a. B-354 by Bobrick
 - b. ASI 0472
 - c. Bradley 4721-15.

- N. Seat Cover Dispenser:
1. Mounting: Surface mounted.
 2. Minimum Capacity: 250 seat covers.
 3. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).
 4. Lockset: Tumbler type.
 5. Products: Subject to compliance with requirements, provide one of the following:
 - a. B-6726 by Bobrick
 - b. ASI 7345-S
 - c. Bradley 9124.

- O. Coat Hook:
1. Description: Double prong unit.
 2. Material and Finish: Stainless steel, No. 4 finish (satin).
 - a. B-6726 by Bobrick
 - b. ASI 7345-S
 - c. Bradley 9124.

2.3 CHILDCARE ACCESSORIES

- A. Diaper Changing Station:
1. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
 - a. Engineered to support minimum of 250-lb (113-kg) static load when opened.
 2. Mounting: Semi-recessed, with unit projecting not more than 1 inch (25 mm) from wall when closed.
 3. Operation: By pneumatic shock absorbing mechanism.
 4. Material and Finish: HDPE with plastic laminate insert in color selected by Architect.
 5. Liner Dispenser: Built in.
 6. Products: Subject to compliance with requirements, provide one of the following:
 - a. Koala Bear Kare Changing Station by Bobrick
 - b. ASI 9012
 - c. Bradley 961.

2.4 UNDERLAVATORY GUARDS

- A. Underlavatory Guard:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Buckaroos, Inc.
 - b. Plumberex Specialty Products, Inc.
 - c. Truebro by IPS Corporation.
 2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
 3. Material and Finish: Antimicrobial, molded plastic, white.

2.5 CUSTODIAL ACCESSORIES

- A. Utility Shelf:
1. Description: With exposed edges turned down not less than 1/2 inch (13 mm) and supported by two triangular brackets welded to shelf underside.

2. Size: 16 inches (406 mm) long by 6 inches (152 mm) deep.
3. Material and Finish: Not less than nominal 0.05 inch (1.3 mm) thick stainless steel, No. 4 finish (satin).

B. Mop and Broom Holder:

1. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
2. Length: 36 inches (914 mm).
3. Hooks: Four.
4. Mop/Broom Holders: Three, spring loaded, rubber hat, cam type.
5. Material and Finish: Stainless steel, No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05 inch (1.3 mm) thick stainless steel.
 - b. Rod: Approximately 1/4-inch (6 mm) diameter stainless steel.

2.6 MATERIALS

- A. Stainless Steel: ASTM A666, Type 304, 0.031 inch (0.8 mm) minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.
- C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036 inch (0.9 mm) minimum nominal thickness.
- D. Galvanized Steel Sheet: ASTM A653/A653M, with G60 (Z180) hot dip zinc coating.
- E. Galvanized Steel Mounting Devices: ASTM A153/A153M, hot dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper and theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.7 FABRICATION

- A. Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full length, continuous hinges. Equip units for concealed anchorage and with corrosion resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings scheduled to receive recessed units for dimensions, plumbness of blocking or frames and preparation that would affect installation of accessories.

B. Verify spacing of plumbing fixtures and toilet compartments that affect installation of accessories. Verify location of accessories.

C. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Protect adjacent or adjoining finished surfaces and work from damage during installation of accessories.

3.3 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F446.

1. Anchor grab bars to through wall anchor plates.

C. Drill holes to correct size and application that is concealed by items with 1/4-inch (6 mm) tolerance.

D. Mount recessed accessories into wall openings with sheet metal screws into metal frames. Mount surface mounted accessories to backup material with toggle bolts, plumb and align.

E. Use tamperproof fasteners.

3.4 PROTECTION

A. Protect adjacent or adjoining finished surfaces and work from damage during installation of work.

3.5 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION

SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Fire protection cabinets
 2. Portable fire extinguisher.
 3. Mounting brackets.

1.2 ACTION SUBMITTALS

- A. Product Data: Submit product data including construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection specialties.
1. Fire Extinguishers: Include rating and classification.
 2. Cabinets: Indicate door hardware, cabinet type, trim style, and panel style. Include roughing in dimensions and details showing recessed, semi-recessed, or surface mounting method and relationships of box and trim to surrounding construction.
- B. Shop Drawings: Submit plans, elevations, sections, details, and attachments of fire protection cabinets to other work.
- C. Samples: Submit samples for each exposed finish required, prepared on samples 6 inches by 6 inches (150 mm by 150 mm) square.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Submit data for fire protection cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10 *Standard for Portable Fire Extinguishers*.
- B. Fire Extinguisher Listing: UL listed with UL Listing Mark for type, rating, and classification of extinguisher.
- C. Source Limitations: Obtain fire extinguishers and fire protection cabinets through one source from a single manufacturer.
- D. Preinstallation Conference: Conduct conference at site.

1.5 COORDINATION

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire protection cabinets with wall depths.

1.6 WARRANTY

- A. Warranty, Fire Extinguisher: Written warranty in which manufacturer agrees to repair or replace components of portable fire extinguishers failing in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - 2. Warranty Period: 6 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire Rated Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire resistance rating of walls where installed.
- B. NFPA Compliance, Fire Extinguishers: Fabricate and label fire extinguishers to comply with NFPA 10 Portable Fire Extinguishers.
- C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 FIRE PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. JL Industries, Inc.; Activar Construction Products Group.
 - b. Larsens Manufacturing Company.
 - c. Nystrom, Inc.
 - d. Potter Roemer LLC.
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Cold rolled steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- D. Recessed Cabinet:
 - 1. Trimless with Concealed Flange: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box, to act as drywall bead.
 - 2. Trimless with Hidden Flange: Flange of same metal and finish as box overlaps surrounding wall finish and is concealed from view by an overlapping door.
 - 3. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
- E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
 - 1. Square Edge Trim: 1-1/4 inch to 1-1/2-inch (32 mm to 38 mm) backbend depth.
- F. Surface Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.

- G. Cabinet Trim Material: Same material and finish as door.
- H. Door Material: Steel sheet.
- I. Door Style: Vertical duo panel with frame.
- J. Door Glazing: Acrylic sheet.
 - 1. Acrylic Sheet Color: Clear transparent acrylic sheet.
- K. Door Hardware: Door operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide projecting door pull and friction latch.
 - 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- L. Accessories:
 - 1. Mounting Bracket: Steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked enamel finish.
 - 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
 - a. Identify fire extinguisher in fire protection cabinet with the words FIRE EXTINGUISHER.
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Silk screened.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.
- M. Materials:
 - 1. Cold Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
 - b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - c. Color: Selected by Architect.
 - 2. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell cast sheet), 3 mm thick, with Finish 1 (smooth or polished).

2.3 FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ansul Incorporated; Tyco International.
 - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - c. Kidde Residential and Commercial Division.
 - d. Larsens Manufacturing Company.
 - e. Nystrom, Inc.
 - f. Potter Roemer LLC.
 - 2. Handles and Levers: Stainless steel.

3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

- B. Multipurpose Dry Chemical Type in Aluminum Container: UL-rated 4-A:60-B:C, 10-lb (4.5-kg) nominal capacity, with monoammonium phosphate based dry chemical in enameled aluminum container.

2.4 MOUNTING BRACKETS

- A. Mounting Brackets: Galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked enamel finish.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ansul Incorporated; Tyco International.
 - b. Guardian Fire Equipment, Inc.
 - c. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - d. Kidde Residential and Commercial Division.
 - e. Larsens Manufacturing Company.
 - f. Nystrom, Inc.
 - g. Potter Roemer LLC.

2.5 IDENTIFICATION

- A. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
 1. Cabinet: Identify cabinet mounted fire extinguishers with the words FIRE EXTINGUISHER in letter decals applied to cabinet door.
 2. Bracket: Identify bracket mounted fire extinguishers with the words FIRE EXTINGUISHER in letter decals applied to mounting surface.
 3. Orientation: Vertical.
- B. Fire Extinguisher Tags: Color code fire extinguisher tags for type of extinguisher.
 1. Tag Color Code:
 - a. Red: Water fire extinguishers.
 - b. Yellow/Cream: Foam spray fire extinguishers.
 - c. Blue: Dry powder fire extinguishers.
 - d. Orange/Yellow: Wet chemical fire extinguishers.
 - e. Black: CO² fire extinguishers.

2.6 FABRICATION

- A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 1. Weld joints and grind smooth.
 2. Miter corners and grind smooth.
 3. Provide factory drilled mounting holes.
 4. Prepare doors and frames to receive locks.
 5. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors from materials indicated and coordinated with cabinet types and trim styles.
 1. Fabricate door frames of one-piece construction with edges flanged.

2. Miter and weld perimeter door frames and grind smooth.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.7 FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500 Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for cabinets to verify actual locations of piping connections before cabinet installation.

B. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.

C. Examine fire extinguishers for proper charging and tagging.
1. Remove and replace damaged, defective, or undercharged fire extinguishers.

D. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Prepare recesses for semi-recessed fire protection cabinets required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. Install fire protection cabinets in locations and at mounting heights indicated or at heights acceptable to authorities having jurisdiction.

1. Fire Protection Cabinets: 42 inches (1067 mm) above finished floor to top of fire extinguisher.

B. Fire Extinguishers: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: Top of fire extinguisher shall be set at 42 inches (1067 mm) above finished floor.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

- D. Identification:
 - 1. Apply vinyl lettering at locations indicated.
 - 2. Apply vinyl lettering on field painted fire protection cabinets after painting is complete.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes or replace fire protection cabinets that cannot be restored to factory finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
- E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.5 FIRE PROTECTION SCHEDULE

- A. Surface Mounted Cabinet - FE-1: Multipurpose Dry Chemical.
 - 1. Door: One-piece solid construction, cold rolled steel, white baked enamel steel, vertical duo glass style with piano hinge and handle.
 - 2. Trim: One-piece trim frame with joints welded and ground smooth, cold rolled white baked enamel steel.
 - 3. Tub: Cold rolled white baked enamel steel, with welded corners ground smooth.
 - 4. Glazing: Clear, 6 mm (1/4 inch) acrylic.
 - 5. Identification: Apply red vinyl lettering at locations indicated.
 - 6. Product: Subject to compliance with requirements, provide one of the following:
 - a. Model No. 2409-SM; Larsen's Manufacturing Company.
 - b. Model No. Steel 1013 by J.L. Industries.
 - c. Model Steel FC-7024 by Nystrom, Inc.
- B. Semi-recessed Cabinet - FE-2: Multipurpose Dry Chemical.
 - 1. Door: One-piece solid construction, cold rolled steel white baked enamel steel vertical duo glass style, with piano hinge, and handle.
 - 2. Trim: One-piece trim frame with joints welded and ground smooth.
 - 3. Tub: Cold rolled white baked enamel steel welded corners and ground smooth.
 - 4. Glazing: Clear, 6 mm (1/4 inch) acrylic.
 - 5. Identification: Apply red vinyl lettering at locations indicated.
 - 6. Fire Rating: 1 hour or 2-hour wall, where indicated.
 - 7. Product: Subject to compliance with requirements, provide one of the following:
 - a. Nonrated Cabinet:
 - 1) Model No. 2409-6R by Larsen's Manufacturing Company.
 - 2) Model No. Steel 1017 by J.L. Industries.
 - 3) Model Steel FC-7022 by Nystrom, Inc.
 - b. Fire Rated Cabinet: Cosmopolitan 1037-FX by J. L. Industries.
- C. Brackets: Surface mounted portable fire extinguisher steel wall brackets; enamel or epoxy paint finish; sized to fit portable fire extinguisher supplied.

- D. Class A Fire Extinguisher for General Use:
 - 1. Type: Multipurpose dry chemical.
 - 2. Heavy duty cylinder with epoxy finish; chrome valve and siphon tubes, replaceable molded valve steam seal; large pressure indicating gages, pull pin; up right squeeze grip operation.
 - a. MRI Room/Area: provide nonferrous fire extinguisher.
 - 3. Product: Subject to compliance with requirements, provide one of the following:
 - a. UL rated 4A-60B:C, 10 lb. capacity:
 - 1) Model No. MP10 by Larsen's Manufacturing Company.
 - 2) Cosmic 10E by J. L. Industries.
 - 3) Model No. EX-3010 by Nystrom.

END OF SECTION

SECTION 10 73 17 - MANUFACTURED CANOPY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Manufactured extruded aluminum canopy including framing, reinforcing, structural anchors, integral gutters and drains, and attachments.

1.2 SUBMITTALS

- A. Product Data: Technical data including material descriptions, fabrication methods, dimensions of individual components, and finishes.
- B. Shop Drawings: Submit plans; elevations; sections, details, and attachments to other work.
 - 1. Anchor Rod Plans: Submit anchor rod plans and templates prior to fabrication of precast panels.
 - a. Indicate dimensions related to wall construction, anchorage details, and locations of support rods.
 - 2. Framing Drawings: Show complete fabrication of canopy framing. Indicate welds and bolted connections.
 - 3. Include section module of wind loadbearing members, calculations for stresses and deflections under design loading.
- C. Samples: Submit 12 inch (305 mm) long section with finish of metal canopy in thickness indicated. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
- D. Delegated Design Submittal: Submit analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

- A. Florida Product Approval (FL No.) or Miami-Dade County Product Notice of Acceptance (NOA): For custom engineered metal canopies..
- B. Certificates and Reports:
 - 1. Welding certificates.
 - 2. Mill certificates.
 - 3. Research/Evaluation Reports: ICC-ES reports for post installed anchors.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Welding: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M Structural Welding Code - Steel.
 - b. AWS D1.2/D1.2 M Structural Welding Code - Aluminum.
 - c. AWS D1.6/D1.6M Structural Welding Code - Sheet Steel.
 - d. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

- B. Manufacturer's Qualifications: Manufacturer having minimum five years documented experience in engineering and fabrication of similar work.
- C. Installer Qualifications: Entity having minimum five years documented experience who is approved by manufacturer.
- D. Source Limitations: Obtain exterior manufactured canopy and components from a single manufacturer.

1.5 COORDINATION

- A. Coordinate canopy assemblies with rain drainage work, flashing, trim, and construction of supports and adjoining work to provide a leakproof, and noncorrosive installation.
- B. Supply inserts and anchoring devices for building into concrete and instruct other trade of proper location and position.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver canopy components to prevent damaged or deformation. Package metal canopy for protection during transportation and handling.
- B. Unload, store, and erect metal canopy components to prevent bending, warping, twisting, and surface damage.
- C. Set metal canopy horizontally on platforms or pallets, covered with weathertight and ventilated covering. Store to ensure dryness, with positive slope for drainage of water. Do not store metal canopy in contact with materials that stain, dent, or cause surface damage.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify location and elevation of footings relative to finished grade, columns, and adjacent construction contiguous with manufactured canopy by field measurements before fabrication and indicate measurements on shop drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating metal canopies without field measurements.

1.8 WARRANTY

- A. Metal Canopy Finishes: Written warranty signed by manufacturer in which manufacturer agrees to repair finish or replace metal canopy components that show evidence of deterioration of factory applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design metal canopy system.
- B. Structural Performance: Metal canopy shall withstand the effects of gravity loads and the indicated loads and stresses within limits and under conditions indicated.
 - 1. Design Loads: Indicated on Structural drawings.
 - 2. Wind Loads: Indicated on Structural drawings.
 - 3. Wind Loads: Determine windloads on minimum design pressures indicated:
 - a. Uniform Pressure: 50 lbf/sq ft, acting inward or outward (standard).
 - b. Wind Load:
 - 1) Buildings: 120 mph, Exposure C).
 - 2) Shelters: 90 mph.
 - 4. Snow Loads: 50 lbf/sq ft.
- C. Seismic Performance: Canopy capable of withstanding the effects of earthquake motions determined according to ASCE/SEI 7.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.
- E. Electrical Devices: Devices UL listed with wiring bearing UL classification and conforming to the current NEC,
- F. FM Global Listing: Provide metal canopy component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global Approval Guide for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
 - 1. Fire/Windstorm Classification: Class 1A-105.
 - 2. Hail Resistance: SH.

2.2 MATERIALS

- A. Manufacturers: Subject to compliance with requirements, including approval from State of Florida Product Approval (FL) or Miami-Dade Product Approval (NOA), provide products by, but not limited to, one of the following:
 - 1. Perfection Architectural Systems, an Avadek company.
 - 2. Mapes Canopies, LLC. (NOA No. 14-0910.01)
 - 3. Peachtree Protective Covers.
- B. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish specified
 - 1. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52
 - a. Thickness: Thickness necessary to comply with design calculations.
 - 2. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
 - 3. Aluminum Castings: ASTM B 26/B 26M, alloy 319.

- C. Cold Rolled Steel Sheet: ASTM A 1008/A, Commercial Steel (CS), Type B.
- D. Zinc Coated (Galvanized) Steel Sheet: ASTM A 653/A, commercial quality, G90 (Z275) coating designation; mill phosphatized.
- E. Steel Tubing: ASTM A 513, welded steel mechanical tubing.
- F. Gutter and Fascia: Extruded aluminum alloy 6063-T6 0.125 inch (3 mm) thick, nominal 3 inch style, fascia and gutter beam.
- G. Framing: Extruded aluminum channel beams for structural support and conductance for rain water, sized to comply with design calculations.
- H. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals incompatible with joined materials.
 - 1. Use type and size suitable for installation conditions.
 - 2. Use Phillips flat head screws for exposed fasteners, unless otherwise indicated.
- I. Anchors and Inserts: Stainless steel, of type and size required for loading and installation indicated.
- J. Bituminous Paint: Cold applied asphalt mastic complying with SSPC-Paint 12 but containing no asbestos fibers, or cold applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION

- A. Configuration: Refer to Drawings.
- B. Provide factory formed metal canopy designed for standing seam deck panel mechanically attached to supports using concealed clips in side laps. Include rain drainage, accessories, and necessary clips, cleats, pressure plates, and similar items.
- C. Metal Canopy Deck: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and snapping panels together.
 - 1. Aluminum Sheet: Coil coated sheet, ASTM B 209 (ASTM B 209M), alloy as indicated by design calculations, with temper as required to suit forming operations and structural performance required.
 - a. Thickness: 0.040 inch (1.02 mm).
 - b. Surface: Smooth, flat finish.
 - c. Finish: Three coat fluoropolymer.
 - d. Color: Selected by Architect.
 - 2. Clips: One piece fixed to accommodate thermal movement.
 - a. Material: 0.062 inch (1.59 mm) thick, stainless steel sheet.

2.4 FINISHES

- A. Comply with NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designating finishes.
- B. Aluminum Finishes: Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.

1. Three Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Color and Gloss: Selected by Architect.
 3. Apply a coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.
- C. Steel Panels and Accessories:
1. Three Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Concealed Steel Items: Galvanized in accordance with ANSI/ASTM A 123 to 2.0 oz/sq.ft.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances, metal canopy supports, and conditions affecting performance of the work.
1. Examine framing to verify that angles, channels, studs, and structural panel support members and anchorage have been installed within alignment tolerances required by manufacturer.
 2. Examine canopy deck panels to verify that joints are supported by framing or blocking and that installation is within flatness tolerances required by manufacturer.
- B. Examine embedded supports for components and system to verify actual locations of penetrations relative to seam locations of metal canopy before installation.
- C. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

- A. Install metal canopy in accordance with manufacturer's written instructions on prepared concrete foundations and slabs.
- B. Install metal canopy plumb and level. Anchor metal canopy and components securely in place, with provisions for thermal and structural movement.
1. Flash and seal metal canopy at perimeter of all openings. Fasten with self tapping screws.
 2. Install screw fasteners in predrilled holes.
 3. Locate and space fastenings in uniform vertical and horizontal alignment.
 4. Flashing, Trim, and Rain Drainage: Install in accordance with SMACNA Architectural Sheet Metal Manual. Install work with laps, joints, and seams that are permanently watertight
 - a. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection.
- C. Fasteners:
1. Aluminum Panels: Use aluminum or stainless-steel fasteners.

- D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- E. Lap Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by canopy manufacturer.
 - 1. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

3.3 ADJUSTING, CLEANING, AND PROTECTING

- A. Remove temporary protective coverings and strippable films, if any, as metal canopy is installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, clean finished surfaces as recommended by metal canopy manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal canopy components damaged or deteriorated beyond repair.

END OF SECTION

SECTION 10 73 40 - LIGHTWEIGHT SHADE STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Shade structure framing.
 - a. Self-supported; base-contract shall be an assembly which does not require anchorage to the building structure.
 2. Foundations, footers, and supports.
 3. Fabric canopy, with anchorage devices to permit dismounting during wind storms.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data including styles, material descriptions, construction details, fabrication details, dimensions of individual components and profiles, hardware, fittings, mounting accessories, features, and finishes.
1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Submit plans, elevations, sections, structural components, mounting heights, and attachment details.
1. Detail fabrication and assembly including seam layout, spacing, and orientation of structure fabric.
 2. Indicate foundations, footings, structural supports, and layout shade structure including reinforcement and supplementary structural support.
 3. Indicate fasteners, weld patterns, cuts, copes, connections, and holes.
 4. Include diagrams for power, signal, and control wiring.
- C. Samples:
1. Fabric: 12 inch (300 mm) square section of fabric from dye lot to be used with specified treatments applied. Mark face of fabric.
 2. Seam, Edge, and Corner Condition: Minimum 12 inch (300 mm) long section showing seam, edge, and corner treatment.
 3. Frame Finish: Minimum 6 inch (150 mm) lengths.
- D. Design Calculations: Structural analysis data and calculations indicating wind and seismic load requirements signed and sealed by the qualified professional engineer responsible for their preparation to certify conformance with project specific design loads and governing code requirements and requirements indicated on the drawings.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit data to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Welding Qualifications: Qualify procedures and personnel according to:
 - a. AWS D1.1/D1.1M Structural Welding Code - Steel.
 - b. AWS D1.2/D1.2M Structural Welding Code - Aluminum.
- B. Fabricator/Installer Qualifications: Entity having minimum 10 years documented experience who designs, engineers, fabricates, and installs custom shade structures and who employs skilled workers who custom fabricate products similar to those required.
- C. Source Limitations: Obtain shade structures from single source.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle shade structure components as recommended by manufacturer. Handle and store to prevent avoid deforming members and to avoid excessive stresses.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of prior to preparation of shop drawings and fabrication.
 - 1. Allow for adjustments within specified tolerations wherever taking of field measurements before fabrication might delay work.

1.8 WARRANTY

- A. Written warranty signed by manufacturer in which manufacturer and fabricator agree to repair or replace components of awnings that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including framework.
 - b. Deterioration of fabric including seam failure.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Fabric Structure Warranty Period: Ten years from date of Substantial Completion.
 - 3. Fabric Warranty Period: Ten years from date of Substantial Completion.
 - 4. Thread Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports, including comprehensive engineering analysis by a qualified professional engineer licensed in the State of Texas, using performance requirements and design criteria indicated.
- B. Structural Performance: Shade structure shall withstand the loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:
 - 1. Live Load: Minimum 20 psf minimum.

2. Structural Design for Wind Forces: Indicated on Drawings, comply with ANSI A58.1.
 3. Wind Design Speed: 140 mph, Exposure Classification C.
 4. Importance Factor: 1.0.
 5. Stability Criteria: Comply with applicable building codes.
 6. Design structural members to comply with deflection criteria of L/180.
 7. Design footings for maximum bearing pressure of 1,500 psf.
- C. Provide structure capable of sustaining severe icing, hail, hurricane force winds and supporting concentrated load such as being walked upon.
1. Fire Test Response Characteristics: Provide fabrics with fire test response characteristics indicated, determined by testing identical products according to test method indicated below by UL:
 - a. Flame Resistance Ratings: Passes NFPA 701.
 - b. Surface Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency for Flame Spread Index of 25 or less.
 - c. Permanently attach label to each awning fabric indicating whether fabric is inherently and permanently flame resistant or is treated with flame retardant chemicals, and whether it requires retreatment after designated time period or cleaning.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

2.2 MATERIALS

- A. Manufacturer: Subject to compliance with requirements, provide shade structures by one of the following:
1. Eide Structures.
 2. Shade and Solar Solutions.
 3. Shelter Structures.
 4. Sunports International, Inc.
- B. Fabric: UV stabilized, stentored, high density polyethylene, and monofilament and tape construction; knitted fabric that will not unravel when cut.
1. Fiber Content: Solution dyed acrylic.
 2. Strengthen corners with non-tear vinyl.
 3. Physical Properties:

SOLID COLORS

Burst Strength:	37.7 psi
Fabric Mass:	6.8 ozm
Tear Strength:	220.4 lb (warp)
	462.9 lb (weft)

- a. Fire Rating: comply with ASTM E84: Minimum flame spread index of 15 with smoke development index of 15.
- b. UVB Block: Color certified by AMC Cancer Research Center to block 90% or more of the UV radiation.
- c. Mildew Resistance: Showing no growth when tested according to ASTM G 21.
- d. Shrinkage: Not greater than 1 percent according to ASTM D 1204.
- e. Stretch Factor: Not less than 4 percent according to ASTM D 4851.

- C. Frame and Accessory: Four post structure, hipped canopy; configuration indicated on Drawings.
1. Steel:
 - a. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - b. Steel Tubing: ASTM A 500/A 500M.
 - c. Galvanized Steel Tubing: ASTM A 787/A 787M.
 - d. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40).
 2. Aluminum: Alloy and temper recommended by awning manufacturer for type of use and finish indicated and with not less than the strength and durability properties of alloy and temper required by structural loads.
 - a. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M).
 - b. Aluminum Extrusions: ASTM B 221 (ASTM B 221M).
 - c. Extruded Structural Pipe and Round Tubing: ASTM B 429/B 429M, standard weight (Schedule 40).
 - d. Drawn Seamless Tubing: ASTM B 210 (ASTM B 210M).
 3. Tensioning Cable: ASTM A603, galvanized with a UV resistant vinyl cladding to eliminate fabric wear. Sized to comply with structural performance.
 4. Anchors, Fasteners, Fittings, Hardware, and Installation Accessories: Complying with performance requirements indicated and suitable for exposure conditions, supporting structure, anchoring substrates, and installation methods indicated. Corrosion resistant or noncorrodible units; weather resistant, tamperproof, vandal and theft resistant, compatible, nonstaining materials. Provide as required for awning assembly, mounting, and secure attachment. Number necessary to comply with performance requirements and to maintain uniform appearance; evenly spaced. Where exposed to view, provide finish and color as selected by Architect from manufacturer's full range.
 - a. Wood Screws: ASME B18.6.1.
 - b. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
 - c. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3 (ASTM A 325M, Type 3); with hex nuts, ASTM A 563, Grade C3 (ASTM A 563M, Class 8S3); and, where indicated, flat washers.
 - d. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing according to ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1) Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).
 - e. Adhesive Bonded Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing according to ASTM E 1512 conducted by a qualified independent testing and inspecting agency.
 - 1) Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).
 - f. Grommets: Stainless steel, No. 2.
 - g. Lacing: 100 percent polyester, braided No. 4.
 5. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 6. Bituminous Paint: Cold applied asphalt emulsion complying with ASTM D 1187.

- D. Foundation and Footings: Design and construct foundations in accordance with governing codes and ordinances.
 - 1. Concrete: ACI 316, comply with requirements of Section 033000, minimum, 3000 psi, 28 day strength, in accordance with ACI 318 or site mixed concrete consisting of 5 sacks of Portland cement complying with ASTM C150, per cubic yard of wet concrete combined with fine aggregate, clean water, and mixed in proportions to attain minimum 28 day compressive strength of not less than 3,000 psi.

2.3 FABRICATION

- A. Fabric: Reinforce wear points and hardware attachment points with polypropylene mesh webbing. Seam fabrics in locations indicated on the Drawings:
 - 1. Fabric Edges and Seams: Fold and stitch selvage and cut fabric edges.
 - 2. Fabric Edges and Seams: Hot cut and sealed.
 - 3. Fabric Edges and Seams: Adhesively bonded.
 - 4. Fabric Attachment: Grommets.
 - a. Grommet Spacing: 6 inches (150 mm) o.c.
 - 5. Insets: Heat sealed and sewn in process.
- B. Frame Fabrication: Fabricate frame and supports from steel. Preassemble in shop to greatest extent possible. Disassemble units as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
 - 1. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
 - 2. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Fabricate slip fit connections exposed to weather to exclude water. Provide weep holes where water may accumulate.
 - 3. Weld corners and connections continuously. Obtain fusion without undercut or overlap. Remove welding flux immediately. At exposed corners and connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
 - 4. Provide for anchorage; coordinate with supporting structure. Space anchoring devices to secure shade fabric in place.

2.4 FINISHES

- A. Aluminum:
 - 1. Baked Enamel or Powder Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - a. Color and Gloss: Selected by Architect.
- B. Steel Finish: Baked enamel or powder coat finish complying with finish manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
 - 1. Color: Selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for supporting members, blocking, inserts, installation tolerances, accurate locations of connections to building electrical system, lighting, and other conditions affecting performance of the work.
- B. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

- A. Comply with manufacturer's instructions.
- B. Install columns at location and in position indicated. Set columns accurately and fix in position by securely attaching to base plate or by direct embedment according to manufacturer's instructions and engineering requirements and approved shop drawings.
- C. Weld frame connections that are not left as exposed joints but cannot be shop welded.
 - 1. Field Welding: Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - a. Obtain fusion without undercut or overlap.
 - b. Remove welding flux immediately.
 - c. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Install fabric, adjust canopy tension cable to maintain a tight fit over framing members.

3.3 CLEANING AND PROTECTION

- A. Damaged Units: Replace damaged and deteriorated components that cannot be successfully repaired to touched up.
- B. Cleaning: Remove protective coverings at time in project construction sequence that provide greatest protection of work. Clean finished surfaces to comply with recommendations of manufacturer.
- C. Protection: Protect completed work ensuring fabric structure will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 10 81 10 - BIRD CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Netting.
 - 2. Removal and disposal of existing bird waste and detritus from areas receiving bird control devices.
 - 3. Accessories necessary for a complete installation.

1.2 SUBMITTALS

- A. Product Data: Technical data for each type of bird control device including product characteristics, including materials, finishes, and construction, installation methods, maintenance and cleaning methods.
 - 1. Waste Removal: Submit procedures proposed for bird waste and copies of licenses and permits from authorities having jurisdiction.
- B. Shop Drawings: Show placement and installation details.
- C. Samples: Submit two samples for each finish product specified representing actual product, color, and patterns.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Entity having minimum 5 years documented experience in the installation and maintenance of bird control systems, who is approved by bird control device manufacturer, and who is licensed for removal and disposal of bird waste classified as hazardous waste.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent based materials, and materials used with solvent based materials, in accordance with requirements of local authorities having jurisdiction.

1.5 WARRANTY

- A. Written warranty signed by manufacturer in which manufacturer agrees to repair or replace components that fail due to a manufacturing defect or UV degradation for the period specified.
 - 1. Material Warranty: Five years from date of substantial completion.
 - 2. Installation Warranty: Two years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. National Fire Protection Association (NFPA) 701 Standard Methods of Fire Tests for Flame Resistant Textiles and Films.

2.2 MATERIALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. ABC Advanced Bird Control.
 2. Avian Flyaway, Inc.
 3. Bird-X Bird Control.
 4. Bird-B-Gone.
 5. Bird Barrier America.
 6. Bird Master.
 7. Cat Claw, Inc.
 8. Fly-Bye Bird Control.
 9. Rasco Industries.

2.3 BIRD CONTROL NETTING

- A. Heavy Duty Bird Net:
 1. Size: 2 inches (51 mm) Heavy Duty.
 2. Color: Black.
 3. Material: UV stabilized knotted polyethylene net; flame resistant, rot proof, nonconductive.
 4. Construction: 6 monofilaments, each 12/1000 inch (0.3 mm) thick with UV stabilizers added, twisted to produce a strong twine with 160-200 twists per meter.
 5. Breaking Strength: In excess of 40 lb (18 kg).
 6. Attachment:
 - a. Solid Steel Corner Attachment: Eye bolts with lock nuts and multipurpose cable brackets with powder actuated fire in pins for intermediate attachments.
 - b. Steel I-Beams for Corner Attachment: Eye bolts with lock nuts. For intermediate attachments, use the appropriate sized girder clips.
 - c. Sheet Metal: Multipurpose cable brackets with self-tapping screws for both corner and intermediate attachments.
 - d. Brick, Concrete and Stone for Corner Attachments: Expanding corner net bolts; for intermediate attachments, use open or closed net loop, net spike, split pin with anchor rivet or multipurpose cable bracket.
- B. Mounting Systems:
 1. Hardware: Metal hardware and products shall be galvanized or stainless steel.
 2. Metal Fasteners: Manufacturer recommended corner bolts with lock nuts, multipurpose cable brackets with powder actuated fire in pins for intermediate attachments, bolts with lock nuts, girder clips; and multipurpose cable brackets with self tapping screws.
 3. Brick, Concrete and Stone Fasteners: Expanding corner net bolts, open or closed net loop, net spike, split pin and anchor rivet or multipurpose cable bracket.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive bird control devices for substrate and mounting conditions.
- B. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

- A. Thoroughly clean surface. Ensure substrates are free of bird droppings, nesting materials, rust, peeling paint, or other debris.
- B. Remove obstacles and repair substrates, including overhanging foliage, brush and loose parts on the structure.
- C. Prepare surfaces using the manufacturer recommended methods.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions. Covering depth of the surface to be protected, including the perimeter.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 12 36 23 - PLASTIC LAMINATE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Countertops clad in plastic laminate.
- B. See Section 05 75 00, for Decorative Formed Metals, at ticket counters.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data including data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: Submit plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.
 - 1. Show locations and sizes of cutouts and holes for items installed in plastic laminate clad countertops.
- C. Samples: Plastic laminates in each type, color, pattern, and surface finish required in manufacturer's standard size.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Certificates:
 - 1. Composite wood products.
 - 2. High pressure decorative laminate.
 - 3. Chemical resistant, high pressure decorative laminate.
 - 4. Adhesives.
- B. Evaluation Reports: ICC-ES Evaluation Reports for fire retardant treated materials.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop having minimum 5 years documented experience, that employs skilled workers who custom fabricate products similar to those required.
- B. Installer Qualifications: Fabricator of products.

1.5 COORDINATION

- A. Coordinate installation of countertops with architectural woodwork.
- B. Coordinate locations of utilities that will penetrate countertops.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver countertops after casework and supports on which it will be installed have been completed in installation areas.

- B. Store countertops in areas where environmental conditions comply with requirements.
- C. Keep surfaces of countertops covered with protective covering during handling and installation.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 degrees F and 90 degrees F (16 degrees C and 32 degrees C) and relative humidity between 43 and 70 percent during the remainder of the construction period.
- C. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.
- D. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standard Suite and Architectural Woodworking Standards, 2nd edition, for grades of plastic laminate clad countertops indicated for construction, finishes, installation, and other requirements.
- B. Structural Performance of Countertops:
 - 1. Countertops: Provide countertop framing capable of withstanding the structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections, or of exhibiting excessive deflections in any of the components making up the countertops and vanities:
 - a. All deadloads.
 - b. 500-pound live load placed on the countertop.
 - c. Deflection at Midspan: $L/1000$ times span or 1/8 inch whichever is less.

2.2 PLASTIC LAMINATE COUNTERTOPS

- A. Grade:
 - 1. Aesthetic: Premium.
 - 2. Performance: Commercial.
- B. High Pressure Decorative Laminate: NEMA LD 3, Grade HGS.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Abet Laminati Inc.
 - b. Formica Corporation.
 - c. Lamin-Art, Inc.
 - d. Nevamar; a Panolam Industries International, Inc. brand.
 - e. Pionite; a Panolam Industries International, Inc. brand.
 - f. Wilsonart.
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces selected by Architect.
- D. Edge Treatment: As indicated on Drawings, rounded black flexible PVC bumper Tee-moulding.
- E. Core Material: As selected by fabricator to comply with quality standard.
- F. Core Material at Sinks: MDF made with exterior glue.
- G. Core Thickness: 3/4 inch (19 mm).
1. Build up countertop thickness to 1-1/2 inches (38 mm) at front, back, and ends with additional layers of core material laminated to top.
- H. Backer Sheet: Provide plastic laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.

2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.
1. Wood Moisture Content: 8 to 13 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.
1. MDF: Medium density fiberboard, ANSI A208.2, Grade 130.
 2. Particleboard: ANSI A208.1, Grade M-2 Exterior Glue.
 3. Softwood Plywood: DOC PS 1.

2.4 FIRE RETARDANT TREATED MATERIALS

- A. Fire Retardant Treated Materials: Where fire retardant treated materials are indicated, use materials acceptable to authorities having jurisdiction and with fire test response characteristics specified as determined by testing identical products according to test method indicated by a qualified testing agency.
1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
 2. Use fire retardant treatment formulations that do not bleed through or adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 3. Identify fire retardant treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

- B. Fire Retardant Treated Lumber and Plywood: Products with a flame spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
 - 1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
 - 2. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and defects affecting appearance of exposed treated woodwork.

- C. Fire Retardant Particleboard: Made from softwood particles and fire-retardant chemicals mixed at time of panel manufacture to achieve flame spread index of 25 or less and smoke developed index of 25 or less when tested according to ASTM E 84.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Flakeboard Company Limited.
 - b. SierraPine.
 - 2. For panels 3/4 inch (19 mm) thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: modulus of rupture, 1600 psi (11 MPa); modulus of elasticity, 300,000 psi (2070 MPa); internal bond, 80 psi (550 kPa); and screw holding capacity on face and edge, 250 and 225 lbf (1100 and 1000 N), respectively.

- D. Fire Retardant MDF: Medium density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame spread index of 25 or less and smoke developed index of 200 or less according to ASTM E 84.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Panel Source International, Inc.
 - b. SierraPine.

2.5 ACCESSORIES

- A. Wire Management Grommets: Circular, molded plastic grommets and matching plastic caps with slot for wire passage.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Doug Mockett & Company, Inc.
 - 2. Outside Diameter: 2 inches (51 mm).
 - 3. Color: Black.

- B. Countertop Support Brackets: Epoxy-coated, prefabricated rigid steel support bracket, with capacity of 1,000 lbs. per pair.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Hafele America Co.
 - b. Model: 287.74.327.
 - 2. Dimensions: 24-inches high by 29-inches long by 1/8-inch thick; for 30-inch deep counter/work-surface.
 - 3. Color: Black.

2.6 MISCELLANEOUS MATERIALS

- A. Adhesive for Bonding Plastic Laminate: PVA.
 - 1. Adhesive for Bonding Edges: Hot melt adhesive or adhesive specified for faces.

2.7 FABRICATION

- A. Sand fire retardant treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch (25 mm) over base cabinets. Ease edges to radius indicated for the following:
 - 1. Solid Wood (Lumber) Members: 1/16 inch (1.5 mm) unless otherwise indicated.
- C. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - 1. Seal edges of cutouts by saturating with varnish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.
- B. Before installing countertops, examine shop fabricated work for completion and complete work as required, including removal of packing.

3.2 INSTALLATION

- A. Grade: Install countertops to comply with same grade as item to be installed.
- B. Assemble countertops and complete fabrication at site to the extent that it was not completed in the shop.
 - 1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately using templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
- C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
 - 1. Secure field joints in countertops with concealed clamping devices located within 6 inches (150 mm) of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

- D. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Fire Retardant Treated Wood: Handle, store, and install fire retardant treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- F. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8 inch in 96 inches (3 mm in 2400 mm) variation from a straight, level plane.
 - 2. Secure backsplashes to walls with adhesive.
 - 3. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 ADJUSTING AND CLEANING

- A. Maintain installed work clean as work progresses. Leave finished work clean and free from blemishes.
- B. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.
- C. Clean countertops on exposed and semiexposed surfaces.
- D. Protection: Provide Kraft paper or suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches (1220 mm) o.c. Remove protection at Substantial Completion.

END OF SECTION

SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Mechanical sleeve seals.
 - 3. Sleeves.
 - 4. Escutcheons.
 - 5. Grout.
 - 6. Fire-suppression equipment and piping demolition.
 - 7. Equipment installation requirements common to equipment sections.
 - 8. Painting and finishing.
 - 9. Concrete bases.
 - 10. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. CPVC: Chlorinated polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Mechanical sleeve seals.
2. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

- C. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 21 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining CPVC Plastic Piping: ASTM F 493.

2.4 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Available Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Carbon steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.

2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated and rough brass.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated and rough brass.
- E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.7 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 FIRE-SUPPRESSION DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove fire-suppression systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 21 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
 - f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
 - g. Bare Piping in Equipment Rooms: One-piece, cast-brass type.

- h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
2. Existing Piping: Use the following:
- a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
 - b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and spring clips.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - e. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with rough-brass finish.
 - f. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
 - g. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
1. Cut sleeves to length for mounting flush with both surfaces.
- a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
- a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
- 1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- T. Verify final equipment locations for roughing-in.
- U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- 3.3 PIPING JOINT CONSTRUCTION
- A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.
 - B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 - C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 - D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

3.4 PAINTING

- A. Painting of fire-suppression systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor fire-suppression materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.8 GROUTING

- A. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 210500

SECTION 210513 - COMMON MOTOR REQUIREMENTS FOR FIRE SUPPRESSION EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in fire suppression equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
1. Permanent-split capacitor.
 2. Split phase.
 3. Capacitor start, inductor run.
 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 210513

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SECTION 211000 - WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following fire-suppression piping inside the building:
 - 1. Wet-pipe sprinkler systems.
 - 2. Dry-pipe sprinkler systems.
- B. Related Sections include the following:
 - 1. Division 28 Section "Fire Detection and Alarm" for alarm devices not specified in this Section.

1.3 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. High-Pressure Piping System: Fire-suppression piping system designed to operate at working pressure higher than standard 175 psig (1200 kPa).
- C. PE: Polyethylene plastic.
- D. Underground Service-Entrance Piping: Underground service piping below the building.

1.4 SYSTEM DESCRIPTIONS

- A. Combined Standpipe and Sprinkler System: Fire-suppression system with both standpipe and sprinkler systems. Sprinkler system is supplied from standpipe system.
- B. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.
- C. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Opening of sprinklers releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from opened sprinklers.

1.5 PERFORMANCE REQUIREMENTS

- A. Standard Piping System Component Working Pressure: Listed for at least 175 psig (1200 kPa).
- B. High-Pressure Piping System Component Working Pressure: Listed for 250 psig (1725 kPa) minimum.
- C. Fire-suppression sprinkler system design shall be approved by authorities having jurisdiction.
 - 1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 - 2. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. (6.3 mL/s over 139-sq. m) area.
 - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. (9.5 mL/s over 139-sq. m) area.
 - c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. (12.6 mL/s over 139-sq. m) area.
 - d. Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq. ft. (18.9 mL/s over 232-sq. m) area.
 - e. Extra-Hazard, Group 2 Occupancy: 0.40 gpm over 2500-sq. ft. (25.2 mL/s over 232-sq. m) area.
 - f. Special Occupancy Hazard: As determined by authorities having jurisdiction.
 - 3. Maximum Protection Area per Sprinkler:
 - a. Office Spaces: 120 sq. ft. (11.1 sq. m).
 - b. Storage Areas: 130 sq. ft. (12.1 sq. m).
 - c. Mechanical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
 - d. Electrical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
 - e. Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.
 - 4. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:
 - a. Light-Hazard Occupancies: 100 gpm (6.3 L/s) for 30 minutes.
 - b. Ordinary-Hazard Occupancies: 250 gpm (15.75 L/s) for 60 to 90 minutes.
 - c. Extra-Hazard Occupancies: 500 gpm (31.5 L/s) for 90 to 120 minutes.
- D. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13 and ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

1.6 SUBMITTALS

- A. Product Data: For the following:

1. Piping materials, including dielectric fittings and sprinkler specialty fittings.
 2. Pipe hangers and supports, including seismic restraints.
 3. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
 4. Air compressors, including electrical data.
 5. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
 6. Alarm devices, including electrical data.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Fire-hydrant flow test report.
- D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been signed and sealed by a professional engineer, including hydraulic calculations.
- E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
- F. Welding certificates.
- G. Field quality-control test reports.
- H. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
- C. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:
1. NFPA 13, "Installation of Sprinkler Systems."
 2. NFPA 415, "Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways."

1.8 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE AND FITTINGS

- A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed threaded ends.
 - 1. Cast-Iron Threaded Flanges: ASME B16.1.
 - 2. Malleable-Iron Threaded Fittings: ASME B16.3.
 - 3. Gray-Iron Threaded Fittings: ASME B16.4.
 - 4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe hot-dip galvanized where indicated. Include ends matching joining method.
 - 5. Steel Threaded Couplings: ASTM A 865 hot-dip galvanized-steel pipe where indicated.
- B. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795 hot-dip galvanized-steel pipe where indicated.
 - 1. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting.

- C. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795 hot-dip galvanized-steel pipe where indicated.
 - 1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
 - 2. Steel Flanges and Flanged Fittings: ASME B16.5.

- D. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory-formed, square-cut- or roll-grooved ends.
 - 1. Grooved-Joint Piping Systems:
 - a. Manufacturers:
 - 1) Victaulic Co. of America.
 - b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
 - c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

2.3 DIELECTRIC FITTINGS

- A. Assembly shall be copper alloy, ferrous, and insulating materials with ends matching piping system.

- B. Dielectric Unions: Factory-fabricated assembly, designed for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C). Include insulating material that isolates dissimilar materials and ends with inside threads according to ASME B1.20.1.
 - 1. Available Manufacturers:
 - a. Watts Industries, Inc.; Water Products Div.

- C. Dielectric Flange Insulation Kits: Components for field assembly shall include CR or phenolic gasket, PE or phenolic bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Available Manufacturers:
 - a. Advance Products and Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.

- D. Dielectric Couplings: Galvanized steel with inert and noncorrosive thermoplastic lining and threaded ends and 300-psig (2070-kPa) working-pressure rating at 225 deg F (107 deg C).
 - 1. Available Manufacturers:

- a. Calpico, Inc.
 - b. Lochinvar Corp.
- E. Dielectric Nipples: Electroplated steel with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved ends and 300-psig (2070-kPa) working-pressure rating at 225 deg F (107 deg C).
- 1. Available Manufacturers:
 - a. Perfection Corporation.
 - b. Precision Plumbing Products, Inc.
 - c. Victaulic Co. of America.

2.4 SPRINKLER SPECIALTY FITTINGS

- A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig (1200-kPa) minimum working-pressure rating, and made of materials compatible with piping. Sprinkler specialty fittings shall have 250-psig (1725-kPa) minimum working-pressure rating if fittings are components of high-pressure piping system.
- B. Outlet Specialty Fittings:
- 1. Mechanical-T and -Cross Fittings: UL 213, ductile-iron housing with gaskets, bolts and nuts, and threaded, locking-lug, or grooved outlets.
 - 2. Snap-On and Strapless Outlet Fittings: UL 213, ductile-iron housing or casting with gasket and threaded outlet.
- C. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.
- D. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.
- E. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.
- F. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.
- G. Dry-Pipe-System Fittings: UL listed for dry-pipe service.

2.5 LISTED FIRE-PROTECTION VALVES

- A. Valves shall be UL listed or FMG approved, with 175-psig (1200 kPa) minimum pressure rating. Valves shall have 250-psig (1725-kPa) minimum pressure rating if valves are components of high-pressure piping system.
- B. Ball Valves: Comply with UL 1091, except with ball instead of disc.
- 1. NPS 1-1/2 (DN 40) and Smaller: Bronze body with threaded ends.

2. NPS 2 and NPS 2-1/2 (DN 50 and DN 65): Bronze body with threaded ends or ductile-iron body with grooved ends.
 3. NPS 3 (DN 80): Ductile-iron body with grooved ends.
 4. Available Manufacturers:
 - a. NIBCO.
 - b. Victaulic Co. of America.
- C. Butterfly Valves: UL 1091.
1. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.
 - a. Available Manufacturers:
 - 1) Global Safety Products, Inc.
 - 2) Milwaukee Valve Company.
 2. NPS 2-1/2 (DN 65) and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.
 - a. Available Manufacturers:
 - 1) Central Sprinkler Corp.
 - 2) Global Safety Products, Inc.
 - 3) McWane, Inc.; Kennedy Valve Div.
 - 4) Mueller Company.
 - 5) NIBCO.
 - 6) Pratt, Henry Company.
 - 7) Victaulic Co. of America.
- D. Check Valves NPS 2 (DN 50) and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.
1. Available Manufacturers:
 - a. Grinnell Fire Protection.
 - b. NIBCO.
 - c. Reliable Automatic Sprinkler Co., Inc.
 - d. Victaulic Co. of America.
 - e. Watts Industries, Inc.; Water Products Div.
- E. Gate Valves: UL 262, OS&Y type.
1. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.
 - a. Available Manufacturers:
 - 1) Crane Co.; Crane Valve Group; Crane Valves.
 - 2) Hammond Valve.
 - 3) NIBCO.
 - 4) United Brass Works, Inc.

2. NPS 2-1/2 (DN 65) and Larger: Cast-iron body with flanged ends.

a. Available Manufacturers:

- 1) Milwaukee Valve Company.
- 2) Mueller Company.
- 3) NIBCO.

F. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.

1. Indicator: Electrical, 115-V ac, prewired, single-circuit, supervisory switch.
2. NPS 2 (DN 50) and Smaller: Ball or butterfly valve with bronze body and threaded ends.

a. Available Manufacturers:

- 1) Milwaukee Valve Company.
- 2) NIBCO.
- 3) Victaulic Co. of America.

3. NPS 2-1/2 (DN 65) and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.

a. Available Manufacturers:

- 1) Central Sprinkler Corp.
- 2) Grinnell Fire Protection.
- 3) McWane, Inc.; Kennedy Valve Div.
- 4) Milwaukee Valve Company.
- 5) NIBCO.
- 6) Victaulic Co. of America.

2.6 UNLISTED GENERAL-DUTY VALVES

- A. Ball Valves NPS 2 (DN 50) and Smaller: MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600-psig (4140-kPa) minimum CWP rating, blowout-proof stem, and threaded ends.
- B. Check Valves NPS 2 (DN 50) and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.
- C. Gate Valves NPS 2 (DN 50) and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.
- D. Globe Valves NPS 2 (DN 50) and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.7 SPECIALTY VALVES

- A. Sprinkler System Control Valves: UL listed or FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig (1200-kPa) minimum pressure rating. Control valves shall have 250-psig (1725-kPa) minimum pressure rating if valves are components of high-pressure piping system.
1. Available Manufacturers:
 - a. Central Sprinkler Corp.
 - b. Grinnell Fire Protection.
 - c. Reliable Automatic Sprinkler Co., Inc.
 - d. Victaulic Co. of America.
 - e. Viking Corp.
 2. Alarm Check Valves: UL 193, designed for horizontal or vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin, and latch design. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
 - a. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
 - b. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
 3. Dry-Pipe Valves: UL 260, differential type; with bronze seat with O-ring seals, single-hinge pin, and latch design. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - a. Air-Pressure Maintenance Device: UL 260, automatic device to maintain correct air pressure in piping. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range, and 175-psig (1200-kPa) maximum inlet pressure.
 - 1) Available Manufacturers:
 - a) Central Sprinkler Corp.
 - b) Grinnell Fire Protection.
 - c) Reliable Automatic Sprinkler Co., Inc.
 - d) Viking Corp.
 - b. Air Compressor: UL 753, fractional horsepower, 120-V ac, 60 Hz, single phase.
 - 1) Available Manufacturers:
 - a) Grinnell Fire Protection.
 - b) Reliable Automatic Sprinkler Co., Inc.
 - c) Viking Corp.

2.8 SPRINKLERS

- A. Sprinklers shall be UL listed or FMG approved, with 175-psig (1200-kPa) minimum pressure rating. Sprinklers shall have 250-psig (1725-kPa) minimum pressure rating if sprinklers are components of high-pressure piping system.
- B. Available Manufacturers:
1. Central Sprinkler Corp.
 2. Grinnell Fire Protection.
 3. Reliable Automatic Sprinkler Co., Inc.
 4. Victaulic Co. of America.
 5. Viking Corp.
- C. Automatic Sprinklers: With heat-responsive element complying with the following:
1. UL 199, for nonresidential applications.
 2. UL 1626, for residential applications.
 3. UL 1767, for early-suppression, fast-response applications.
- D. Sprinkler Types and Categories: Nominal 1/2-inch (12.7-mm) orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
1. Open Sprinklers: UL 199, without heat-responsive element.
 - a. Orifice: 1/2 inch (12.7 mm), with discharge coefficient K between 5.3 and 5.8.
 - b. Orifice: 17/32 inch (13.5 mm), with discharge coefficient K between 7.4 and 8.2.
- E. Sprinkler types, features, and options as follows:
1. Concealed ceiling sprinklers, including cover plate.
 2. Extended-coverage sprinklers.
 3. Flow-control sprinklers, with automatic open and shutoff feature.
 4. Flush ceiling sprinklers, including escutcheon.
 5. High-pressure sprinklers.
 6. Open sprinklers.
 7. Pendent sprinklers.
 8. Pendent, dry-type sprinklers.
 9. Quick-response sprinklers.
 10. Recessed sprinklers, including escutcheon.
 11. Sidewall sprinklers.
 12. Sidewall, dry-type sprinklers.
 13. Upright sprinklers.
- F. Sprinkler Finishes: Chrome plated, bronze, and painted.
- G. Special Coatings: Wax, lead, and corrosion-resistant paint.
- H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat with 1-inch (25-mm) vertical adjustment.
 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- I. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

2.9 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig (1725-kPa) pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
1. Available Manufacturers:
 - a. ADT Security Services, Inc.
 - b. Grinnell Fire Protection.
 - c. ITT McDonnell & Miller.
 - d. Potter Electric Signal Company.
 - e. System Sensor.
 - f. Viking Corp.
 - g. Watts Industries, Inc.; Water Products Div.
- C. Pressure Switch: UL 753, electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.
1. Available Manufacturers:
 - a. Grinnell Fire Protection.
 - b. Potter Electric Signal Company.
 - c. System Sensor.
 - d. Viking Corp.
- D. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
1. Available Manufacturers:
 - a. McWane, Inc.; Kennedy Valve Div.
 - b. Potter Electric Signal Company.
 - c. System Sensor.

2.10 PRESSURE GAGES

- A. Description: UL 393, 3-1/2- to 4-1/2-inch- (90- to 115-mm-) diameter, dial pressure gage with range of 0 to 250 psig (0 to 1725 kPa) minimum.
 - 1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.
 - 2. Air System Piping: Include retard feature and caption "AIR" or "AIR/WATER" on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in Part 1 "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.2 EARTHWORK

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.3 EXAMINATION

- A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.
- B. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 PIPING APPLICATIONS, GENERAL

- A. Shop weld pipe joints where welded piping is indicated.
- B. Do not use welded joints for galvanized-steel pipe.
- C. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
- D. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.

3.5 SPRINKLER SYSTEM PIPING APPLICATIONS

A. Standard-Pressure, Wet-Pipe Sprinkler System, 175-psig (1200-kPa) Maximum Working Pressure:

1. Sprinkler-Piping Fitting Option: Specialty sprinkler fittings, [NPS 2 (DN 50)] [NPS 2-1/2 (DN 65)] [NPS 3 (DN 80)] and smaller, including mechanical-T and -cross fittings, may be used downstream from sprinkler zone valves.
2. NPS 1-1/2 (DN 40) and Smaller: Threaded-end, black, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
3. NPS 2 (DN 50): Threaded-end, black, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
4. NPS 2 (DN 50): Plain-end, black, standard-weight steel pipe; steel welding fittings; and welded joints.
5. NPS 2 (DN 50): Grooved-end, black, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
6. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Threaded-end, black, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
7. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Plain-end, black, standard-weight steel pipe; steel welding fittings; and welded joints.
8. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Grooved-end, black, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
9. NPS 4 to NPS 6 (DN 100 to DN 150): Plain-end, black, standard-weight steel pipe; steel welding fittings; and welded joints.
10. NPS 4 to NPS 6 (DN 100 to DN 150): Grooved-end, black, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

B. Standard-Pressure, Dry-Pipe Sprinkler System, 175-psig (1200-kPa) Maximum Working Pressure:

1. NPS 1-1/2 (DN 40) and Smaller: Threaded-end, galvanized, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
2. NPS 2 (DN 50): Threaded-end, galvanized, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
3. NPS 2 (DN 50): Grooved-end, galvanized, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Threaded-end, galvanized, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
5. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Grooved-end, galvanized, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
6. NPS 4 to NPS 6 (DN 100 to DN 150): Grooved-end, galvanized, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.6 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13.

- a. Shutoff Duty: Use ball or gate valves.

3.7 JOINT CONSTRUCTION

- A. Refer to Division 21 Section "Common Work Results for Fire Suppression" for basic piping joint construction.
- B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 (DN 200) with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.
- C. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.
 1. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
 2. Dry-Pipe Systems: Use fittings and gaskets listed for dry-pipe service.
- D. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.
 1. NPS 2 (DN 50) and Smaller: Use dielectric unions, couplings, or nipples.
 2. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.
 3. NPS 5 (DN 125) and Larger: Use dielectric flange insulation kits.

3.8 PIPING INSTALLATION

- A. Refer to Division 21 Section "Common Work Results for Fire Suppression" for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- C. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.
- E. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.

- H. Install alarm devices in piping systems.
- I. Hangers and Supports: Comply with NFPA 13 for hanger materials.
 - 1. Install sprinkler system piping according to NFPA 13.
- J. Earthquake Protection: Install piping according to NFPA 13 to protect from earthquake damage.
- K. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- L. Drain dry-pipe sprinkler piping.
- M. Pressurize and check dry-pipe sprinkler system piping and air-pressure maintenance devices.
- N. Fill wet-pipe sprinkler system piping with water.

3.9 VALVE INSTALLATION

- A. Install listed fire-protection valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.
- D. Specialty Valves:
 - 1. Alarm Check Valves: Install in vertical position for proper direction of flow, including bypass check valve and retarding chamber drain-line connection.
 - 2. Dry-Pipe Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - a. Air-Pressure Maintenance Devices for Dry-Pipe Systems: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range; and 175-psig (1200-kPa) maximum inlet pressure.
 - b. Install air compressor and compressed-air supply piping.

3.10 SPRINKLER APPLICATIONS

- A. Drawings indicate sprinkler types to be used. Where specific types are not indicated, use the following sprinkler types:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Pendent sprinklers.
3. Wall Mounting: Sidewall sprinklers.
4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated.
5. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated.
6. Sprinkler Finishes:
 - a. Upright, Pendent, and Sidewall Sprinklers: White painted in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.
 - b. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 - c. Flush Sprinklers: Bright chrome, with painted white escutcheon.
 - d. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
 - e. Residential Sprinklers: Dull chrome.

3.11 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels and tiles.
- B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

3.12 MONITOR INSTALLATION

- A. Install monitor bases securely attached to building substrate.

3.13 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.
- D. Connect air compressor to the following piping and wiring:
 1. Pressure gages and controls.
 2. Electrical power system.
 3. Fire alarm devices, including low-pressure alarm.
- E. Electrical Connections: Power wiring is specified in Division 26.
- F. Connect alarm devices to fire alarm.

- G. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- H. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- I. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.14 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

3.15 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Energize circuits to electrical equipment and devices.
 - 4. Start and run air compressors.
 - 5. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 6. Coordinate with fire alarm tests. Operate as required.
- B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.16 CLEANING AND PROTECTION

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.
- C. Protect sprinklers from damage until Substantial Completion.

3.17 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 211000

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Joining materials.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Equipment installation requirements common to equipment sections.
9. Concrete bases.
10. Supports and anchorages.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

- A. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

- B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

- E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

- F. Welding Filler Metals: Comply with AWS D10.12.

- G. Solvent Cements for Joining Plastic Piping and Tubing:
 - 1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 2. CPVC Piping: ASTM F 493.

2.3 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.4 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Carbon steel. Include two for each sealing element.
- D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.

2.7 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.

- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors.
- M. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.
- N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
 - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Nonpressure Piping: Join according to ASTM D 2855.
- J. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- K. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- L. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.5 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.8 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 220500

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Liquid-in-glass thermometers.
2. Thermowells.
3. Dial-type pressure gages.
4. Gage attachments.

B. Related Sections:

1. Division 21 Section "Facility Fire-Suppression Water-Service Piping" for fire-protection water-service meters outside the building.
2. Division 21 fire-suppression piping Sections for fire-protection pressure gages.
3. Division 22 Section "Facility Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.
4. Division 22 Section "Domestic Water Piping" for water meters inside the building.

1.2 ACTION SUBMITTALS

- ##### A. Product Data:
- For each type of product indicated.

1.3 CLOSEOUT SUBMITTALS

- ##### A. Operation and Maintenance Data:
- For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Palmer Wahl Instrumentation Group.
 - b. Terice, H. O. Co.
 - c. Weiss Instruments, Inc.
 - d. Winters Instruments - U.S.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 7-inch (178-mm) nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
7. Window: Glass or plastic.
8. Stem: Aluminum and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
9. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ashcroft Inc.
 - b. Palmer Wahl Instrumentation Group.
 - c. Terice, H. O. Co.
 - d. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - e. Weiss Instruments, Inc.

2. Standard: ASME B40.100.
3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Ring: Brass.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.4 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- G. Install valve and snubber in piping for each pressure gage for fluids.
- H. Install thermometers in the following locations:
 1. Outlet of each water heater.
 2. Inlet of each circulator pump.

- I. Install pressure gages in the following locations:
 - 1. Building water service entrance into building.
 - 2. Inlet and outlet of each pressure-reducing valve.

3.2 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

- A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F and 0 to 150 deg C.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Water Piping: 0 to 100 psi and 0 to 600 kPa.

END OF SECTION 220519

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Iron, single-flange butterfly valves.
4. Bronze swing check valves.

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.2 DEFINITIONS

A. CWP: Cold working pressure.

B. Easy Access: Access to a valve that is either exposed or concealed within a valve box, access panel, above a lay-in type ceiling, or other means not requiring removal of a permanent wall or ceiling and accessed in a squatting, sitting, or standing position, or by use of a ladder with no obstacles preventing direct access.

C. EPDM: Ethylene propylene copolymer rubber.

D. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

E. SWP: Steam working pressure.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.4 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set ball valves open to minimize exposure of functional surfaces.
 - 4. Set butterfly valves closed or slightly open.
 - 5. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Handwheel: For valves other than quarter-turn types.
 - 2. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller.
- E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
 - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - 2. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
 - c. Hammond Valve.
 - d. Jamesbury; a subsidiary of Metso Automation.
 - e. Kitz Corporation.
 - f. Marwin Valve; a division of Richards Industries.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Two piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Crane Co.; Crane Valve Group; Crane Valves.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.

- f. NIBCO INC.
- g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig (1035 kPa).
- c. CWP Rating: 600 psig (4140 kPa).
- d. Body Design: Two piece.
- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Bronze.
- i. Ball: Chrome-plated brass.
- j. Port: Full.

2.4 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. American Valve, Inc.
- b. Conbraco Industries, Inc.; Apollo Valves.
- c. Crane Co.; Crane Valve Group; Center Line.
- d. Hammond Valve.
- e. Kitz Corporation.
- f. Milwaukee Valve Company.
- g. NIBCO INC.
- h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 200 psig (1380 kPa).
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Nickel-plated ductile iron.

2.5 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. American Valve, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Hammond Valve.
 - e. Kitz Corporation.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
- a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 1. Shutoff Service: Ball or butterfly valves.
 2. Pump-Discharge Check Valves:
 - a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze disc.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 (DN 50) and Smaller:
 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 2. Ball Valves: Two piece, full port, brass or bronze with trim of same material.
 3. Bronze Swing Check Valves: Class 125, bronze disc.
- B. Pipe NPS 2-1/2 (DN 65) and Larger:
 1. Bronze and Brass Valves: NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
 2. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, ductile-iron disc.

3.6 SANITARY-WASTE VALVE SCHEDULE

- A. Pipe NPS 2 (DN 50) and Smaller:
 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.

2. Bronze Swing Check Valves: Class 125, bronze disc.
3. Bronze Gate Valves: Class 125, NRS.

END OF SECTION 220523

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SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe positioning systems.
7. Equipment supports.

B. Related Sections:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 fire-suppression piping Sections for pipe hangers for fire-suppression piping.
3. Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.

1.2 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Equipment supports.

C. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper B-Line, Inc.
 - b. Flex-Strut Inc.
 - c. Power-Strut Div.; Tyco International, Ltd.
 - d. Thomas & Betts Corporation.
 - e. Unistrut Corporation; Tyco International, Ltd.
2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
7. Plastic Coating: Polyurethane.

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Carpenter & Paterson, Inc.
 2. National Pipe Hanger Corporation.
 3. PHS Industries, Inc.
 4. Piping Technology & Products, Inc.
 5. Rilco Manufacturing Co., Inc.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.7 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.

- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- N. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
 - d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
 - 5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.5 PAINTING

- A. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use padded hangers for piping that is subject to scratching.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
 - 5. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 - 6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - 7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - 8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
 - 9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

- J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb (340 kg).
 - b. Medium (MSS Type 32): 1500 lb (680 kg).
 - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
 7. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

- O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- P. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

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SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Equipment labels.
 2. Warning signs and labels.
 3. Pipe labels.
 4. Stencils.
 5. Valve tags.
 6. Warning tags.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system to include in maintenance manuals.

1.3 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
1. Material and Thickness: Brass, 0.032-inch (0.8-mm) Stainless steel, 0.025-inch (0.64-mm) Aluminum, 0.032-inch (0.8-mm) or anodized aluminum, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
 3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 4. Fasteners: Stainless-steel rivets or self-tapping screws.
 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: Yellow.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
- F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

- B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches (38 mm) high.

2.4 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.
 - 1. Stencil Material: Aluminum.
 - 2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.
 - 1. Tag Material: Brass, 0.032-inch (0.8-mm) Stainless steel, 0.025-inch (0.64-mm) Aluminum, 0.032-inch (0.8-mm) or anodized aluminum, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link or beaded chain.
- B. Metal Ceiling Labels for Valves: Engraved with 1/2-inch (13-mm) letters for piping system abbreviation and valve numbers.
 - 1. Material and Thickness: Brass, 0.032-inch (0.8-mm) Stainless steel, 0.025-inch (0.64-mm) Aluminum, 0.032-inch (0.8-mm) or anodized aluminum, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
 - 3. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size: 3 by 5-1/4 inches (75 by 133 mm) minimum.
 - 2. Fasteners: Reinforced grommet and wire or string.
 - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
 - 1. Domestic Water Piping:

- a. Background Color: Green.
 - b. Letter Color: White.
2. Natural Gas or LP Piping:
 - a. Background Color: Yellow.
 - b. Letter Color: Black.
 3. Sanitary Waste and Storm Drainage Piping:
 - a. Background Color: White.
 - b. Letter Color: Black.

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Provide valve labels with valve tag number on ceiling grid close to valve location for valves concealed above the ceiling.
- C. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 1. Valve-Tag Size and Shape:
 - a. Cold Water: 1-1/2 inches (38 mm), round.
 - b. Hot Water: 1-1/2 inches (38 mm), round.
 2. Valve-Tag Color:
 - a. Cold Water: Green.
 - b. Hot Water: Green.
 - c. Natural Gas or LPG: Yellow.
 3. Letter Color:
 - a. Cold Water: White.
 - b. Hot Water: White.
 - c. Natural Gas or LPG: Black.

3.5 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

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SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic cold-water piping.
 - 2. Domestic hot-water piping.
 - 3. Domestic recirculating hot-water piping.
 - 4. Roof drains and rainwater leaders.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).
- B. Field quality-control reports.

1.3 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.4 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.5 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cell-U-Foam Corporation; Ultra-CUF.
 - b. Pittsburgh Corning Corporation; Foamglas.
 - 2. Block Insulation: ASTM C 552, Type I.
 - 3. Special-Shaped Insulation: ASTM C 552, Type III.
 - 4. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
 - 5. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.

- c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
- d. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

H. Mineral-Fiber, Preformed Pipe Insulation:

- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000-Degree Pipe Insulation.
 - d. Owens Corning; Fiberglas Pipe Insulation.
- 2. Type I, 850 Deg F (454 Deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials.

- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armacell LLC; Tubolit.
 - b. Nomaco Insulation; IMCOLOCK and NOMALOCK.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Insulco, Division of MFS, Inc.; SmoothKote.
 - b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
 - c. Ramco Insulation, Inc.; Super-Stik.
 - d. Rock Wool Manufacturing Company; Delta One Shot.

B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Insulco, Division of MFS, Inc.; SmoothKote.
 - b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
 - c. Ramco Insulation, Inc.; Super-Stik.
 - d. Rock Wool Manufacturing Company; Delta One Shot.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-96.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aeroseal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
 - e. RBX Corporation; Rubatex Contact Adhesive.
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - d. Mon-Eco Industries, Inc.; 22-25.
- E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
 - d. Mon-Eco Industries, Inc.; 22-25.
- F. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 739, Dow Silicone.
 - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.

- d. Speedline Corporation; Polyco VP Adhesive.

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.
 - d. Marathon Industries, Inc.; 590.
 - e. Mon-Eco Industries, Inc.; 55-40.
 - f. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
 - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 5. Color: White.

2.5 SEALANTS

- A. Joint Sealants:
 - 1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Pittsburgh Corning Corporation; Pittseal 444.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Permanently flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
 - 5. Color: White or gray.
- B. FSK and Metal Jacket Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

- b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - d. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
 5. Color: Aluminum.
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
 5. Color: White.

2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for pipe.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A-Fab.
 - b. Vimasco Corporation; Elastafab 894.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: White.
 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- C. Metal Jacket:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
 - c. RPR Products, Inc.; Insul-Mate.
 2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
- D. Underground Direct-Buried Jacket: 125-mil- (3.2-mm-) thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pittsburgh Corning Corporation; Pittwrap.
 - b. Polyguard Products, Inc.; Insulrap No Torch 125.

2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches (75 mm).
 3. Thickness: 11.5 mils (0.29 mm).
 4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
 2. Width: 3 inches (75 mm).
 3. Thickness: 6.5 mils (0.16 mm).
 4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 370 White PVC tape.
 - b. Compac Corporation; 130.
 - c. Venture Tape; 1506 CW NS.
 2. Width: 2 inches (50 mm).
 3. Thickness: 6 mils (0.15 mm).
 4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
 5. Elongation: 500 percent.
 6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 488 AWF.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - c. Compac Corporation; 120.
 - d. Venture Tape; 3520 CW.
 2. Width: 2 inches (50 mm).
 3. Thickness: 3.7 mils (0.093 mm).
 4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.

5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.10 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping and Seals.
2. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.

B. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
 - c. Spindle: Aluminum, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) GEMCO; Nylon Hangers.
 - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
 - b. Baseplate: Perforated, nylon sheet, 0.030 inch (0.76 mm) thick by 1-1/2 inches (38 mm) in diameter.

- c. Spindle: Nylon, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches (63 mm).
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.
- D. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. C & F Wire.
 - b. Childers Products.
 - c. PABCO Metals Corporation.
 - d. RPR Products, Inc.

2.11 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Engineered Brass Company.
 - b. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
 - c. McGuire Manufacturing.
 - d. Plumberex.
 - e. Truebro; a brand of IPS Corporation.
 - f. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
 - 2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.12 CORNER ANGLES

- A. PVC Corner Angles: 30 mils (0.8 mm) thick, minimum 1 by 1 inch (25 by 25 mm), PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.

- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
1. Install insulation continuously through hangers and around anchor attachments.
 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
 - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

- A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
 2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
 3. Protect exposed corners with secured corner angles.
 4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
 - a. Do not weld anchor pins to ASME-labeled pressure vessels.
 - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
 - c. On tanks and vessels, maximum anchor-pin spacing is 3 inches (75 mm) from insulation end joints, and 16 inches (400 mm) o.c. in both directions.
 - d. Do not overcompress insulation during installation.
 - e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
 - f. Impale insulation over anchor pins and attach speed washers.
 - g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
 6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches (150 mm) from each end. Install wire or cable between two circumferential girdles 12 inches (300 mm) o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches (1200 mm) o.c. Use this network for securing insulation with tie wire or bands.
 7. Stagger joints between insulation layers at least 3 inches (75 mm).
 8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
 9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
 10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.
- B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.
1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
 2. Seal longitudinal seams and end joints.

3.6 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.7 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.8 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.9 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.10 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.11 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

- D. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.12 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
 - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.13 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.14 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Hot and Recirculated Hot Water:
 - 1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
 - b. Flexible Elastomeric: 3/4 inch (19 mm).
 - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
 - 2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches (38 mm) thick.

- b. Flexible Elastomeric: 1 inch (25 mm) thick.
- c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

B. Stormwater and Overflow:

- 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

C. Roof Drain and Overflow Drain Bodies:

- 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

D. Condensate:

- 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

E. Condensate Receptors and Drain Bodies:

- 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

3.15 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping:

- 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Cellular Glass: 2 inches (50 mm) thick.
 - b. Flexible Elastomeric: 2 inches (50 mm) thick.
 - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.

B. Domestic Hot and Recirculated Hot Water:

- 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Cellular Glass: 2 inches (50 mm) thick.
 - b. Flexible Elastomeric: 2 inches (50 mm) thick.
 - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.

3.16 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
 - 1. PVC: 20 mils (0.5 mm) thick.

END OF SECTION 220700

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. CPVC pipe and fittings.
3. Ductile-iron pipe and fittings.
4. Pipe joining materials.
5. Encasement for piping.
6. Dielectric fittings.

1.2 RELATED REQUIREMENTS

- ##### A. Division 22 Section "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.3 SUBMITTALS

- ##### A. Product Data: For each type of product indicated.
- ##### B. Field quality-control reports.

1.4 FIELD CONDITIONS

- ##### A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
1. Notify Owner no fewer than two days in advance of proposed interruption of water service.
 2. Do not interrupt water service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- ##### A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

- B. Potable-water piping and components shall comply with NSF 14 and NSF 61.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) or ASTM B 88, Type K (ASTM B 88M, Type A) water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
 - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 ENCASEMENT FOR PIPING

- A. Standard: ASTM A 674 or AWWA C105/A21.5.
- B. Form: Sheet or tube.
- C. Color: Black or natural.

2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
 - b. Hart Industries International, Inc.
 - c. Jomar International.
 - d. Matco-Norca.
 - e. Watts; a division of Watts Water Technologies, Inc.
 - f. Wilkins; a Zurn company.
 2. Standard: ASSE 1079.
 3. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
 4. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
 - b. Matco-Norca.
 - c. Watts; a division of Watts Water Technologies, Inc.
 - d. Wilkins; a Zurn company.
 2. Standard: ASSE 1079.
 3. Factory-fabricated, bolted, companion-flange assembly.
 4. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
 5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 2. Nonconducting materials for field assembly of companion flanges.
 3. Pressure Rating: 150 psig (1035 kPa).
 4. Gasket: Neoprene or phenolic.
 5. Bolt Sleeves: Phenolic or polyethylene.

6. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elster Perfection Corporation.
 - b. Grinnell Mechanical Products; Tyco Fire Products LP.
 - c. Matco-Norca.
 - d. Precision Plumbing Products, Inc.
 - e. Victaulic Company.
2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F 1545.
4. Pressure Rating and Temperature: 300 psig (2070 kPa) at 225 deg F (107 deg C).
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Division 22 Section "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Division 22 Section "Domestic Water Piping Specialties."
- E. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- F. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

- G. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

3.3 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 - 2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 - 3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
 - 4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
 - 5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
 - 6. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
 - 7. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.

- E. Install supports for vertical copper tubing every 10 feet (3 m).
- F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code. Comply with requirements for connection sizes in Division 22 plumbing fixture Sections.
 - 3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.7 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Division 22 Section "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.

- 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
2. Piping Tests:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 1 ½ times working pressure but not less than 100 psig, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for two hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.9 ADJUSTING

- A. Perform the following adjustments before operation:
 1. Close drain valves, hydrants, and hose bibbs.
 2. Open shutoff valves to fully open position.
 3. Open throttling valves to proper setting.
 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Adjust calibrated balancing valves to flows indicated.
 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Clean non-potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Under-building-slab, domestic water, building-service piping, NPS 3 (DN 80) and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A); wrought-copper, solder-joint fittings; and brazed joints.
- D. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 (DN 100 to DN 200) and larger, shall be one of the following:
1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A); wrought-copper, solder-joint fittings; and brazed joints.
- E. Aboveground domestic water piping, NPS 1-1/2 (DN 40) and smaller, shall be one of the following:
1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast- or wrought-copper, solder-joint fittings; and soldered joints.
- F. Aboveground domestic water piping, NPS 2 to NPS 4 (DN 50 to DN 100), shall be one of the following:
1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast- or wrought-copper, solder-joint fittings; and soldered joints.

3.12 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Shutoff Duty: Use ball valves for piping NPS 2 (DN 50) and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger. Use butterfly valves with flanged ends for piping NPS 6 (DN 150) and larger.
 2. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
 3. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116

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SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Balancing valves.
4. Temperature-actuated, water mixing valves.
5. Strainers.
6. Outlet boxes.
7. Hose bibbs.
8. Drain valves.
9. Water-hammer arresters.
10. Water meters.

B. Related Requirements:

1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers and pressure gages in domestic water piping.
2. Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

1.2 SUBMITTALS

- A. Product Data: For each type of product.
- B. Field quality-control reports.
- C. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61 and NSF 14.

2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa) unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
 - b. Conbraco Industries, Inc.
 - c. Toro Company (The); Irrigation Div.
 - d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. MIFAB, Inc.
 - c. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - d. Woodford Manufacturing Company; a division of WCM Industries, Inc.
 - e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Rough bronze.

2.4 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
 - b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Size: NPS 3/4 (DN 20).
5. Design Flow Rate: 10 gpm (38 L/s).

6. Pressure Loss at Design Flow Rate: 13 psig (90 kPa).
7. Body: Bronze.
8. End Connections: Threaded.
9. Configuration: Designed for horizontal, straight-through flow.
10. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.5 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves <B.V.>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. ITT Corporation; Bell & Gossett Div.
 - c. NIBCO Inc.
 - d. TACO Incorporated.
 - e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
2. Type: Ball or Y-pattern globe valve with two readout ports and memory-setting indicator.
3. Body: Brass or bronze.
4. Size: Same as connected piping.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.6 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Primary, Thermostatic, Water Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bradley Corporation.
 - b. Lawler Manufacturing Company, Inc.
 - c. Leonard Valve Company.
 - d. Powers; a division of Watts Water Technologies, Inc.
 - e. Symmons Industries, Inc.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
4. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: 110 deg F (43 deg C).

9. Valve Finish: Rough bronze.
10. Piping Finish: Copper.

B. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bradley Corporation.
 - b. Lawler Manufacturing Company, Inc.
 - c. Leonard Valve Company.
 - d. Powers; a division of Watts Water Technologies, Inc.
 - e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - f. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1070, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
4. Body: Bronze or polysulfone with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Tempered-Water Setting: 110 deg F (43 deg C).

2.7 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
2. Body: Bronze.
3. End Connections: Threaded.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
 - a. Strainers NPS 2 (DN 50) and Smaller: 0.020 inch (0.51 mm).
6. Drain: Pipe plug.

2.8 OUTLET BOXES

A. Clothes Washer Outlet Boxes <WB-1>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Engineering Company.
 - b. Guy Gray Manufacturing Co., Inc.
 - c. IPS Corporation.
 - d. Oatey.
2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.

4. Faucet: Combination valved fitting or separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
5. Supply Shutoff Fittings: NPS 1/2 (DN 15) ball valves and NPS 1/2 (DN 15) copper, water tubing.
6. Drain: NPS 2 (DN 50) standpipe and P-trap for direct waste connection to drainage piping.

B. Icemaker Outlet Boxes <IB-1>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Engineering Company.
 - b. Guy Gray Manufacturing Co., Inc.
 - c. IPS Corporation.
 - d. Oatey.
2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 (DN 15) or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 (DN 15) ball valve and NPS 1/2 (DN 15) copper, water tubing.

2.9 HOSE BIBBS

A. Hose Bibbs <HB-1>:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 3/4 (DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig (860 kPa).
7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze, or chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle.
12. Operation for Service Areas: Operating key.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.10 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.11 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. MIFAB, Inc.
 - c. Precision Plumbing Products, Inc.
 - d. Sioux Chief Manufacturing Company, Inc.
 - e. Watts Drainage Products.
 - f. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.12 WATER METERS

A. Displacement-Type Water Meters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AALIAN; a Venture Measurement product line.
 - b. Badger Meter, Inc.
 - c. Mueller Co. Ltd.; a subsidiary of Mueller Water Products Inc.
 - d. Sensus.
2. Description:
 - a. Standard: AWWA C700.
 - b. Pressure Rating: 150-psig (1035-kPa) working pressure.
 - c. Body Design: Nutating disc; totalization meter.
 - d. Registration: In gallons (liters) or cubic feet (cubic meters) as required by utility company.
 - e. Case: Bronze.

f. End Connections: Threaded.

- B. Remote Registration System: Direct-reading type complying with AWWA C706; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
1. Locate backflow preventers in same room as connected equipment or system.
 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
 3. Do not install bypass piping around backflow preventers.
 4. Install backflow preventers 18-36" above finished floor. Test results to be turned over to grounds department within 10 working days for annual inspection scheduling.
- B. Install balancing valves in locations where they can easily be adjusted.
- C. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
1. Install cabinet-type units recessed in or surface mounted on wall as specified.
- D. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch (38-by-89-mm) fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Division 06 Section "Rough Carpentry."
- E. Install water-hammer arresters in water piping according to PDI-WH 201.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
1. Pressure vacuum breakers.

2. Reduced-pressure-principle backflow preventers.
3. Water pressure-reducing valves.
4. Calibrated balancing valves.
5. Primary, thermostatic, water mixing valves.
6. Outlet boxes.

- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:

1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
2. Test results to be turned over to grounds department within 10 working days for annual inspection scheduling.

- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

- C. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.

- B. Set field-adjustable flow set points of balancing valves.

- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 221119

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

B. Related Sections:

1. Division 22 Section "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.2 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).
2. Waste, Force-Main Piping: 150 psig (1035 kPa).

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Fernco Inc.
 - c. Matco-Norca, Inc.
 - d. MIFAB, Inc.
 - e. Tyler Pipe.
 2. Standards: ASTM C 1277 and CISPI 310.
 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Heavy-Duty, Hubless-Piping Couplings:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Clamp-All Corp.
 - c. MIFAB, Inc.
 - d. Tyler Pipe.
 2. Standards: ASTM C 1277 and ASTM C 1540.

3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Hard Copper Tube: ASTM B 88, Type L and Type M (ASTM B 88M, Type B and Type C), water tube, drawn temper.
- D. Soft Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, annealed temper.
- E. Copper Pressure Fittings:
 1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- F. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- G. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.5 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.
 1. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Solvent Cement: ASTM D 2564.
 1. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Dallas Specialty & Mfg. Co.
 - 2) Fernco Inc.
 - 3) Mission Rubber Company; a division of MCP Industries, Inc.
 - 4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
 - b. Standard: ASTM C 1173.
 - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - d. Sleeve Materials:
 - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
4. Pressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cascade Waterworks Mfg. Co.
 - 2) Dresser, Inc.
 - 3) Romac Industries, Inc.
 - 4) Smith-Blair, Inc.; a Sensus company.
 - 5) The Ford Meter Box Company, Inc.
 - 6) Viking Johnson.
 - b. Standard: AWWA C219.
 - c. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
 - d. Center-Sleeve Material: Manufacturer's standard.
 - e. Gasket Material: Natural or synthetic rubber.
 - f. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Capitol Manufacturing Company.
 - 2) Jomar International Ltd.
 - 3) Matco-Norca, Inc.
 - 4) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 5) Wilkins; a Zurn company.
 - b. Description:
 - 1) Standard: ASSE 1079.
 - 2) Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
 - 3) End Connections: Solder-joint copper alloy and threaded ferrous.
3. Dielectric Flanges:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Capitol Manufacturing Company.
 - 2) Matco-Norca, Inc.
 - 3) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 4) Wilkins; a Zurn company.
 - b. Description:
 - 1) Standard: ASSE 1079.
 - 2) Factory-fabricated, bolted, companion-flange assembly.
 - 3) Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
 - 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction

loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 2-1/2 (DN 65) and smaller; 1 percent downward in direction of flow for piping NPS 3 (DN 80) and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- N. Install aboveground PVC piping according to ASTM D 2665.

- O. Install underground PVC piping according to ASTM D 2321.
- P. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."
- Q. Install force mains at elevations indicated.
- R. Plumbing Specialties:
 - 1. Install backwater valves in sanitary waste gravity-flow piping. Comply with requirements for backwater valves specified in Division 22 Section "Sanitary Waste Piping Specialties."
 - 2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
 - 3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
- S. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Common Work Results for Plumbing."
- U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Common Work Results for Plumbing."
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Common Work Results for Plumbing."

3.3 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- E. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendices.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Unshielded, nonpressure transition couplings.
3. In Aboveground Force Main Piping: Fitting-type transition couplings.
4. In Underground Force Main Piping:
 - a. NPS 1-1/2 (DN 40) and Smaller: Fitting-type transition couplings.
 - b. NPS 2 (DN 50) and Larger: Pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.

3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves:

1. Install shutoff valve on each sewage pump discharge.
2. Install gate valve for piping NPS 2 (DN 50) and smaller.
3. Install gate valve for piping NPS 2-1/2 (DN 65) and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves.
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Division 22 Section "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 2. Install individual, straight, horizontal piping runs:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
 3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting, valve, and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
 3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
 4. NPS 6 and NPS 8 (DN 150 and DN 200): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
 5. NPS 10 and NPS 12 (DN 250 and DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.
 6. Spacing for 10-foot (3 m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).
- F. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).
- G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
 3. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
 4. NPS 3 and NPS 5 (DN 80 and DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
 5. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
 6. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.
- H. Install supports for vertical copper tubing every 10 feet (3 m).
- I. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 and NPS 8 (DN 150 and DN 200): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
5. NPS 10 and NPS 12 (DN 250 and DN 300): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.

J. Install supports for vertical PVC piping every 48 inches (1200 mm).

K. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Comply with requirements for backwater valves, cleanouts, and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

D. Connect force-main piping to the following:

1. Sewage Pump: To sewage pump discharge.

E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

F. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 6. Prepare reports for tests and required corrective action.

- E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 2. Cap and subject piping to static-water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 4. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.11 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller shall be any of the following:
 - 1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
 - 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- C. Aboveground, soil and waste piping NPS 5 (DN 125) and larger shall be any of the following:
 - 1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
 - 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- D. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be any of the following:
 - 1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
 - 2. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper, soldered joints.
 - 3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

- E. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be any of the following:
 - 1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

- F. Underground, soil and waste piping NPS 5 (DN 125) and larger shall be any of the following:
 - 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
 - 2. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
 - 3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

- G. Underground, grease waste and vent piping NPS 4 (DN 100) and smaller shall be the following:
 - 1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

END OF SECTION 221316

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SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backwater valves.
2. Cleanouts.
3. Floor drains.
4. Air-admittance valves.
5. Roof flashing assemblies.
6. Through-penetration firestop assemblies.
7. Trap-seal protection devices
8. Miscellaneous sanitary drainage piping specialties.
9. Flashing materials.
10. Solids interceptors.

B. Related Requirements:

1. Division 22 Section "Storm Drainage Piping Specialties" for storm drainage piping inside the building, drainage piping specialties, and drains.
2. Division 33 Section "Storm Utility Drainage Piping" for storm draining piping and piping specialties outside the building.

1.2 DEFINITIONS

- A. FRP: Fiberglass-reinforced plastic.
- B. HDPE: High-density polyethylene plastic.
- C. PE: Polyethylene plastic.
- D. PP: Polypropylene plastic.
- E. PVC: Polyvinyl chloride plastic.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.7 COORDINATION

- A. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

- A. Horizontal, Cast-Iron Backwater Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.14.1.
 - 3. Size: Same as connected piping.
 - 4. Body: Cast iron.
 - 5. Cover: Cast iron with bolted access check valve.
 - 6. End Connections: Hub and spigot or hubless.
 - 7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
 - 8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

2.2 CLEANOUTS

- A. Exposed Metal Cleanouts <CO>:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Josam Company; Josam Div.
 - b. Sioux Chief Manufacturing Company, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Watts Drainage Products Inc.
 - e. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 3. Size: Same as connected drainage piping
 4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
 5. Closure: Countersunk, brass plug.
 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- B. Metal Floor Cleanouts <ECO>:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Sioux Chief Manufacturing Company, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Watts Drainage Products Inc.
 - e. Zurn Plumbing Products Group; Specification Drainage Operation.
 2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
 3. Size: Same as connected branch.
 4. Type: Threaded, adjustable housing.
 5. Body or Ferrule: Cast iron.
 6. Clamping Device: Not required.
 7. Outlet Connection: Spigot.
 8. Closure: Plastic plug.
 9. Adjustable Housing Material: Cast iron with threads.
 10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
 11. Frame and Cover Shape: Round.
 12. Top Loading Classification: Heavy Duty.
 13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
- C. Metal Floor Cleanouts <FCO>:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Sioux Chief Manufacturing Company, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Watts Drainage Products Inc.
 - e. Zurn Plumbing Products Group; Specification Drainage Operation.
 2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
 3. Size: Same as connected branch.
 4. Type: Threaded, adjustable housing.

5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Spigot.
8. Closure: Plastic plug.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Light Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

D. Cast-Iron Wall Cleanouts <WCO>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Sioux Chief Manufacturing Company, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Watts Drainage Products Inc.
 - e. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, drilled-and-threaded brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains <FD-1>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Sioux Chief Manufacturing Company, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Watts Drainage Products Inc.
 - e. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Coating on Interior and Exposed Exterior Surfaces: Not required.
10. Sediment Bucket: Not required.

11. Top or Strainer Material: Nickel bronze.
12. Top of Body and Strainer Finish: Nickel bronze.
13. Top Shape: Round.
14. Dimensions of Top or Strainer: Per Floor Drain Schedule on drawings.
15. Top Loading Classification: Light Duty.
16. Funnel: Not required.
17. Inlet Fitting: Not required.
18. Trap Material: Same as Sanitary Waste Piping material.
19. Trap Pattern: Standard P-trap.
20. Trap Features: Not required.

B. Cast-Iron Floor Drains <FD-2>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Sioux Chief Manufacturing Company, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Watts Drainage Products Inc.
 - e. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Coating on Interior and Exposed Exterior Surfaces: Not required.
10. Sediment Bucket: Required.
11. Top or Strainer Material: Nickel bronze.
12. Top of Body and Strainer Finish: Nickel bronze.
13. Top Shape: Round.
14. Dimensions of Top or Strainer: Per Floor Drain Schedule on drawings.
15. Top Loading Classification: Heavy Duty.
16. Funnel: Not required.
17. Inlet Fitting: Not required.
18. Trap Material: Same as Sanitary Waste Piping material.
19. Trap Pattern: Standard P-trap.
20. Trap Features: Not required.

C. Cast-Iron Floor Drains <FD-3>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Sioux Chief Manufacturing Company, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Watts Drainage Products Inc.

- e. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.6.3.
 - 3. Pattern: Floor drain.
 - 4. Body Material: Gray iron.
 - 5. Seepage Flange: Required.
 - 6. Anchor Flange: Required.
 - 7. Clamping Device: Required.
 - 8. Outlet: Bottom.
 - 9. Coating on Interior and Exposed Exterior Surfaces: Not required.
 - 10. Sediment Bucket: Required.
 - 11. Top or Strainer Material: Nickel bronze.
 - 12. Top of Body and Strainer Finish: Nickel bronze.
 - 13. Top Shape: Round.
 - 14. Dimensions of Top or Strainer: Per Floor Drain Schedule on drawings.
 - 15. Top Loading Classification: Light Duty.
 - 16. Funnel: Not required.
 - 17. Inlet Fitting: Not required.
 - 18. Trap Material: Same as Sanitary Waste Piping material.
 - 19. Trap Pattern: Standard P-trap.
 - 20. Trap Features: Not required.

2.4 AIR-ADMITTANCE VALVES

A. Fixture Air-Admittance Valves <AAV>:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ayrlett, LLC.
 - b. Oatey.
 - c. ProSet Systems Inc.
 - d. Studor, Inc.
- 2. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
- 3. Housing: Plastic.
- 4. Operation: Mechanical sealing diaphragm.
- 5. Size: Same as connected fixture or branch vent piping.

2.5 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Acorn Engineering Company; Elmdor/Stoneman Div.
 - b. Thaler Metal Industries Ltd.

- B. Description: Manufactured assembly made of 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch- (1.6-mm-) thick, lead flashing collar and skirt extending at least 8 inches (200 mm) from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

1. Open-Top Vent Cap: Without cap.

2.6 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

- A. Through-Penetration Firestop Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ProSet Systems Inc.
2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.

2.7 TRAP SEAL PROTECTION DEVICES

- A. Barrier Type Trap Seal Protection Devices:

1. Neoprene Diaphragm Type:
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) SureSeal Manufacturing.
 - b. Standard: ASSE 1072-2007.
 - c. Body: ABS Plastic
 - d. Diaphragm & Sealing Gasket: Neoprene Rubber
 - e. Size: 2 inch (50 mm), 3 inch (75 mm), or 4 inch (100 mm).
 - f. Gravity Drain Outlet Connection: Compression fit sealing gasket 80 durometer.
2. Elastomeric Membrane Type:
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) ProVent Systems, Inc.
 - 2) Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

b. Description:

- 1) Material: Molded elastomer.
- 2) Operation: Opens for wastewater flowing through floor drain. Closes and returns to original molded shape after wastewater discharge is complete.

2.8 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains <HD>:

1. Description: Shop or field fabricated from same material used for Sanitary Waste Piping. Include P-trap and no hub riser section.
2. Size: Same as connected waste piping.

B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

C. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch (25 mm) above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

D. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

E. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

F. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

2.9 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
 - 1. General Use: 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
 - 2. Vent Pipe Flashing: 3.0-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
 - 3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.
- B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:
 - 1. General Applications: 12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm thickness).
 - 2. Vent Pipe Flashing: 8 oz./sq. ft. (2.5 kg/sq. m or 0.27-mm thickness).
- C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.
- E. Fasteners: Metal compatible with material and substrate being fastened.
- F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- G. Solder: ASTM B 32, lead-free alloy.
- H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.10 SOLIDS INTERCEPTORS

- A. Solids Interceptors:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Type: Factory-fabricated interceptor made for removing and retaining sediment from wastewater.
 - 3. Body Material: Cast iron or steel.
 - 4. Interior Separation Device: Screens.
 - 5. Interior Lining: Corrosion-resistant enamel.
 - 6. Exterior Coating: Corrosion-resistant enamel.
 - 7. Body Dimensions: 17 inch (432 mm) W x 17 inch (432 mm) L x 16.5 inch (419 mm) H.
 - 8. Flow Rate: 30 GPM (113 LPM).

9. Inlet and Outlet Size: 2 inch (50 mm).
10. End Connections: Threaded.
11. Mounting: Inline.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 75 feet (23 m) for piping NPS 3 (DN 75) and smaller and 100 feet (30 m) for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 1. Position floor drains for easy access and maintenance.
 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
 - b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
 - c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.
 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
 5. Install trap-seal protection devices in floor drains during trim out stage of project.
- F. Trap-seal protection devices shall be installed in accordance with the manufacturer's instructions and the requirements of the applicable codes.

- G. Install fixture air-admittance valves on fixture drain piping.
- H. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- I. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.
- J. Assemble open drain fittings and install with top of hub 1 inch (25 mm) above floor.
- K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- L. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- M. Install vent caps on each vent pipe passing through roof.
- N. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- O. Install solids interceptors with cleanout immediately downstream from interceptors that do not have integral cleanout on outlet. Install trap on interceptors that do not have integral trap and are connected to sanitary drainage and vent systems.
- P. Install wood-blocking reinforcement for wall-mounting-type specialties.
- Q. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.
 - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each solids interceptors.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Protect trap-seal protection devices from being touched with solvent cement or primers during installation.
- C. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 221413 - FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

B. Related Sections:

1. Division 33 Section "Storm Utility Drainage Piping" for storm drainage piping outside the building.

1.2 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water (30 kPa).

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Storm-Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of storm-drainage service.

2. Do not proceed with interruption of storm-drainage service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Heavy-Duty, Hubless-Piping Couplings:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Clamp-All Corp.
 - c. MIFAB, Inc.
 - d. Mission Rubber Company; a division of MCP Industries, Inc.
 - e. Tyler Pipe.
 2. Standards: ASTM C 1277 and ASTM C 1540.
 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.
 1. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Solvent Cement: ASTM D 2564.

1. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Unshielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Dallas Specialty & Mfg. Co.
 - 2) Fernco Inc.
 - 3) Mission Rubber Company; a division of MCP Industries, Inc.
 - 4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
 - b. Standard: ASTM C 1173.
 - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - d. Sleeve Materials:
 - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.

- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- L. Install storm drainage piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Storm Drain: 2 percent downward in direction of flow for piping NPS 2-1/2 (DN 65) and smaller; 1 percent downward in direction of flow for piping NPS 3 (DN 80) and larger.
 - 2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- N. Install aboveground PVC piping according to ASTM D 2665.
- O. Install underground PVC piping according to ASTM D 2321.
- P. Plumbing Specialties:
 - 1. Install backwater valves in storm drainage gravity-flow piping. Comply with requirements for backwater valves specified in Division 22 Section "Storm Drainage Piping Specialties."
 - 2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure

- plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Storm Drainage Piping Specialties."
3. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Storm Drainage Piping Specialties."
- Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Common Work Results for Plumbing."
- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Common Work Results for Plumbing."
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Common Work Results for Plumbing."

3.3 JOINT CONSTRUCTION

- A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hubless, Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- C. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
1. Install transition couplings at joints of piping with small differences in OD's.
 2. In Drainage Piping: Unshielded, nonpressure transition couplings.

3.5 VALVE INSTALLATION

- A. General valve installation requirements are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- B. Backwater Valves: Install backwater valves in piping subject to backflow.
1. Horizontal Piping: Horizontal backwater valves.

2. Install backwater valves in accessible locations.
3. Comply with requirements for backwater valves specified in Division 22 Section "Storm Drainage Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
 3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
 3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
 4. NPS 6 and NPS 8 (DN 150 and DN 200): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
 5. NPS 10 and NPS 12 (DN 250 and DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.
 6. Spacing for 10-foot (3 m) pipe lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).
- F. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).
- G. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
 2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.

3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 and NPS 8 (DN 150 and DN 200): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
5. NPS 10 and NPS 12 (DN 250 and DN 300): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.

H. Install supports for vertical PVC piping every 48 inches (1200 mm).

I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
2. Install horizontal backwater valves with cleanout cover flush with floor.
3. Comply with requirements for backwater valves, cleanouts, and, drains specified in Division 22 Section "Storm Drainage Piping Specialties."

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
 - C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Test Procedure: Test storm drainage piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
 4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 5. Prepare reports for tests and required corrective action.

3.10 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.11 PIPING SCHEDULE

- A. Aboveground storm drainage piping NPS 6 (DN 150) and smaller shall be any of the following:
 1. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.
 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- B. Aboveground, storm drainage piping NPS 8 (DN 200) and larger shall be any of the following:
 1. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.
 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- C. Underground storm drainage piping NPS 6 (DN 150) and smaller shall be any of the following:
 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- D. Underground, storm drainage piping NPS 8 (DN 200) and larger shall be the following:
1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- E. Aboveground condensate piping NPS 6 (DN 150) and smaller shall be any of the following:
1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- F. Underground condensate piping NPS 6 (DN 150) and smaller shall be any of the following:
1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

END OF SECTION 221413

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SECTION 221423 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Roof drains.
 2. Condensate receptors.
 3. Miscellaneous storm drainage piping specialties.
 4. Cleanouts.
 5. Backwater valves.
 6. Roof flashing assemblies.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 METAL ROOF DRAINS

- A. Cast-Iron, Large Sump, General-Purpose, Dual Outlet Primary and Secondary Roof Drains <RD-1>:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Froet Industries, LLC.
 - b. Smith, Jay R. Mfg. Co.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
 2. Standard: ASME A112.6.4, for general-purpose roof drains.
 3. Body Material: Cast iron.
 4. Dimension of Body: Nominal 15-inch (381-mm) diameter.
 5. Combination Flashing Ring and Gravel Stop: Required.
 6. Outlet: Bottom or Side.
 7. Extension Collars: Required.

8. Underdeck Clamp: Required.
9. Sump Receiver Plate: Required.
10. Dome Material: Cast iron.
11. Perforated Gravel Guard: Not required.
12. Vandal-Proof Dome: Not required.
13. Water Dam: Integral.

B. Metal, Medium-Sump, Promenade Roof Drains <AD-1>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. Smith, Jay R. Mfg. Co.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.4, for promenade roof drains.
3. Body Material: Cast iron.
4. Dimension of Body: 8- to 10-inch (215- to 254-mm) diameter.
5. Dimension of Frame and Grate: Nominal 10 inches (254 mm) square.
6. Outlet: Bottom.
7. Grate Material: Nickel-bronze alloy.
8. Vandal-Proof Grate: Required.
9. Extension Collars: Not required.
10. Underdeck Clamp: Not required.
11. Expansion Joint: Not required.
12. Sump Receiver Plate: Not required.

2.2 CONDENSATE RECEPTORS

A. Cast-Iron Condensate Receptors <CR-1>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Sediment Bucket: Not required.
10. Top or Strainer Material: Nickel bronze.
11. Top of Body and Strainer Finish: Nickel bronze.

12. Top Shape: Round with Raised Flange.
13. Top Loading Classification: Light Duty.
14. Funnel: Not required.

2.3 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Downspout Covers:

1. Description: Round fabricated stainless steel frame with fabricated secured perforated stainless steel hinged strainer.
2. Size: Same as connected pipe.

2.4 CLEANOUTS

A. Exposed Metal Cleanouts <CO>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Sioux Chief Manufacturing Company, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Watts Drainage Products Inc.
 - e. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Metal Floor Cleanouts <ECO>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Sioux Chief Manufacturing Company, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Watts Drainage Products Inc.
 - e. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Threaded, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Spigot.
8. Closure: Plastic plug.

9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Heavy Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Metal Floor Cleanouts <FCO>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Sioux Chief Manufacturing Company, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Watts Drainage Products Inc.
 - e. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Threaded, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Spigot.
8. Closure: Plastic plug.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Light Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

D. Cast-Iron Wall Cleanouts <WCO>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Sioux Chief Manufacturing Company, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Watts Drainage Products Inc.
 - e. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, drilled-and-threaded brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

2.5 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.14.1.
3. Size: Same as connected piping.
4. Body: Cast iron.
5. Cover: Cast iron with bolted access check valve.
6. End Connections: Hub and spigot or hubless.
7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

2.6 ROOF FLASHING ASSEMBLIES

- A. Roof Flashing Assemblies: Refer to Division 7 for roof flashing assemblies.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 07 Sections.
 1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 2. Install expansion joints, if indicated, in roof drain outlets.
 3. Position roof drains for easy access and maintenance.
- B. Install downspout covers at exposed end of overflow storm pipes as shown on plans.
- C. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
 1. Use cleanouts the same size as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
 2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
 3. Locate cleanouts at minimum intervals of 75 feet (15 m) for piping NPS 4 (DN 100) and smaller and 75 feet (30 m) for larger piping.
 4. Locate cleanouts at base of each vertical stack.
- D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

- E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- F. Install horizontal backwater valves in floor with cover flush with floor.
- G. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.
- H. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. (30-kg/sq. m) lead sheets, 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of 4.0-lb/sq. ft. (20-kg/sq. m) lead sheets, 0.0625-inch (1.6-mm) thickness or thinner.
 - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches (250 mm) and with skirt or flange extending at least 8 inches (200 mm) around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221423

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SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial, light-duty, storage, electric, domestic-water heaters.
2. Thermostat-control, electric, tankless, domestic-water heaters.
3. Domestic-water heater accessories.

1.2 SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
1. Wiring Diagrams: For power, signal, and control wiring.
- C. Warranty: Sample of special warranty.
- D. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
- C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.4 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 2. Warranty Periods: From date of Substantial Completion.
 - a. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:
 - 1) Storage Tank: Three years.
 - 2) Controls and Other Components: Three years.
 - b. Electric, Tankless, Domestic-Water Heaters: Five year(s).
 - c. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bradford White Corporation.
 - b. Lochinvar Corporation.
 - c. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
 - d. State Industries.
2. Standard: UL 174.
3. Storage-Tank Construction: Steel, vertical arrangement.
 - a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig (1035 kPa).
 - c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
4. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: ASSE 1005.
 - d. Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2.
 - e. Jacket: Steel with enameled finish.

- f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - g. Heating Elements: Two; electric, screw-in immersion type; wired for simultaneous operation unless otherwise indicated. Limited to 12 kW total.
 - h. Temperature Control: Adjustable thermostat.
 - i. Safety Control: High-temperature-limit cutoff device or system.
 - j. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
5. Special Requirements: NSF 5 construction with legs for off-floor installation.

2.2 ELECTRIC, TANKLESS, DOMESTIC-WATER HEATERS

A. Thermostat-Control, Electric, Tankless, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bosch Water Heating.
 - b. Chronomite Laboratories, Inc.
 - c. Eemax, Inc.
 - d. Niagara Industries, Inc.
2. Standard: UL 499 for electric, tankless, (domestic-water heater) heating appliance.
3. Construction: Copper piping or tubing complying with NSF 61 barrier materials for potable water, without storage capacity.
 - a. Connections: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig (1035 kPa).
 - c. Heating Element: Resistance heating system.
 - d. Temperature Control: Thermostat.
 - e. Safety Control: High-temperature-limit cutoff device or system.
 - f. Jacket: Aluminum or steel with enameled finish or plastic.
4. Support: Bracket for wall mounting.

2.3 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL Inc.
 - b. Honeywell International Inc.
 - c. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
 - d. State Industries.

- e. Taco, Inc.
 - 2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
 - 3. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
 - B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 (DN 20) with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.
 - C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
 - D. Heat-Trap Fittings: ASHRAE 90.2.
 - E. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
 - F. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
 - G. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.
- 2.4 SOURCE QUALITY CONTROL
- A. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.
 - B. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Division 03.

1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
 2. Maintain manufacturer's recommended clearances.
 3. Arrange units so controls and devices that require servicing are accessible.
 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 7. Install anchor bolts to elevations required for proper attachment to supported equipment.
 8. Anchor domestic-water heaters to substrate.
- B. Electric, Tankless, Domestic-Water Heater Mounting: Install electric, tankless, domestic-water heaters on wall bracket.
1. Maintain manufacturer's recommended clearances.
 2. Arrange units so controls and devices that require servicing are accessible.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 5. Anchor domestic-water heaters to substrate.
- C. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Division 22 Section "Domestic Water Piping Specialties."
- F. Install thermometers on inlet and outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."
- G. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.
- H. Fill electric, domestic-water heaters with water.

- I. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.
- C. Prepare test and inspection reports.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial and tankless, electric, domestic-water heaters.

END OF SECTION 223300

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Solid-brass, manually operated lavatory faucets.
2. Sink faucets.
3. Lavatory and sink supply fittings.
4. Lavatory and sink waste fittings.
5. Individual showers. **(not always required)**
6. Shower faucets.
7. Flushometer valves.
8. Toilet seats.
9. Protective shielding guards.
10. Dishwasher air-gap fittings.
11. Water closets.
12. Urinals.
13. Lavatories.
14. Sinks.
15. Emergency Shower with Eyewash Combination Units. **(MS and HS only)**
16. Mop Sinks.

B. Related Sections include the following:

1. Division 22 Section "Drinking Fountains and Water Coolers."

1.2 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. FRP: Fiberglass-reinforced plastic.
- C. PMMA: Polymethyl methacrylate (acrylic) plastic.
- D. PVC: Polyvinyl chloride plastic.
- E. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.3 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of all plumbing fixtures and related components covered in this specification section that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of fixtures, flush valves and faucets.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Period(s): From date of Substantial Completion:
 - a. Five years.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.
- D. Warranty.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
 - 2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.

3. Slip-Resistant Bathing Surfaces: ASTM F 462.
 4. Stainless-Steel Residential Sinks: ASME A112.19.3.
 5. Vitreous-China Fixtures: ASME A112.19.2M.
 6. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- G. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
 2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
 3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
 4. Faucets: ASME A112.18.1.
 5. Hose-Connection Vacuum Breakers: ASSE 1011.
 6. Hose-Coupling Threads: ASME B1.20.7.
 7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 8. NSF Potable-Water Materials: NSF 61.
 9. Pipe Threads: ASME B1.20.1.
 10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 11. Supply Fittings: ASME A112.18.1.
 12. Brass Waste Fittings: ASME A112.18.2.
- H. Comply with the following applicable standards and other requirements specified for shower faucets:
1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
 2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
 3. Faucets: ASME A112.18.1.
 4. Hand-Held Showers: ASSE 1014.
 5. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
 6. Hose-Coupling Threads: ASME B1.20.7.
 7. Manual-Control Antiscald Faucets: ASTM F 444.
 8. Pipe Threads: ASME B1.20.1.
 9. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
 10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 11. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
- I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
1. Atmospheric Vacuum Breakers: ASSE 1001.
 2. Brass and Copper Supplies: ASME A112.18.1.
 3. Manual-Operation Flushometers: ASSE 1037.
 4. Plastic Tubular Fittings: ASTM F 409.
 5. Brass Waste Fittings: ASME A112.18.2.
- J. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Flexible Water Connectors: ASME A112.18.6.

2. Hose-Coupling Threads: ASME B1.20.7.
3. Pipe Threads: ASME B1.20.1.
4. Plastic Toilet Seats: ANSI Z124.5.
5. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 SOLID-BRASS, MANUALLY OPERATED LAVATORY FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
- B. Lavatory Faucets <L-1>: Manual-type, single-control non-mixing, vandal resistant, commercial, solid-brass valve.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Bradley Corporation.
 - c. Chicago Faucets.
 - d. Delta Faucet Company.
 - e. Kohler Co.
 - f. T & S Brass and Bronze Works, Inc.
 - g. Zurn Industries, LLC; Commercial Brass and Fixtures.
 2. Standard: ASME A112.18.1/CSA B125.1.
 3. General: Include cold-water indicator; coordinate faucet inlet with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
 4. Body Type: Single hole with deck plate.
 5. Body Material: Commercial, solid brass.
 6. Finish: Polished chrome plate.
 7. Maximum Flow: 0.25 gal. (0.95 L) per metering cycle.
 8. Mounting Type: Deck, exposed.
 9. Valve Handle(s): Push button.
 10. Spout: Rigid type.
 11. Spout Outlet: Aerator.
 12. Operation: Compression, manual.
 13. Drain: Not part of faucet.
- C. Lavatory Faucets <L-2>: Manual-type, single-control mixing, commercial, solid-brass valve.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Bradley Corporation.
 - c. Chicago Faucets.
 - d. Delta Faucet Company.

- e. Kohler Co.
 - f. T & S Brass and Bronze Works, Inc.
 - g. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Standard: ASME A112.18.1/CSA B125.1.
 3. General: Include cold-water indicator; coordinate faucet inlet with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
 4. Body Type: Centerset.
 5. Body Material: Commercial, solid brass.
 6. Finish: Polished chrome plate.
 7. Maximum Flow: 0.25 gal. (0.95 L) per metering cycle.
 8. Mounting Type: Deck, exposed.
 9. Valve Handle(s): Lever.
 10. Spout: Rigid type.
 11. Spout Outlet: Aerator.
 12. Operation: Compression, manual.
 13. Drain: Not part of faucet.

2.2 SINK FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.
- B. Sink Faucets <**S-1 (ES only)**>: Manual type, single-control, single-temperature valve.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following:
 - a. Chicago Faucets.
 - b. Delta Faucet Company.
 - c. Elkay Manufacturing Co.
 - d. Just Manufacturing.
 - e. T & S Brass and Bronze Works, Inc.
 - f. Zurn Industries, LLC; Commercial Brass and Fixtures.
 2. Standard: ASME A112.18.1/CSA B125.1.
 3. General: Include cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
 4. Body Type: Single hole.
 5. Body Material: Commercial, solid brass.
 6. Finish: Polished chrome plated.
 7. Maximum Flow Rate: 1.5 gpm (5.7 L/min.).
 8. Handle(s): Lever.
 9. Mounting Type: Deck, exposed.
 10. Spout Type: Rigid gooseneck, solid brass.
 11. Vacuum Breaker: Not required for hose outlet.
 12. Spout Outlet: Aerator.
- C. Sink Faucets <**S-1, S-2, S-3, S-4 and S-5 (ES) or S-3, S-4, S-5 and S-6 (MS/HS)**>: Manual type, dual-control mixing valve.

1. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following:
 - a. Chicago Faucets.
 - b. Delta Faucet Company.
 - c. Elkay Manufacturing Co.
 - d. Just Manufacturing.
 - e. T & S Brass and Bronze Works, Inc.
 - f. Zurn Industries, LLC; Commercial Brass and Fixtures.
 2. Standard: ASME A112.18.1/CSA B125.1.
 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
 4. Body Type: Widespread.
 5. Body Material: Commercial, solid brass.
 6. Finish: Polished chrome plated.
 7. Maximum Flow Rate: 1.5 gpm (5.7 L/min.).
 8. Handle(s): Wristblade.
 9. Mounting Type: Deck, concealed.
 10. Spout Type: Swing, solid brass.
 11. Vacuum Breaker: Not required for hose outlet.
 12. Spout Outlet: Aerator.
- D. Sink Faucets <MS-1 and MS-2 (for can wash)>: Manual type, single-control mixing valve.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Chicago Faucets.
 - b. Delta Faucet Company.
 - c. Elkay Manufacturing Co.
 - d. Just Manufacturing.
 - e. T & S Brass and Bronze Works, Inc.
 - f. Zurn Industries, LLC; Commercial Brass and Fixtures.
 2. Standard: ASME A112.18.1/CSA B125.1.
 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
 4. Body Type: Widespread.
 5. Body Material: Commercial, solid brass.
 6. Finish: Rough chrome finish.
 7. Maximum Flow Rate: 2.5 gpm (9.5 L/min.).
 8. Handle(s): Lever.
 9. Mounting Type: Back/wall, exposed.
 10. Spout Type: Rigid, solid brass with wall brace.
 11. Vacuum Breaker: Required for hose outlet.
 12. Spout Outlet: Hose thread according to ASME B1.20.7.

2.3 LAVATORY AND SINK SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
 - 1. Operation: Loose key.
- E. Risers:
 - 1. NPS 1/2 (DN 15).
 - 2. Chrome-plated, rigid-copper-pipe and brass straight or offset tailpieces riser.

2.4 LAVATORY AND SINK WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain:
 - 1. Lavatories: Grid type with NPS 1-1/4 (DN 32) offset and straight tailpiece.
 - 2. Sinks: Basket type with NPS 1-1/2 (DN 40) offset and straight tailpiece.
- C. Trap:
 - 1. Size:
 - a. Lavatories: NPS 1-1/4 (DN 32).
 - b. Sinks: NPS 1-1/2 (DN 40).
 - 2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 17 gauge thick brass tube to wall; and chrome-plated, brass or steel wall flange.

2.5 INDIVIDUAL SHOWERS (**not always required**)

- A. Individual PMMA Showers <SH-1 **and** SH-2>:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aqua Bath Company, Inc.
 - b. Aqua Glass Corporation.
 - c. Aquatic Industries, Inc.
 - d. Crane Plumbing, L.L.C.

- e. Kohler Co.
 - f. LASCO Bathware.
 - g. Praxis Industries, LLC.; Aquarius Bathware.
- 2. General: PMMA shower enclosure with faucet and receptor and appurtenances.
 - 3. Standard: ANSI Z124.1.2.
 - 4. Type: One-piece unit with top.
 - 5. Style: Handicapped/wheelchair.
 - 6. Faucet: <SH-1>.
 - 7. Nominal Size and Shape: 36 by 36 inches (915 by 915 mm) square.
 - 8. Color: White.
 - 9. Bathing Surface: Slip resistant according to ASTM F 462.
 - 10. Outlet: Drain with NPS 2 (DN 50) outlet.
 - 11. Shower Rod and Curtain: Required.
 - 12. Grab Bar: ASTM F 446, mounted on support area back wall.

2.6 SHOWER FAUCETS

- A. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for shower materials that will be in contact with potable water.
- B. Shower Faucets <SH-1 and SH-2>:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Chicago Faucets.
 - c. Kohler Co.
 - d. Moen Incorporated.
 - e. Symmons Industries, Inc.
 - f. Zurn Industries, LLC; AquaSpec Commercial Faucet Products.
 - 2. Description: Single-handle, pressure-balance mixing valve with hot- and cold-water indicators; check stops; and shower head.
 - 3. Faucet:
 - a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016.
 - b. Body Material: Solid brass.
 - c. Finish: Polished chrome plate.
 - d. Maximum Flow Rate: 1.5 gpm (5.7 L/min.) unless otherwise indicated.
 - e. Mounting: Concealed.
 - f. Operation: Single-handle, push-pull or twist or rotate control.
 - g. Antiscald Device: Integral with mixing valve.
 - h. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
 - 4. Supply Connections: NPS 1/2 (DN 15).
 - 5. Shower Head:

- a. Standard: ASME A112.18.1/CSA B125.1.
- b. Type: Ball joint with arm and flange.
- c. Shower Head Material: Metallic with chrome-plated finish.
- d. Spray Pattern: Fixed.
- e. Integral Volume Control: Required.
- f. Temperature Indicator: Not required.

2.7 FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Water Closet Flushometer Valves <WC-1, WC-2, (and WC-3 Elementary Schools only)>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Coyne & Delany Co.
 - c. Gerber Plumbing Fixtures LLC.
 - d. Kohler Co.
 - e. Sloan Valve Company.
 - f. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig (860 kPa).
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Style: Exposed.
8. Consumption: 1.28 gal. (4.8 L) per flush.
9. Minimum Inlet: NPS 1-1/4 (DN 32).
10. Minimum Outlet: NPS 1-1/4 (DN 32).

B. Lever-Handle, Diaphragm Urinal Flushometer Valves <U-1 and U-2>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Coyne & Delany Co.
 - c. Gerber Plumbing Fixtures LLC.
 - d. Kohler Co.
 - e. Sloan Valve Company.
 - f. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig (860 kPa).
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Style: Exposed.

8. Consumption: 0.125 gal. (0.5 L) per flush.
9. Minimum Inlet: NPS 1 (DN 25).
10. Minimum Outlet: NPS 1-1/4 (DN 32).

2.8 TOILET SEATS

A. Toilet Seats <WC-1 and WC-2>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Bemis Manufacturing Company.
 - c. Centoco Manufacturing Corporation.
 - d. Church Seats.
 - e. Kohler Co.
 - f. Sanderson Plumbing Products, Inc.
 - g. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (Heavy duty).
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining, check.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: White.

B. Toilet Seats <WC-3 (Elementary Schools Only)>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Bemis Manufacturing Company.
 - c. Centoco Manufacturing Corporation.
 - d. Church Seats.
 - e. Kohler Co.
 - f. Sanderson Plumbing Products, Inc.
 - g. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (Heavy duty).
5. Shape: Round, open front.
6. Hinge: Self-sustaining, check.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: White.

2.9 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Engineered Brass Company.
 - b. McGuire Manufacturing.
 - c. Truebro; a brand of IPS Corporation.
 - d. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.10 DISHWASHER AIR-GAP FITTINGS

A. Dishwasher Air-Gap Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brass Craft Manufacturing; a subsidiary of Masco Corporation.
 - b. Dearborn Brass.
 - c. Geberit US.
 - d. Sioux Chief Manufacturing Company, Inc.
 - e. Watts Brass & Tubular; a division of Watts Water Technologies, Inc.
2. Standard: ASSE 1021.
3. Description: Device designed to prevent backflow of contaminated liquid into domestic dishwashers.
4. Material: Plastic body with chrome-plated-brass cover.
5. Hose Connections: 5/8-inch- (16-mm-) ID inlet and 7/8-inch- (22-mm-) ID outlet.
6. Capacity: At least 5 gpm (0.32 L/s); at inlet pressure of at least 5 psig (35 kPa) and at temperature of at least 140 deg F (60 deg C).
7. Mounting: Deck.
8. Hoses: Rubber and suitable for temperature of at least 140 deg F (60 deg C).
 - a. Inlet Hose: 5/8 inch (16 mm) ID and 48 inches (1219 mm) long.
 - b. Outlet Hose: 7/8 inch (22 mm) ID and 48 inches (1219 mm) long.

2.11 WATER CLOSETS

A. Water Closets <WC-1>: Floor mounted, bottom outlet, top spud.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.

- b. Crane Plumbing, L.L.C.
 - c. Gerber Plumbing Fixtures LLC.
 - d. Kohler Co.
 - e. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Flushometer valve.
 - e. Height: Standard.
 - f. Rim Contour: Elongated.
 - g. Water Consumption: 1.28 gal. (4.8 L) per flush.
 - h. Spud Size and Location: NPS 1-1/2 (DN 40); top.
 - i. Color: White.
 3. Bowl-to-Drain Connecting Fitting: ASME A112.4.3.
 4. Flushometer Valve: Same as water closet designation.
 5. Toilet Seat: Same as water closet designation.
- B. Water Closets <WC-2>: Floor mounted, bottom outlet, top spud.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Crane Plumbing, L.L.C.
 - c. Gerber Plumbing Fixtures LLC.
 - d. Kohler Co.
 - e. Zurn Industries, LLC; Commercial Brass and Fixtures.
 2. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Flushometer valve.
 - e. Height: Handicapped/elderly, complying with ICC/ANSI A117.1.
 - f. Rim Contour: Elongated.
 - g. Water Consumption: 1.28 gal. (4.8 L) per flush.
 - h. Spud Size and Location: NPS 1-1/2 (DN 40); top.
 - i. Color: White.
 3. Bowl-to-Drain Connecting Fitting: ASME A112.4.3.
 4. Flushometer Valve: Same as water closet designation.
 5. Toilet Seat: Same as water closet designation.
- C. Water Closets <WC-3 (Elementary Schools Only)>: Floor mounted, bottom outlet, top spud.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Crane Plumbing, L.L.C.
 - c. Gerber Plumbing Fixtures LLC.
 - d. Kohler Co.
 - e. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Flushometer valve.
 - e. Height: Child.
 - f. Rim Contour: Elongated.
 - g. Water Consumption: 1.28 gal. (4.8 L) per flush.
 - h. Spud Size and Location: NPS 1-1/2 (DN 40); top.
 - i. Color: White.

3. Bowl-to-Drain Connecting Fitting: ASME A112.4.3.
4. Flushometer Valve: Same as water closet designation.
5. Toilet Seat: Same as water closet designation.

2.12 URINALS

A. Urinals <U-1>: Wall hung, back outlet, siphon jet.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Crane Plumbing, L.L.C.
 - c. Gerber Plumbing Fixtures LLC.
 - d. Kohler Co.
 - e. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Fixture:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
 - e. Water Consumption: Ultra low.
 - f. Spud Size and Location: NPS 3/4 (DN 20); top.
 - g. Outlet Size and Location: NPS 2 (DN 50); back.
 - h. Color: White.

3. Flushometer Valve: Same as water closet designation.

4. Waste Fitting:
 - a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
 - b. Size: NPS 2 (DN 50).
 5. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.
- B. Urinals <U-2>: Wall hung, back outlet, siphon jet, accessible.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Crane Plumbing, L.L.C.
 - c. Gerber Plumbing Fixtures LLC.
 - d. Kohler Co.
 - e. Zurn Industries, LLC; Commercial Brass and Fixtures.
 2. Fixture:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
 - e. Water Consumption: Ultra low.
 - f. Spud Size and Location: NPS 3/4 (DN 20); top.
 - g. Outlet Size and Location: NPS 2 (DN 50); back.
 - h. Color: White.
 3. Flushometer Valve: Same as water closet designation.
 4. Waste Fitting:
 - a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
 - b. Size: NPS 2 (DN 50).
 5. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.

2.13 LAVATORIES

- A. Lavatory <L-1 and L-2>: Vitreous china, wall mounted, with back.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Crane Plumbing, L.L.C.

- c. Gerber Plumbing Fixtures LLC.
 - d. Kohler Co.
 - e. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Fixture:
- a. Standard: ASME A112.19.2/CSA B45.1.
 - b. Type: For wall hanging.
 - c. Nominal Size: Rectangular, 20 by 18 inches (508 by 457 mm).
 - d. Faucet-Hole Punching: Three holes, 2-inch (51-mm) centers.
 - e. Faucet-Hole Location: Top.
 - f. Color: White.
 - g. Mounting Material: Chair carrier.
3. Faucet: Same as lavatory designation.
4. Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier. Include rectangular, steel uprights.

2.14 SINKS

- A. Sinks <S-1 and S-2 (**For MS and HS**)>: Science room cabinet.
1. Manufacturers: Per Division 12 specifications.
 2. Fixture: Per Division 12 specifications.
 3. Faucet: Per Division 12 specifications.
 4. Supply Fittings: Comply with requirements in "Lavatory and Sink Supply Fittings" Article.
 5. Waste Fittings: Comply with requirements in "Lavatory and Sink Waste Fittings" Article, except include continuous waste for multibowl sinks.
- B. Sinks <**S-1, S-2, S-3, S-4, and S-5**>: One or two bowl, countertop mounted, stainless steel.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkay Manufacturing Co.
 - b. Franke Consumer Products, Inc.
 - c. Just Manufacturing.
 - d. Kohler Co.
 - e. Sterling; a Kohler company.
 2. Fixture:
 - a. Standard: ASME A112.19.3/CSA B45.4 for stainless-steel kitchen sinks.
 - b. Overall Dimensions: Refer to drawings.
 - c. Metal Thickness: 18 guage.
 - d. Bowl:
 - 1) Dimensions: Refer to drawings.
 - 2) Drain: 3-1/2-inch (89-mm) crumb cup.

- a) Location: Refer to drawings.
- 3. Faucet: Same as sink designation.
- 4. Supply Fittings: Comply with requirements in "Lavatory and Sink Supply Fittings" Article.
- 5. Waste Fittings: Comply with requirements in "Lavatory and Sink Waste Fittings" Article, except include continuous waste for multibowl sinks.

2.15 Emergency Shower with Eyewash Combination Units <EW-1>:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Safety; a division of Acorn Engineering Company.
 - b. Bradley Corporation.
 - c. Encon Safety Products.
 - d. Guardian Equipment Co.
 - e. Haws Corporation.
 - f. Speakman Company.
- 2. Piping:
 - a. Material: Galvanized steel.
 - b. Unit Supply: NPS 1-1/4 (DN 32) minimum.
 - c. Unit Drain: Outlet at back or side near bottom.
- 3. Shower:
 - a. Capacity: Not less than 20 gpm (76 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1 (DN 25) with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Pull rod.
 - d. Shower Head: Chrome-plated brass or stainless steel.
- 4. Eyewash Unit:
 - a. Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 (DN 15) with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle.
 - d. Spray-Head Assembly: Two receptor-mounted spray heads.
 - e. Receptor: Chrome-plated brass or stainless-steel bowl.
 - f. Mounting: Attached shower pedestal.

2.16 MOP SINKS

- A. Mop Sinks <MS-1>: Plastic, floor mounted.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Plumbing, L.L.C.

- b. Fiat Products.
 - c. Mustee, E. L., & Sons, Inc.
 - d. Zurn Industries, LLC; Light Commercial Specialty Plumbing Products.
2. Fixture:
 - a. Standard: IAPMO/ANSI Z124.6.
 - b. Material: Cast polymer.
 - c. Nominal Size: 24 by 24 by 10 inches (610 by 610 mm by 255 mm), as listed in Plumbing Fixture Schedule.
 - d. Rim Guard: Stainless steel. On front top surfaces.
 - e. Wall Guard: Stainless steel.
 - f. Mop Hanger.
 - g. Hose and Hose Bracket.
 - h. Drain: Grid with NPS 3 (DN 80) outlet.
 3. Mounting: On floor and flush to wall.
 4. Faucet: <MS-1>.
- B. Mop Sinks <MS-2 (for when Can Wash is needed)>: Plastic, floor mounted.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Plumbing, L.L.C.
 - b. Fiat Products.
 - c. Mustee, E. L., & Sons, Inc.
 - d. Zurn Industries, LLC; Light Commercial Specialty Plumbing Products.
 2. Fixture:
 - a. Standard: IAPMO/ANSI Z124.6.
 - b. Material: Cast polymer.
 - c. Nominal Size: 24 by 36 by 10 inches (610 by 915 mm by 255 mm), as listed in Plumbing Fixture Schedule.
 - d. Rim Guard: Stainless steel. On front top surfaces.
 - e. Wall Guard: Stainless steel.
 - f. Mop Hanger.
 - g. Hose and Hose Bracket.
 - h. Drain: Grid with NPS 3 (DN 80) outlet.
 3. Mounting: On floor and flush to wall.
 4. Faucet: <MS-2>.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing-fixture installation.
- B. Examine walls, floors, cabinets, and counters for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Support Installation:
 - 1. Install supports, affixed to building substrate, for wall-mounting fixtures.
 - 2. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - 3. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 - 4. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attached to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install counter-mounting fixtures in and attached to casework.
- G. Install fixtures level and plumb according to roughing-in drawings.
- H. Install accessible fixtures at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.
- I. Set floor-mounted sinks in leveling bed of cement grout.
- J. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 - 1. Exception: Use ball valves if supply stops are not specified with fixture. Comply with valve requirements specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
 - 2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.
 - 3. Install stops in locations where they can be easily reached for operation.

- K. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
 - L. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
 - M. Flushometer-Valve Installation:
 - 1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
 - 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
 - 3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
 - 4. Install actuators in locations that are easy for people with disabilities to reach.
 - N. Install toilet seats on water closets.
 - O. Install dishwasher air-gap fitting at each sink receiving dishwasher drainage.
 - P. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks.
 - Q. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
 - R. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes unless otherwise indicated.
 - S. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
 - T. Install dielectric fitting in supply piping to plumbing fixtures if piping and equipment connections are made of different metals. Comply with requirements for dielectric fittings specified in Division 22 Section "Domestic Water Piping."
 - U. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."
- 3.3 CONNECTIONS
- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
 - B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

- C. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."
- D. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."
- E. Ground equipment according to Division 26 Section "Grounding and Bonding."
- F. Connect wiring according to Division 26 Section "Low Voltage Conductors and Cables."

3.4 IDENTIFICATION

- A. Install equipment nameplates or equipment markers on emergency plumbing fixtures. Comply with requirements for identification materials specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.6 ADJUSTING

- A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.7 CLEANING AND PROTECTION

- A. After completing installation of plumbing fixtures, inspect and repair damaged finishes.
- B. Clean plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed plumbing fixtures and fittings.
- D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

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SECTION 224700 - DRINKING FOUNTAINS AND WATER COOLERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Drinking fountains.
 - 2. Pressure water coolers.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for fixtures for people with disabilities.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- D. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.
- E. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
- F. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants" for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.

PART 2 - PRODUCTS

2.1 DRINKING FOUNTAINS

- A. Drinking Fountains <DF-1 and DF-2>: Stainless steel, wall mounted.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkay Manufacturing Co.
 - b. Halsey Taylor.
 - c. Haws Corporation.
 - d. Murdock-Super Secur; a division of Acorn Engineering Company.
 - e. Tri Palm International, LLC; Oasis Brand.
 2. Standards:
 - a. Comply with ASME A112.19.3/CSA B45.4.
 - b. Comply with NSF 61.
 3. Type Receptor: With back.
 4. Receptor Shape: Rectangular.
 5. Bubblers: One, with adjustable stream regulator, located on deck, vandal-resistant and keyed into position.
 6. Control: Push button or push bar.
 7. Drain: Grid type with NPS 1-1/4 (DN 32) tailpiece.
 8. Supply: NPS 3/8 (DN 10) with shutoff valve.
 9. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 (DN 32) chrome-plated brass P-trap and waste.
 10. Support: ASME A112.6.1M, Type III lavatory carrier.
- B. Drinking Fountains <DF-3>: Stainless steel, pedestal, wheelchair accessible.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Belson Outdoors, Inc.
 - b. Halsey Taylor.
 - c. Haws Corporation.
 - d. Murdock-Super Secur; a division of Acorn Engineering Company.
 - e. Tri Palm International, LLC; Oasis Brand.
 2. Standards: Comply with ICC A117.1 and NSF 61.
 3. Pedestal: Square, with offset to receptor.
 4. Receptor(s):
 - a. Number: Two.
 - b. Material: Chrome-plated brass or stainless steel.
 - c. Shape: Square.
 - d. Bubbler: One for each receptor, with adjustable stream regulator.

- e. Drain: Grid type with NPS 1-1/4 (DN 32) tailpiece.
- 5. Controls: Push button.
- 6. Access to Internal Components: Panel in pedestal.
- 7. Supply Piping: NPS 1/2 (DN 15) with shutoff valve.
- 8. Drain Piping: NPS 1-1/4 (DN 32) minimum trap and waste.

2.2 PRESSURE WATER COOLERS

A. Pressure Water Coolers <EWC-1>: Wall mounted, wheelchair accessible.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkay Manufacturing Co.
 - b. Halsey Taylor.
 - c. Haws Corporation.
 - d. Tri Palm International, LLC; Oasis Brand.
- 2. Cabinet: Bi-level with two attached cabinets, all stainless steel.
- 3. Bubbler: One, with adjustable stream regulator, located on each cabinet deck, vandal-resistant and keyed into position.
- 4. Control: Push button or push bar.
- 5. Drain: Grid with NPS 1-1/4 (DN 32) tailpiece.
- 6. Supply: NPS 3/8 (DN 10) with shutoff valve.
- 7. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 (DN 32) brass P-trap.
- 8. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
- 9. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
 - a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 10. Capacities and Characteristics:
 - a. Cooled Water: 8 gph (0.0084 L/s).
 - b. Ambient-Air Temperature: 90 deg F (32 deg C).
 - c. Inlet-Water Temperature: 80 deg F (27 deg C).
 - d. Cooled-Water Temperature: 50 deg F (10 deg C).
 - e. Electrical Characteristics:
 - 1) Volts: 120-V ac.
 - 2) Phase: Single.
 - 3) Hertz: 60.
- 11. Support: ASME A112.6.1M, Type I water-cooler carrier.

- B. Pressure Water Coolers <EWC-2>: Wall mounted, wheelchair accessible.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkay Manufacturing Co.
 - b. Halsey Taylor.
 - c. Haws Corporation.
 - d. Tri Palm International, LLC; Oasis Brand.
 2. Cabinet: Single, all stainless steel.
 3. Bubbler: One, with adjustable stream regulator, located on each cabinet deck, vandal-resistant and keyed into position.
 4. Control: Push button or push bar.
 5. Drain: Grid with NPS 1-1/4 (DN 32) tailpiece.
 6. Supply: NPS 3/8 (DN 10) with shutoff valve.
 7. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 (DN 32) brass P-trap.
 8. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
 9. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
 - a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 10. Capacities and Characteristics:
 - a. Cooled Water: 8 gph (0.0084 L/s).
 - b. Ambient-Air Temperature: 90 deg F (32 deg C).
 - c. Inlet-Water Temperature: 80 deg F (27 deg C).
 - d. Cooled-Water Temperature: 50 deg F (10 deg C).
 - e. Electrical Characteristics:
 - 1) Volts: 120-V ac.
 - 2) Phase: Single.
 - 3) Hertz: 60.
 11. Support: ASME A112.6.1M, Type I water-cooler carrier.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
- B. Examine walls and floors for suitable conditions where fixtures will be installed.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- B. Install chrome-plated brass or copper tube, fittings, and valves in locations exposed to view.
- C. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.
- D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- F. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- G. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

- A. Connect fixtures with water supplies, traps, and risers, and with soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."
- C. Install ball or gate shutoff valve on water supply to each fixture. Install valve upstream from filter for water cooler. Comply with valve requirements specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- D. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."
- E. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.
- B. Adjust pressure water cooler temperature settings.

3.5 CLEANING

- A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.
- C. Provide protective covering for installed fixtures.
- D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224700

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: Class F.
- I. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- B. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

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SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Grout.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- B. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- C. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- D. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.

3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.
 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."

- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves.
 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves with sleeve-seal system.

- 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
4. Concrete Slabs above Grade:
- a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves.
5. Interior Partitions:
- a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 230517

SECTION 230518 - ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With rough-brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. Split-Casting Brass Type: With rough-brass finish and with concealed hinge and setscrew.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

- b. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with rough-brass finish.
- c. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with rough-brass finish.

END OF SECTION 230518

SECTION 230519 - METERS AND GAGES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following meters and gages for mechanical systems:
 - 1. Thermometers.
 - 2. Gages.
 - 3. Test plugs.
 - 4. Flowmeters.
 - 5. Thermal-energy meters.

1.3 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated; include performance curves.
- B. Shop Drawings: Schedule for thermometers, gages and flowmeters indicating manufacturer's number, scale range, and location for each.
- C. Product Certificates: For each type of thermometer, gage and flowmeter, signed by product manufacturer.
- D. Operation and Maintenance Data: For flowmeters and thermal-energy meters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

- A. Manufacturers:
1. Palmer - Wahl Instruments Inc.
 2. Terice, H. O. Co.
 3. Weiss Instruments, Inc.
 4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Case: Die-cast aluminum or brass, 7 inches (178 mm) long.
- C. Tube: blue reading, organic-liquid filled, with magnifying lens.
- D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- E. Window: Glass or plastic .
- F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
- G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.
- H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.3 PLASTIC-CASE, LIQUID-IN-GLASS THERMOMETERS

- A. Manufacturers:
1. Ernst Gage Co.
 2. Eugene Ernst Products Co.
 3. Marsh Bellofram.
 4. Miljoco Corp.
 5. Terice, H. O. Co.
 6. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
 7. Winters Instruments.
- B. Case: Plastic, 7 inches (178 mm) long.
- C. Tube: Blue reading, mercury or organic-liquid filled, with magnifying lens.

- D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- E. Window: Glass or plastic.
- F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
- G. Stem: Metal, for thermowell installation and of length to suit installation.
- H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.4 DUCT-TYPE, LIQUID-IN-GLASS THERMOMETERS

- A. Available Manufacturers:
 - 1. Miljoco Corp.
 - 2. Palmer - Wahl Instruments Inc.
 - 3. Trerice, H. O. Co.
 - 4. Weiss Instruments, Inc.
- B. Case: Die-cast aluminum , 7 inches (178 mm) long.
- C. Tube: blue reading with magnifying lens.
- D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- E. Window: Glass or plastic .
- F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device .
- G. Stem: Metal, for installation in mounting bracket and of length to suit installation.
- H. Mounting Bracket: Flanged fitting for attachment to duct and made to hold thermometer stem.
- I. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.5 THERMOWELLS

- A. Available Manufacturers:
 - 1. AMETEK, Inc.; U.S. Gauge Div.
 - 2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
 - 3. Ernst Gage Co.
 - 4. Marsh Bellofram.

5. Miljoco Corp.
6. NANMAC Corporation.
7. Noshok, Inc.
8. Palmer - Wahl Instruments Inc.
9. REO TEMP Instrument Corporation.
10. Tel-Tru Manufacturing Company.
11. Trerice, H. O. Co.
12. Weiss Instruments, Inc.
13. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
14. WIKA Instrument Corporation.
15. Winters Instruments.

B. Manufacturers: Same as manufacturer of thermometer being used.

C. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.6 PRESSURE GAGES

A. Available Manufacturers:

1. AMETEK, Inc.; U.S. Gauge Div.
2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
3. Ernst Gage Co.
4. Eugene Ernst Products Co.
5. KOBOLD Instruments, Inc.
6. Marsh Bellofram.
7. Miljoco Corp.
8. Noshok, Inc.
9. Palmer - Wahl Instruments Inc.
10. REO TEMP Instrument Corporation.
11. Trerice, H. O. Co.
12. Weiss Instruments, Inc.
13. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
14. WIKA Instrument Corporation.
15. Winters Instruments.

B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.

1. Case: Liquid-filled type, drawn steel or cast aluminum , 4-1/2-inch (114-mm) diameter.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4 (DN 8), bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red metal.
7. Window: Glass or plastic.
8. Ring: Metal Brass Stainless steel.

9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure (100 kPa of vacuum to 103 kPa of pressure).
11. Range for Fluids under Pressure: Two times operating pressure.

C. Pressure-Gage Fittings:

1. Valves: NPS 1/4 (DN 8) brass or stainless-steel needle type.
2. Syphons: NPS 1/4 (DN 8) coil of brass tubing with threaded ends.
3. Snubbers: ASME B40.5, NPS 1/4 (DN 8) brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.7 TEST PLUGS

- A. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.
- B. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).
- C. Core Inserts: One or two self-sealing rubber valves.
 1. Insert material for air, water, oil, or gas service at 20 to 200 deg F (minus 7 to plus 93 deg C) shall be CR.
 2. Insert material for air or water service at minus 30 to plus 275 deg F (minus 35 to plus 136 deg C) shall be EPDM.
- D. Test Kit: Furnish one test kit(s) containing one pressure gage and adaptor, two thermometer(s), and carrying case. Pressure gage, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping. Manufacturer: Peterson Equipment Co., Inc, Model 1500
 1. Pressure Gage: Small bourdon-tube insertion type with 2- to 3-inch- (51- to 76-mm-) diameter dial and probe. Dial range shall be 0 to 200 psig (0 to 1380 kPa) .
 2. Low-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial ranges shall be 25 to 125 deg F (minus 4 to plus 52 deg C).
 3. High-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial ranges shall be 0 to 220 deg F (minus 18 to plus 104 deg C) .
 4. Carrying case shall have formed instrument padding.
 5. Kit shall be per national and OCPS standards.

2.8 WAFER-ORIFICE FLOWMETERS

A. Available Manufacturers:

1. ABB, Inc.; ABB Instrumentation.

2. Armstrong Pumps, Inc.
 3. Badger Meter, Inc.; Industrial Div.
 4. Bell & Gossett; ITT Industries.
 5. Meriam Instruments Div.; Scott Fetzer Co.
- B. Description: Differential-pressure-design orifice insert for installation between pipe flanges; with calibrated flow-measuring element, separate flowmeter, hoses or tubing, valves, fittings, and conversion chart compatible with flow-measuring element, flowmeter, and system fluid.
- C. Construction: Cast-iron body, brass valves with integral check valves and caps, and calibrated nameplate.
- D. Pressure Rating: 300 psig (2070 kPa) .
- E. Temperature Rating: 250 deg F (121 deg C) .
- F. Range: Flow range of flow-measuring element and flowmeter shall cover operating range of equipment or system served.
- G. Permanent Indicators: Suitable for wall or bracket mounting, calibrated for connected flowmeter element, and having 6-inch- (150-mm-) diameter, or equivalent, dial with fittings and copper tubing for connecting to flowmeter element.
1. Scale: Gallons per minute (Liters per second).
 2. Accuracy: Plus or minus 1 percent between 20 and 80 percent of range.
- H. Portable Indicators: Differential-pressure type calibrated for connected flowmeter element and having two 12-foot (3.7-m) hoses in carrying case.
1. Scale: Gallons per minute (Liters per second).
 2. Accuracy: Plus or minus 2 percent between 20 and 80 percent of range.
- I. Operating Instructions: Include complete instructions with each flowmeter.

2.9 FLOW INDICATORS

- A. Available Manufacturers:
1. Brooks Instrument Div.; Emerson Electric Co.
 2. Dwyer Instruments, Inc.
 3. Ernst Gage Co.
 4. Eugene Ernst Products Co.
 5. McCrometer, Inc.
 6. OPW Engineered Systems; Dover Corp.
 7. Penberthy, Inc.
- B. Description: Instrument for installation in piping systems for visual verification of flow.

- C. Construction: Bronze or stainless-steel body; with sight glass and plastic pelton-wheel indicator, and threaded or flanged ends.
- D. Pressure Rating: 125 psig (860 kPa) .
- E. Temperature Rating: [200 deg F (93 deg C)] .
- F. End Connections for NPS 2 (DN 50) and Smaller: Threaded.
- G. End Connections for NPS 2-1/2 (DN 65) and Larger: Flanged.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

- A. Install liquid-in-glass thermometers in the following locations:
 - 1. Inlet and outlet of each hydronic zone.
 - 2. Inlet and outlet of each hydronic chiller.
 - 3. Inlet and outlet of each hydronic coil in air-handling units and built-up central systems.
 - 4. Outside-air, return-air, and mixed-air ducts.
- B. Provide the following temperature ranges for thermometers:
 - 1. Domestic Hot Water: 30 to 180 deg F, with 2-degree scale divisions (Minus 1 to plus 82 deg C, with 1-degree scale divisions) .
 - 2. Chilled Water: 0 to 100 deg F, with 2-degree scale divisions (Minus 18 to plus 38 deg C, with 1-degree scale divisions) .

3.2 GAGE APPLICATIONS

- A. Install dry-case-type pressure gages for discharge of each pressure-reducing valve.
- B. Install liquid-filled-case-type pressure gages at chilled- -water inlets and outlets of chillers.
- C. Install liquid-filled-case-type pressure gages at suction and discharge of each pump.

3.3 INSTALLATIONS

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install remote-mounting dial thermometers on panel, with tubing connecting panel and thermometer bulb supported to prevent kinks. Use minimum tubing length.
- C. Install thermowells with socket extending a minimum of 2 inches (51 mm) into fluid and in vertical position in piping tees where thermometers are indicated.

- D. Duct Thermometer Support Flanges: Install in wall of duct where duct thermometers are indicated. Attach to duct with screws.
- E. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
- F. Install remote-mounting pressure gages on panel.
- G. Install needle-valve and snubber fitting in piping for each pressure gage for fluids (except steam).
- H. Install needle-valve and syphon fitting in piping for each pressure gage for steam.
- I. Install test plugs in tees in piping.
- J. Install flow indicators, in accessible positions for easy viewing, in piping systems.
- K. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters as prescribed by manufacturer's written instructions.
- L. Install flowmeter elements in accessible positions in piping systems.
- M. Install differential-pressure-type flowmeter elements with at least minimum straight lengths of pipe upstream and downstream from element as prescribed by manufacturer's written instructions.
- N. Install wafer-orifice flowmeter elements between pipe flanges.
- O. Install permanent indicators on walls or brackets in accessible and readable positions.
- P. Install connection fittings for attachment to portable indicators in accessible locations.
- Q. Install flowmeters at discharge of hydronic system pumps and at inlet of hydronic air coils.
- R. Assemble components and install thermal-energy meters.
- S. Mount meters on wall if accessible; if not, provide brackets to support meters.

3.4 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.
- B. Connect flowmeter-system elements to meters.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Connect wiring according to Division 26 Section "Conductors and Cables."

3.5 ADJUSTING

- A. Calibrate meters according to manufacturer's written instructions, after installation.
- B. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION 230519

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SECTION 230523 - VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following general-duty valves:
 - 1. Copper-alloy ball valves.
 - 2. Ferrous-alloy ball valves.
 - 3. Ferrous-alloy butterfly valves.
 - 4. High-pressure butterfly valves.
 - 5. Bronze check valves.
 - 6. Bronze gate valves.

1.3 DEFINITIONS

- A. The following are standard abbreviations for valves:
 - 1. CWP: Cold working pressure.
 - 2. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 3. PTFE: Polytetrafluoroethylene plastic.
 - 4. SWP: Steam working pressure.
 - 5. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.9 for building services piping valves.
 - 1. Exceptions: Domestic hot- and cold-water piping valves unless referenced.
- B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

- B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 VALVES, GENERAL

- A. Refer to Part 3 "Valve Applications" Article for applications of valves.
- B. Bronze Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.
- C. Ferrous Valves: NPS 2-1/2 (DN 65) and larger with flanged ends, unless otherwise indicated.
- D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- F. Valve Actuators:
 1. Gear Drive: For quarter-turn valves NPS 8 (DN 200) and larger.
 2. Handwheel: For valves other than quarter-turn types.
 3. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller, except plug valves.
- G. Extended Valve Stems: On insulated valves.
- H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
- I. Valve Grooved Ends: AWWA C606.

1. Solder Joint: With sockets according to ASME B16.18.
 - a. Caution: Use solder with melting point below 840 deg F (454 deg C) for angle, check, gate, and globe valves; below 421 deg F (216 deg C) for ball valves.
2. Threaded: With threads according to ASME B1.20.1.

J. Valve Bypass and Drain Connections: MSS SP-45.

2.2 COPPER-ALLOY BALL VALVES

- A. Copper-Alloy Ball Valves, General: MSS SP-110.
- B. Two-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full or regular-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stem.

2.3 FERROUS-ALLOY BALL VALVES

- A. Ferrous-Alloy Ball Valves, General: MSS SP-72, with flanged ends.
- B. Ferrous-Alloy Ball Valves: Class 150, full or regular port.

2.4 FERROUS-ALLOY BUTTERFLY VALVES

- A. Ferrous-Alloy Butterfly Valves, General: MSS SP-67, Type I, for tight shutoff, with disc and lining suitable for potable water, unless otherwise indicated.
- B. Flanged, 200-psig (1380-kPa) CWP Rating, Ferrous-Alloy Butterfly Valves: Flanged-end type with one- or two-piece stem.

2.5 BRONZE CHECK VALVES

- A. Bronze Check Valves, General: MSS SP-80.
- B. Type 2, Class 125, Bronze, Horizontal Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.
- C. Type 2, Class 125, Bronze, Vertical Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.

2.6 BRONZE GATE VALVES

- A. Bronze Gate Valves, General: MSS SP-80, with ferrous-alloy handwheel.
- B. Type 1, Class 125, Bronze Gate Valves: Bronze body with nonrising stem and bronze solid wedge and union-ring bonnet.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

- A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, butterfly **or gate** valves.
 - 2. Throttling Service: Angle, ball, butterfly, or globe valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Chilled-Water & Hot-Water Piping: Use the following types of valves:
 - 1. Ball Valves, NPS 2 (DN 50) and Smaller: **Two**-piece, 600-psig (4140-kPa) CWP rating, copper alloy.
 - 2. Butterfly Valves, NPS 2-1/2 (DN 65) and Larger: Flanged, 200-psig (1380-kPa) CWP rating, ferrous alloy, with EPDM liner.
- D. Select valves, except wafer and flangeless types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Solder-joint or threaded ends, except provide valves with threaded ends for heating hot water, steam, and steam condensate services.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged or threaded ends.
 - 3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
 - 4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.

5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged or threaded ends.
6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.
7. For Grooved-End, Copper Tubing and Steel Piping: Valve ends may be grooved. Do not use for steam or steam condensate piping.

3.3 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement.

3.4 JOINT CONSTRUCTION

- A. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 230523

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SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Pipe stands.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.
 - 3. Pipe stands.

- C. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

- A. Non-MFMA Manufacturer Metal Framing Systems:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International; a subsidiary of Mueller Water Products Inc.
 - b. Empire Industries, Inc.
 - c. ERICO International Corporation.
 - d. Haydon Corporation; H-Strut Division.
 - e. PHD Manufacturing, Inc.
 - f. PHS Industries, Inc.
 - 2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 - 3. Standard: Comply with MFMA-4.

4. Channels: Continuous slotted steel channel with inturred lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Coating: Zinc.

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Carpenter & Paterson, Inc.
 2. Clement Support Services.
 3. ERICO International Corporation.
 4. National Pipe Hanger Corporation.
 5. PHS Industries, Inc.
 6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
 7. Piping Technology & Products, Inc.
 8. Rilco Manufacturing Co., Inc.
 9. Value Engineered Products, Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

C. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

2.7 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

- a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
 - d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
 - e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.3 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.4 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.5 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and attachments for general service applications.
- F. Use padded hangers for piping that is subject to scratching.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - 2. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
- J. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 3. C-Clamps (MSS Type 23): For structural shapes.
- K. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
- L. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Isolation pads.
 - 2. Isolation mounts.
 - 3. Freestanding and restrained spring isolators.
 - 4. Spring hangers.
 - 5. Inertia, vibration isolation equipment bases.

1.3 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Loading:
 - 1. Basic Wind Speed: 153 MPH.
 - 2. Building Classification Category: III.
 - 3. Minimum 10 lb/sq. ft. (48.8 kg/sq. m) multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

- B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, wind forces required to select vibration isolators, wind restraints, and for designing vibration isolation bases.
 - a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Division 22 Sections for equipment mounted outdoors.
 - 2. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
- C. Qualification Data: For professional engineer.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ace Mountings Co., Inc.
 - 2. Amber/Booth Company, Inc.
 - 3. California Dynamics Corporation.
 - 4. Isolation Technology, Inc.
 - 5. Kinetics Noise Control.
 - 6. Mason Industries.
 - 7. Vibration Eliminator Co., Inc.
 - 8. Vibration Isolation.
 - 9. Vibration Mountings & Controls, Inc.
- B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - 1. Resilient Material: Oil- and water-resistant neoprene.
- C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate

for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

E. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

F. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.2 VIBRATION ISOLATION EQUIPMENT BASES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Amber/Booth Company, Inc.
 2. California Dynamics Corporation.
 3. Isolation Technology, Inc.
 4. Kinetics Noise Control.
 5. Mason Industries.
 6. Vibration Eliminator Co., Inc.
 7. Vibration Isolation.
 8. Vibration Mountings & Controls, Inc.
- B. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.
 1. Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - a. Include supports for suction and discharge elbows for pumps.
 2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
 4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.3 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 1. Powder coating on springs and housings.
 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 3. Baked enamel or powder coat for metal components on isolators for interior use.
 4. Color-code or otherwise mark vibration isolation control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- B. Equipment Restraints:
 - 1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
- C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

3.3 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 230548

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SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Duct labels.
4. Valve tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
 2. Letter Color: White.
 3. Background Color: Black.
 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
 6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules).
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 2. Lettering Size: At least 1-1/2 inches ((38 mm) high).

2.3 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch ((1.6 mm)) thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Per section 3.4.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 2-1/2inch (64 by 69 mm).
- F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- G. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches ((38 mm) high).

2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.
 - 1. Tag Material: Brass, 0.032-inch (0.8-mm) or anodized aluminum, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.
- C. When equipment is located above the ceiling install label on the ceiling grid T-bar below the equipment.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09.
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
 - 1. Chilled-Water Piping:
 - a. Background Color: Green.
 - b. Letter Color: White.
 - 2. Hot-Water Piping:
 - a. Background Color: Yellow.
 - b. Letter Color: Black.
 - 3. Refrigerant Piping:
 - a. Background Color: Black.
 - b. Letter Color: White
 - 4. Gas Piping.
 - a. Background Color: Yellow.
 - b. Letter Color: Black.

3.4 DUCT LABEL INSTALLATION

- A. Install duct labels with permanent adhesive on air ducts in the following color codes:
 - 1. Blue: For cold-air supply ducts.
 - 2. Yellow: For hot-air supply ducts.
 - 3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 - 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape:
 - a. Chilled Water: 1-1/2 inches (38 mm), round.
 - b. Condenser Water: 1-1/2 inches (38 mm), round.
 - c. Gas: 1-1/2 inches (38 mm), round.
 - 2. Valve-Tag Color:
 - a. Chilled Water: Natural.
 - b. Condenser Water: Natural.
 - c. Gas: Yellow.
 - 3. Letter Color:
 - a. Chilled Water: Black.
 - b. Condenser Water: Black.
 - c. Gas: Black.

END OF SECTION 230553

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SECTION 230593- TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes TAB to produce design objectives for the following:
 - 1. Air Systems:
 - a. Constant-volume air systems.
 - b. Variable-air-volume systems.
 - 2. Hydronic Piping Systems:
 - a. Constant-flow systems.
 - b. Variable-flow systems.
 - c. Primary-secondary systems.
 - 3. HVAC equipment quantitative-performance settings.
 - 4. Kitchen hood airflow balancing.
 - 5. Vibration measuring.
 - 6. Indoor-air quality measuring.
 - 7. Verifying that automatic control devices are functioning properly.
 - 8. Reporting results of activities and procedures specified in this Section.

1.3 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.
- C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.
- D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

- E. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- F. Report Forms: Test data sheets for recording test data in logical order.
- G. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- H. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- I. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- J. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- K. TAB: Testing, adjusting, and balancing.
- L. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- M. Test: A procedure to determine quantitative performance of systems or equipment.
- N. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.4 SUBMITTALS

- A. Qualification Data: Within 30 days from Contractor's Notice to Proceed, submit 2 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 45 days from Contractor's Notice to Proceed, submit 6 copies of the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 60 days from Contractor's Notice to Proceed, submit 2 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.
- D. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.
- E. Sample Report Forms: Submit two sets of sample TAB report forms.
- F. Warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.

- B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems."
- D. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems."
- E. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
 - 1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.6 PROJECT CONDITIONS

- A. Owner Occupancy: Owner will not occupy the building during entire TAB period. T&B reports shall be finalized and approved prior to owner occupancy.
- B. T&B firm shall be independent from the mechanical contractor.

1.7 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 WARRANTY

- A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
 - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.

2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
 1. Contract Documents are defined in the General and Supplementary Conditions of Contract.
 2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine Project Record Documents described in Division 1 Section "Project Record Documents."
- D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
- F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- G. Examine system and equipment test reports.
- H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

- I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- K. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.
- L. Examine plenum ceilings used for supply air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.
- M. Examine strainers for clean screens and proper perforations.
- N. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- O. Examine system pumps to ensure absence of entrained air in the suction piping.
- P. Examine equipment for installation and for properly operating safety interlocks and controls.
- Q. Examine automatic temperature system components to verify the following:
 - 1. Dampers, valves, and other controlled devices are operated by the intended controller.
 - 2. Dampers and valves are in the position indicated by the controller.
 - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
 - 4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
 - 5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
 - 6. Sensors are located to sense only the intended conditions.
 - 7. Sequence of operation for control modes is according to the Contract Documents.
 - 8. Controller set points are set at indicated values.
 - 9. Interlocked systems are operating.
 - 10. Changeover from heating to cooling mode occurs according to indicated values.
- R. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
 - 1. Permanent electrical power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.

3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" and this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- E. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.

- K. Check for proper sealing of air-handling unit components.
- L. Check for proper sealing of air duct system.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure fan static pressures to determine actual static pressure as follows:
 - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
 - 3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
 - 4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
 - 5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
 - 6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 - 1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure terminal outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
- B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load.
 2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
 3. Measure total system airflow. Adjust to within indicated airflow.
 4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
 5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
 6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
 8. Record the final fan performance data.
- C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Balance systems similar to constant-volume air systems.
 2. Set terminal units and supply fan at full-airflow condition.
 3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
 4. Readjust fan airflow for final maximum readings.
 5. Measure operating static pressure at the sensor that controls the supply fan, if one is installed, and verify operation of the static-pressure controller.
 6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
 7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.
 8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
- D. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
 2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
 3. Set terminal units at full-airflow condition.
 4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
 5. Adjust terminal units for minimum airflow.
 6. Measure static pressure at the sensor.
 7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
 - 1. Open all manual valves for maximum flow.
 - 2. Check expansion tank liquid level.
 - 3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
 - 4. Check flow-control valves for specified sequence of operation and set at indicated flow.
 - 5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
 - 6. Set system controls so automatic valves are wide open to heat exchangers.
 - 7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
 - 8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.8 PROCEDURES FOR HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures, except for positive-displacement pumps:
 - 1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
 - 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
 - 4. Report flow rates that are not within plus or minus 5 percent of design.
- B. Set calibrated balancing valves, if installed, at calculated presettings.
- C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
 - 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- E. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
 - 1. Determine the balancing station with the highest percentage over indicated flow.

2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
3. Record settings and mark balancing devices.

F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.10 PROCEDURES FOR PRIMARY-SECONDARY-FLOW HYDRONIC SYSTEMS

A. Balance the primary system crossover flow first, then balance the secondary system.

3.11 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.12 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

3.13 PROCEDURES FOR TEMPERATURE MEASUREMENTS

- A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.

3.14 TEMPERATURE-CONTROL VERIFICATION

- A. Verify that controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.
- D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Check free travel and proper operation of control devices such as damper and valve operators.
- F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.
- G. Check the interaction of electrically operated switch transducers.
- H. Check the interaction of interlock and lockout systems.
- I. Check main control supply-air pressure and observe compressor and dryer operations.
- J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.
- K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.15 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
 - 2. Air Outlets and Inlets: 0 to minus 10 percent.
 - 3. Heating-Water Flow Rate: 0 to minus 10 percent.
 - 4. Cooling-Water Flow Rate: 0 to minus 5 percent.

3.16 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.17 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
 - 1. Include a list of instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to certified field report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.
- D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
 - 1. Title page.
 - 2. Name and address of TAB firm.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.
 - 9. Signature of TAB firm who certifies the report.
 - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.

- c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer, type size, and fittings.
 14. Notes to explain why certain final data in the body of reports varies from indicated values.
 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outside-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outside, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.
- F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data: Include the following:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches (mm), and bore.
 - i. Sheave dimensions, center-to-center, and amount of adjustments in inches (mm).
 - j. Number of belts, make, and size.
 - k. Number of filters, type, and size.
 2. Motor Data:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.

- e. Sheave make, size in inches (mm), and bore.
 - f. Sheave dimensions, center-to-center, and amount of adjustments in inches (mm).
3. Test Data (Indicated and Actual Values):
- a. Total airflow rate in cfm (L/s).
 - b. Total system static pressure in inches wg (Pa).
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg (Pa).
 - e. Filter static-pressure differential in inches wg (Pa).
 - f. Preheat coil static-pressure differential in inches wg (Pa).
 - g. Cooling coil static-pressure differential in inches wg (Pa).
 - h. Heating coil static-pressure differential in inches wg (Pa).
 - i. Outside airflow in cfm (L/s).
 - j. Return airflow in cfm (L/s).
 - k. Outside-air damper position.
 - l. Return-air damper position.
 - m. Vortex damper position.

G. Apparatus-Coil Test Reports:

1. Coil Data:
 - a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch (mm) o.c.
 - f. Make and model number.
 - g. Face area in sq. ft. (sq. m).
 - h. Tube size in NPS (DN).
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm (L/s).
 - b. Average face velocity in fpm (m/s).
 - c. Air pressure drop in inches wg (Pa).
 - d. Outside-air, wet- and dry-bulb temperatures in deg F (deg C).
 - e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
 - f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
 - g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
 - h. Water flow rate in gpm (L/s).
 - i. Water pressure differential in feet of head or psig (kPa).
 - j. Entering-water temperature in deg F (deg C).
 - k. Leaving-water temperature in deg F (deg C).
 - l. Refrigerant expansion valve and refrigerant types.
 - m. Refrigerant suction pressure in psig (kPa).
 - n. Refrigerant suction temperature in deg F (deg C).
 - o. Inlet steam pressure in psig (kPa).

H. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Coil identification.
 - d. Capacity in **Btuh (kW)**.
 - e. Number of stages.
 - f. Connected volts, phase, and hertz.
 - g. Rated amperage.
 - h. Airflow rate in **cfm (L/s)**.
 - i. Face area in **sq. ft. (sq. m)**.
 - j. Minimum face velocity in **fpm (m/s)**.

2. Test Data (Indicated and Actual Values):
 - a. Heat output in **Btuh (kW)**.
 - b. Airflow rate in **cfm (L/s)**.
 - c. Air velocity in **fpm (m/s)**.
 - d. Entering-air temperature in **deg F (deg C)**.
 - e. Leaving-air temperature in **deg F (deg C)**.
 - f. Voltage at each connection.
 - g. Amperage for each phase.

I. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in **inches (mm)**, and bore.
 - h. Sheave dimensions, center-to-center, and amount of adjustments in **inches (mm)**.
2. Motor Data:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in **inches (mm)**, and bore.
 - f. Sheave dimensions, center-to-center, and amount of adjustments in **inches (mm)**.
 - g. Number of belts, make, and size.

3. Test Data (Indicated and Actual Values):

- a. Total airflow rate in **cfm (L/s)**.
 - b. Total system static pressure in **inches wg (Pa)**.
 - c. Fan rpm.
 - d. Discharge static pressure in **inches wg (Pa)**.
 - e. Suction static pressure in **inches wg (Pa)**.
- J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
 - a. System and air-handling unit number.
 - b. Location and zone.
 - c. Traverse air temperature in **deg F (deg C)**.
 - d. Duct static pressure in **inches wg (Pa)**.
 - e. Duct size in **inches (mm)**.
 - f. Duct area in **sq. ft. (sq. m)**.
 - g. Indicated airflow rate in **cfm (L/s)**.
 - h. Indicated velocity in **fpm (m/s)**.
 - i. Actual airflow rate in **cfm (L/s)**.
 - j. Actual average velocity in **fpm (m/s)**.
 - k. Barometric pressure in **psig (Pa)**.
- K. Air-Terminal-Device Reports:
1. Unit Data:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Test apparatus used.
 - d. Area served.
 - e. Air-terminal-device make.
 - f. Air-terminal-device number from system diagram.
 - g. Air-terminal-device type and model number.
 - h. Air-terminal-device size.
 - i. Air-terminal-device effective area in **sq. ft. (sq. m)**.
 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in **cfm (L/s)**.
 - b. Air velocity in **fpm (m/s)**.
 - c. Preliminary airflow rate as needed in **cfm (L/s)**.
 - d. Preliminary velocity as needed in **fpm (m/s)**.
 - e. Final airflow rate in **cfm (L/s)**.
 - f. Final velocity in **fpm (m/s)**.
 - g. Space temperature in **deg F (deg C)**.
- L. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
1. Unit Data:

- a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and size.
 - e. Model and serial numbers.
 - f. Water flow rate in **gpm (L/s)**.
 - g. Water pressure differential in **feet of head or psig (kPa)**.
 - h. Required net positive suction head in **feet of head or psig (kPa)**.
 - i. Pump rpm.
 - j. Impeller diameter in **inches (mm)**.
 - k. Motor make and frame size.
 - l. Motor horsepower and rpm.
 - m. Voltage at each connection.
 - n. Amperage for each phase.
 - o. Full-load amperage and service factor.
 - p. Seal type.
2. Test Data (Indicated and Actual Values):
- a. Static head in **feet of head or psig (kPa)**.
 - b. Pump shutoff pressure in **feet of head or psig (kPa)**.
 - c. Actual impeller size in **inches (mm)**.
 - d. Full-open flow rate in **gpm (L/s)**.
 - e. Full-open pressure in **feet of head or psig (kPa)**.
 - f. Final discharge pressure in **feet of head or psig (kPa)**.
 - g. Final suction pressure in **feet of head or psig (kPa)**.
 - h. Final total pressure in **feet of head or psig (kPa)**.
 - i. Final water flow rate in **gpm (L/s)**.
 - j. Voltage at each connection.
 - k. Amperage for each phase.
- M. Instrument Calibration Reports:
1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.
- 3.18 INSPECTIONS
- A. Initial Inspection:
1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.
 2. Randomly check the following for each system:

- a. Measure airflow of at least 10 percent of air outlets.
- b. Measure water flow of at least 5 percent of terminals.
- c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
- d. Measure sound levels at two locations.
- e. Measure space pressure of at least 10 percent of locations.
- f. Verify that balancing devices are marked with final balance position.
- g. Note deviations to the Contract Documents in the Final Report.

B. Final Inspection:

1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. TAB firm test and balance engineer shall conduct the inspection in the presence of Owner.
3. Architect shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

3.19 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, exposed supply and outdoor air.
 - 3. Indoor, concealed return located in unconditioned space.
 - 4. Indoor, exposed return located in unconditioned space.
 - 5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
 - 6. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
 - 7. Indoor, exposed exhaust between isolation damper and penetration of building exterior.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- B. Qualification Data: For qualified Installer.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Friendly Feel Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap.
 - e. Owens Corning; SOFTR All-Service Duct Wrap.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; Commercial Board.
 - b. Fibrex Insulations Inc.; FBX.
 - c. Johns Manville; 800 Series Spin-Glas.
 - d. Knauf Insulation; Insulation Board.
 - e. Manson Insulation Inc.; AK Board.
 - f. Owens Corning; Fiberglas 700 Series.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; FlameChek.
 - b. Johns Manville; Firetemp Wrap.
 - c. Nelson Fire Stop Products; Nelson FSB Flameshield Blanket.
 - d. Thermal Ceramics; FireMaster Duct Wrap.
 - e. 3M; Fire Barrier Wrap Products.
 - f. Unifrax Corporation; FyreWrap.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - d. Mon-Eco Industries, Inc.; 22-25.
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
 - d. Mon-Eco Industries, Inc.; 22-25.

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 5. Color: White.

2.5 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - d. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
 5. Color: Aluminum.

2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
 2. Width: 3 inches (75 mm).
 3. Thickness: 6.5 mils (0.16 mm).
 4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.8 SECUREMENTS

- A. Insulation Pins and Hangers:
 1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.

- a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; CD.
 - 3) Midwest Fasteners, Inc.; CD.
 - 4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; CHP-1.
 - 2) GEMCO; Cupped Head Weld Pin.
 - 3) Midwest Fasteners, Inc.; Cupped Head.
 - 4) Nelson Stud Welding; CHP.
 3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
 4. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) GEMCO.
 - 2) Midwest Fasteners, Inc.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- 3.4 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION
- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- 3.5 INSTALLATION OF MINERAL-FIBER INSULATION
- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
 - b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).
 5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.
 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
 - b. On duct sides with dimensions larger than 18 inches (450 mm), space pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

3.6 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

3.7 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
6. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
7. Indoor, exposed exhaust between isolation damper and penetration of building exterior.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Factory-insulated access panels and doors.

3.8 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

B. Concealed, round and flat-oval, return-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

C. Concealed, round and flat-oval, outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

D. Concealed, rectangular, supply-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

E. Concealed, rectangular, return-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

F. Concealed, rectangular, outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.
- G. Concealed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.
- H. Concealed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket; thickness as required to achieve 2-hour fire rating.
- I. Concealed, return-air plenum insulation shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.
- J. Concealed, outdoor-air plenum insulation shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.
- K. Exposed, round and flat-oval, supply-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.
- L. Exposed, round and flat-oval, return-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.
- M. Exposed, round and flat-oval, outdoor-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.
- N. Exposed, round, flat-oval and rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.
- O. Exposed, rectangular, supply-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.
- P. Exposed, rectangular, return-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.
- Q. Exposed, rectangular, outdoor-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.
- R. Exposed, return-air plenum insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.
- S. Exposed, outdoor-air plenum insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

END OF SECTION 230713

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SECTION 230716 - HVAC EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes insulating the following HVAC equipment that is not factory insulated:
 - 1. Heat exchangers.
 - 2. Chilled-water pumps.
 - 3. Expansion/compression tanks.
 - 4. Air separators.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- B. Qualification Data: For qualified Installer.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with equipment Installer for equipment insulation application.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Breeching Insulation Schedule" and "Equipment Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pittsburgh Corning Corporation; Foamglas.
 - 2. Block Insulation: ASTM C 552, Type I.
 - 3. Special-Shaped Insulation: ASTM C 552, Type III.
 - 4. Board Insulation: ASTM C 552, Type IV.
 - 5. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

- G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Sheet and K-FLEX LS.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA, Inc.; Aeroseal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
- D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
 - d. Mon-Eco Industries, Inc.; 22-25.

2.3 MASTICS

- A. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H .B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 5. Color: White.

2.4 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Pittsburgh Corning Corporation; Pittseal 444.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
5. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - d. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: White.

2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.6 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. Metal Jacket:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
 - c. RPR Products, Inc.; Insul-Mate.
 2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.
 - d. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
 - e. Factory-Fabricated Fitting Covers:

- 1) Same material, finish, and thickness as jacket.
- 2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
- 3) Tee covers.
- 4) Flange and union covers.
- 5) End caps.
- 6) Beveled collars.
- 7) Valve covers.
- 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 2. Width: 3 inches (75 mm).
 3. Thickness: 11.5 mils (0.29 mm).
 4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 488 AWF.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - c. Compac Corporation; 120.
 - d. Venture Tape; 3520 CW.
 2. Width: 2 inches (50 mm).
 3. Thickness: 3.7 mils (0.093 mm).
 4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
 5. Elongation: 5 percent.
 6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.8 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.
3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Wire: 0.080-inch (2.0-mm) nickel-copper alloy.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. C & F Wire.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

- B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- O. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Manholes.
 5. Handholes.
 6. Cleanouts.

3.4 INSTALLATION OF EQUIPMENT, TANK, AND VESSEL INSULATION

- A. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.
1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
 2. Seal longitudinal seams and end joints.
- B. Insulation Installation on Pumps:
1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch (150-mm) centers, starting at corners. Install 3/8-inch- (10-mm-) diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
 2. Fabricate boxes from aluminum, at least 0.040 inch (1.0 mm) thick.
 3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.5 FIELD-APPLIED JACKET INSTALLATION

- A. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.6 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Do not field paint aluminum or stainless-steel jackets.

3.7 EQUIPMENT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
- B. Insulate indoor and outdoor equipment that is not factory insulated.
- C. Heat-exchanger (water-to-water for cooling service) insulation shall be the following:
 - 1. Flexible Elastomeric: 2 inches (50 mm) thick.
- D. Chilled-water pump insulation shall be the following:
 - 1. Cellular Glass: 3 inches (75 mm) thick.
- E. Chilled-water expansion/compression tank insulation shall be the following:
 - 1. Flexible Elastomeric: 1 inch (25 mm) thick.
- F. Chilled-water air-separator insulation shall be the following:
 - 1. Flexible Elastomeric: 1 inch (25 mm) thick.
- G. Chilled-water chemical by-pass feeder insulation shall be the following:
 - 1. Flexible Elastomeric: 1 inch (25 mm) thick.
- H. Chilled-water filters insulation shall be the following:
 - 1. Flexible Elastomeric: 1 inch (25 mm) thick.

3.8 FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Equipment, Exposed, up to 48 Inches (1200 mm) in Diameter or with Flat Surfaces up to 72 Inches (1800 mm):
 - 1. Aluminum, Corrugated with Z-Shaped Locking Seam: 0.020 inch (0.51 mm) thick.
- D. Equipment, Exposed, Larger Than 48 Inches (1200 mm) in Diameter or with Flat Surfaces Larger Than 72 Inches (1800 mm):
 - 1. Aluminum, Stucco Embossed with 1-1/4-Inch- (32-mm-) Deep Corrugations: 0.032 inch (0.81 mm) thick.

END OF SECTION 230716

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SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
 - 1. Condensate drain piping, indoors.
 - 2. Chilled-water and brine piping, indoors and outdoors.
 - 3. Ho-water piping.
 - 4. Refrigerant suction and hot-gas piping, indoors and outdoors.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- B. Qualification Data: For qualified Installer.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Pittsburgh Corning Corporation; Foamglas.
 2. Block Insulation: ASTM C 552, Type I.
 3. Special-Shaped Insulation: ASTM C 552, Type III.
 4. Board Insulation: ASTM C 552, Type IV.
 5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
 6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
- C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA, Inc.; Aeroseal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
- D. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 739, Dow Silicone.
 - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Polyco VP Adhesive.
- E. Mineral-Fiber, Preformed Pipe Insulation:
 1. Products: Subject to compliance with requirements, **available products that may be incorporated into the Work include, but are not limited to, the following:**
 - a. Johns Manville; Micro-Lok.
 - b. Knauf Insulation; 1000 Pipe Insulation.
 - c. Owens Corning; Fiberglas Pipe Insulation.
 2. Type I, **850 deg F (454 deg C)** Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, **with factory-applied ASJ**. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
 - b. Eagle Bridges - Marathon Industries; 570.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
 3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 5. Color: White.

2.4 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
 - c. Vimasco Corporation; 713 and 714.
 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
 4. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
 5. Color: White.

2.5 SEALANTS

- A. Joint Sealants:
 1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
 - d. Mon-Eco Industries, Inc.; 44-05.

- e. Pittsburgh Corning Corporation; Pittseal 444.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Permanently flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
 - 5. Color: White or gray.
- B. FSK and Metal Jacket Flashing Sealants:
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
 - 5. Color: Aluminum.
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
 - 5. Color: White.
- 2.6 FACTORY-APPLIED JACKETS
- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. (68 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm) for covering pipe and pipe fittings.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Chil-Glas Number 10.

2.8 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. (271 g/sq. m).
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

2.9 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 - 2. Adhesive: As recommended by jacket material manufacturer.
 - 3. Color: White.
 - 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- C. Metal Jacket:
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
 - c. RPR Products, Inc.; Insul-Mate.
2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
- a. Sheet and roll stock ready for shop or field sizing.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
 - d. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.10 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 2. Width: 3 inches (75 mm).
 3. Thickness: 11.5 mils (0.29 mm).
 4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 370 White PVC tape.
 - b. Compac Corporation; 130.
 - c. Venture Tape; 1506 CW NS.
2. Width: 2 inches (50 mm).
3. Thickness: 6 mils (0.15 mm).
4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

2.11 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
2. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

PART 3 - EXECUTION

3.1 EXAMINATION

- #### A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A.

- #### B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, for outdoor pipe apply a corrosion coating to insulated surfaces as follows:

1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 1. Install insulation continuously through hangers and around anchor attachments.
 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Manholes.
 5. Handholes.
 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
 - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets,

- valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at **6 inches (150 mm)** o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least **1 inch (25 mm)**, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.9 FIELD-APPLIED JACKET INSTALLATION

- A. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

- B. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.10 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended UV protective coating for exterior installation.

- B. Do not field paint aluminum or stainless-steel jackets.

3.11 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):

1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 3/4 inch (19 mm) thick.
 - B. Chilled Water and Brine, 40 Deg F (5 Deg C) and below:
 1. NPS 12 (DN 300) and Smaller: Insulation shall be the following:
 - a. Cellular Glass: 2 inches (50 mm) thick.
 2. NPS 14 (DN 350) and Larger: Insulation shall be the following:
 - a. Cellular Glass: 3 inches (75 mm) thick.
 - C. Heating-Hot-Water Supply and Return, 200 Deg F (93 Deg C) and below:
 1. NPS 12 (DN 300) and Smaller: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
 - b. Mineral-Fiber, Preformed Pipe, Type I: 1 inch (25 mm) thick.
 - D. Chilled Water and Brine, above 40 Deg F (5 Deg C):
 1. NPS 12 (DN 300) and Smaller: Insulation shall be the following:
 - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
 - E. Refrigerant Suction and Hot-Gas Piping:
 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inch (25 mm) thick.
 - F. Refrigerant Suction and Hot-Gas Flexible Tubing:
 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inch (25 mm) thick.
- 3.13 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE
- A. Chilled Water and Brine:
 1. All Pipe Sizes: Insulation shall be the following:
 - a. Cellular Glass: 3 inches (75 mm) thick.
 - B. Refrigerant Suction and Hot-Gas Piping:
 1. All Pipe Sizes: Insulation shall be the following:

- a. Flexible Elastomeric: 2 inches (50 mm) thick.
- C. Refrigerant Suction and Hot-Gas Flexible Tubing:
- 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 2 inches (50 mm) thick.
- 3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE
- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
 - B. If more than one material is listed, selection from materials listed is Contractor's option.
 - C. Piping, Concealed:
 - 1. None.
 - D. Piping, Exposed:
 - 1. PVC: 20 mils (0.5 mm) thick.
- 3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE
- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
 - B. If more than one material is listed, selection from materials listed is Contractor's option.
 - C. Piping, Concealed:
 - 1. None.
 - D. Piping, Exposed:
 - 1. Aluminum, Corrugated with Z-Shaped Locking Seam: 0.020 inch (0.51 mm) thick.

END OF SECTION 230719

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SECTION 230900 - INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes open protocol DDC control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls, lighting in new and existing facilities, generators, freezer, coolers and make-up water meter.

1.3 DEFINITIONS

- A. DDC: Direct digital control.
- B. I/O: Input/output.
- C. BACnet: ASHRAE Standard 135/2004 open protocol standards.
- D. MS/TP: Master slave/token passing. BACnet standard for 485 communications
- E. PC: Personal computer.
- F. PID: Proportional plus integral plus derivative.
- G. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.

1.4 SYSTEM PERFORMANCE

- A. Comply with the following performance requirements:
 - 1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
 - 2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
 - 3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
 - 4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.

5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
 - a. Water Temperature: Plus or minus 1 deg F (0.5 deg C).
 - b. Water Flow: Plus or minus 5 percent of full scale.
 - c. Water Pressure: Plus or minus 2 percent of full scale.
 - d. Space Temperature: Plus or minus 0.35 deg F (0.5 deg C).
 - e. Ducted Air Temperature: Plus or minus 0.35 deg F (0.5 deg C).
 - f. Outside Air Temperature: Plus or minus 0.35 deg F (1.0 deg C).
 - g. Dew Point Temperature: Plus or minus 0.35 deg F (1.5 deg C).
 - h. Temperature Differential: Plus or minus 0.25 deg F (0.15 deg C).
 - i. Relative Humidity: Plus or minus 2 percent.
 - j. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
 - k. Airflow (Terminal): Plus or minus 10 percent of full scale.
 - l. Air Pressure (Ducts): Plus or minus 0.1-inch wg (25 Pa).
 - m. Carbon Dioxide: Plus or minus 50 ppm.
 - n. Electrical: Plus or minus 5 percent of reading.

1.5 SUBMITTALS

- A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
 1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
 2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
 3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
 2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
 3. Wiring Diagrams: Power, signal, and control wiring.
 4. Details of control panel faces, including controls, instruments, and labeling.
 5. Written description of sequence of operation.

6. Schedule of dampers including size, leakage, and flow characteristics.
 7. Schedule of valves including flow characteristics.
 8. DDC System Hardware:
 - a. Wiring diagrams for control units with termination numbers.
 - b. Schematic diagrams and floor plans for field sensors and control hardware.
 - c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
 9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
 10. Controlled Systems:
 - a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
 - b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
 - c. Written description of sequence of operation including schematic diagram.
 - d. Points list.
- C. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135 and that system is Open Protocol.
- D. Software and Firmware Operational Documentation: Include the following:
1. Software operating and upgrade manuals.
 2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
 3. Device address list.
 4. Printout of software application and graphic screens.
 5. Software license required by and installed for DDC workstations and control systems.
- E. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.
- F. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
 2. Interconnection wiring diagrams with identified and numbered system components and devices.
 3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
 4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
 5. Calibration records and list of set points.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with ASHRAE 135 (BACnet) for DDC system components.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.
- B. System Software: Update to latest version of software at Project completion.

1.8 COORDINATION

- A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.
- B. Coordinate equipment with Division 26 Section "Lighting Controls" to achieve compatibility with equipment that interfaces with that system.
- C. Coordinate equipment with Division 28 Section "Fire Detection and Alarm" to achieve compatibility with equipment that interfaces with that system.
- D. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.
- E. Coordinate equipment with Division 26 Section "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CONTROL SYSTEM

- A. Manufacturers:

1. Siemens.

- B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

2.3 DDC EQUIPMENT

- A. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation.
 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - a. Global communications.
 - b. Discrete/digital, analog, and pulse I/O.
 - c. Monitoring, controlling, or addressing data points.
 - d. Software applications, scheduling, and alarm processing.
 - e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
 3. Standard Application Programs:
 - a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, antishort cycling, PID control, DDC with fine tuning, and trend logging.
 - b. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
 - c. Chiller Control Programs: Control function of condenser-water reset, chilled-water reset, and equipment sequencing.
 - d. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
 - e. Remote communications.
 - f. Maintenance management.
 - g. Units of Measure: Inch-pound.
 4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
 5. ASHRAE 135 – BACnet Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

6. LonWorks Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol.
- B. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - a. Global communications.
 - b. Discrete/digital, analog, and pulse I/O.
 - c. Monitoring, controlling, or addressing data points.
 3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
 4. ASHRAE 135 – BACnet Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
 5. LonWorks Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol.
- C. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
1. Binary Inputs: Allow monitoring of on-off signals without external power.
 2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
 3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
 4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
 5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
 6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
 7. Universal I/Os: Provide software selectable binary or analog outputs.
- D. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
1. Output ripple of 5.0 mV maximum peak to peak.
 2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
 3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.
- E. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:

1. Minimum dielectric strength of 1000 V.
2. Maximum response time of 10 nanoseconds.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.4 SYSTEM SOFTWARE

A. General:

1. Contractor shall provide all software required for efficient operation of all functions required by this specification. Software shall be modular in design for flexibility in expansion or revision of the system. Software shall, as a minimum, include:
 - a. Complete database entry.
 - b. Configuration of all application programs to provide the sequence of operation indicated.
 - c. Complete graphics package, including graphics floor plans and individual graphics, for each system.
 - d. Alarm limits and alarm messages for all critical and non-critical alarms.
 - e. Configuration of all reports and point summaries indicated.
2. System software shall be complete such that each control loop shall function as specified in the Sequence of Operation.
3. Building control system manufacturer shall be required to write the software program and test the operation of every control loop. A letter certifying that the system is ready for inspection shall be submitted to the engineer prior to the controllers being shipped to the field. The Engineer may at his option visit the contractor's office and witness proper operation of each control loop prior to shipping from the contractor's point of fabrication. The control contractor shall provide a means of simulating every input to the system as a requirement for debugging the software. Prior to shipping of the microprocessor controller, the debugged software shall be transmitted to the owner for approval.
4. After all field connections have been made and control power is available in the control panel, the owner shall be notified and the control system shall be energized. Any required reloading of the software shall be performed and start-up of the mechanical system and building control system shall commence.
5. Building control contractor shall be responsible for all necessary revisions to the software as required to provide a complete and workable system consistent with the letter and intent of the specification. All control performance criteria are specified in the Sequence of Operations section of the specification.
6. After the system has operated properly for 90 days following start-up of the final component of the heating and air conditioning systems, an as-built copy of the software shall be transmitted to the owner for permanent record purposes. Any software upgrading or enhancements to improve the system operation or as required for proper operation of the system during the first year of operation is the responsibility of the building control system contractor. Any changes to the software shall be immediately transmitted to the Owner.
7. The Building Network Controller shall incorporate the GUI (Graphical User Interface) via a standard web browser. Use of hardware keys or special licenses requirements to access the system with a browser is unacceptable. The Building controller will serve up the web pages on a standalone per building application for the intent that if the WAN is not working, an operator can access the system on site via the building internal network using an IP. A server computer will be located at the energy management office to

- supervise the remote panels and alarm if the communication is lost as well as any control function alarm. This server computer will also be the area of trending archives.
8. Software required to provide the initial operation routines shall not consume more than 70% of the programmable capability of the controller.
 9. Software shall be provided in these five categories:
 - a. System executive software.
 - b. Software for user control over system configuration at the Central Site location, and by Maintenance Personnel in the field.
 - c. Facility monitoring functions.
 - d. Direct digital control.
 - e. Application software.
 10. Each category of software shall consist of interactive software modules. Each module shall have an associated priority level and shall execute as determined by the program controller as defined in the real time operating system.
 11. Building operator shall be able to communicate and direct all control functions through the use of a 2-button "mouse" operator interface to monitor and control all functions and sequences within the system.
 12. Central site shall allow receipt of alarms and messages while in a functional mode other than energy management. I.e. incoming alarms shall be displayed while the operator is in a word processing, spreadsheet or other operating mode. The system must automatically switch from a non- energy management mode, respond to an alarm, and return to the exact position left in the previous functional mode.
 13. Central site must be able to generate standard ASCII file formats to allow use with third-party software (**Microsoft Excel**) to generate and store owner-designed reports.

B. Systems Software:

1. Central site shall display graphically, in up to 64 different colors, the following system information:
 - a. Floor plan maps shall show heating and cooling zones throughout the buildings in a range of colors which provide a visual display of temperature relative to their respective setpoints. The colors shall be updated dynamically as zones' comfort condition change. Locations of space sensors shall also be shown for each zone. Setpoint adjustment and color band displays shall be provided as specified.
 - b. Lighting floor plan maps shall show the status of each individual lighting circuit. When the lights are "on", the area served shall respond in a pre-selected color. When the lights are "off", the area served shall appear gray.
 - c. Mechanical system graphics shall show the type of mechanical system components serving any zone through the use of a pictorial representation of components. It shall also provide a current status of all I/O points being controlled and applicable to each piece of equipment including analog readouts in appropriate engineering units at appropriate locations on the graphic representation.
 - d. The following information shall be selected from a "pop- up" menu available on various graphics:
 - 1) Alarms.
 - 2) Messages.
 - 3) Module Status.
 - 4) Programming Parameters.
 - 5) Quit.
 - 6) Schedules.
 - 7) Schedule Graphs.
 - 8) Schedule Groups.

- 9) Setpoints.
 - 10) Trends.
 - 11) Utilities.
 - e. Programming, scheduling and set-point changes shall be accessible for modification on each menu for the associated equipment. Operator shall be able to automatically download changes from the central site to the appropriate program for the equipment being controlled. Operator shall be able to upload information from the field modules to the central site.
2. Input Format:
 - a. Allowable operators, as defined under user access, shall be able to control system functions by their inputs at an appropriate user terminal. Primary operator interface shall be via two button mouse.
 3. Verification of Operator Input:
 - a. System shall acknowledge all inputs as functions or commands to be performed. System's handling of operator inputs, such as requests to start a motor, output a log, change a time program, acknowledge an alarm, or do any of the other commands described in this specification, shall be in a similar format.
 4. Operator Commands:
 - a. All operator commands shall be in graphics data base and menu driven. After the operator selects the desired object item or menu, the system shall display either the status of selected object item or the allowable options available. Upon entry of a command to the point or points desired as described above, the system shall, before performing any command requested and any entered data. System shall include error monitoring software for user's input error.
 5. Output Format:
 - a. The system shall operate on a System Format basis, regardless of the manner or hardware configuration in which the data is acquired. A "system" shall consist of a logical grouping of data points, related to a piece of mechanical equipment, an energy distribution system, or an architectural area. For example, in some cases, it may be desired to display, as a single system, a space temperature with its associated air handling unit, and in other cases to display all space temperatures on a floor or in a building. The DDC shall allow such determinations to be made without regard to the physical hardware locations of a point or group of points. Likewise, the system shall accommodate future changes of system grouping and operations without field hardware changes.
 - b. All displays and logs shall contain a header line indicating date, day-of-week, and time.
 - c. All output displays or logs of a point or group of points shall contain, as a minimum, the following information:
 - 1) Graphic presentation of the System.
 - 2) User name of point.
 - 3) Point descriptor.
 - 4) Current value/status.
 - 5) Associated engineering units.
 - 6) Alarm description.
 - d. User names, point descriptors, and engineering units shall be operator definable on a per point basis.
 6. Set points:
 - a. System shall utilize a contiguous band of colors each corresponding to actual zone temperatures relative to the desired heating and cooling setpoints. The ideal temperature shall be shown as a green color band. This color band corresponds to

the dead band between the onset of mechanical heating or cooling. Temperatures warmer than ideal shall be shown in orange.

- b. Temperatures cooler than ideal shall be blue. All alarm colors shall be in red.
 - c. System shall be capable of utilizing the mouse operator interface device to change individual zone temperature setpoints. The change shall be accomplished by pointing to a graphic temperature bar and by depressing a button, moving the mouse cursor to an increased or decreased temperature set-point within that zone. System shall also be capable of utilizing the mouse interface device or a conventional keyboard to change a numeric temperature set-point value instead of utilizing the graphic temperature bar. Floor plan graphic shall then be able to change colors on a zone by zone basis to reflect the actual temperature in each zone relative to the changed desired heating or cooling set-point.
 - d. System shall be capable of globally changing all setpoints. The global change capability shall be accessed via a "pop up menu" called by depressing a button on the mouse.
7. Graphic Structure and Hardware:
- a. The intent of the graphics is to ensure the operator is always aware of his position within the system as well as how to logically progress through the graphical hierarchy to select any desired graphic or other source of information. The GUI will be served as a web page and access from any computer without any special software or hardware keys. The building network controller will hold the graphics for standalone operation. A computer on site will not be acceptable to serve the graphics. The sever computer will have the ability to access the system for engineering from the owner, alarming archives and alarms, remote monitoring of the health of the communications to the field devices and to archive the trend collection data from the building controllers. The web pages will follow a minimum Graphical layout shall be as follows:
 - (1) Main greeting page will have links for all building monitored for quick access.
 - (2) Once a building is selected a picture of the building will be displayed along with a menu of all systems controlled from this section. There will also be links for the floor plans.
 - (3) Once the floor plan has been chosen, the selected graphic page will display the architectural floor plan. This plan will have temperature readings and Setpoints of all VAV's within this floor. There will also be links or button depicting the location and equipment number that is serving that area. This link will hyperlink into the graphic of the AHU. The temperatrre and setpoint reading will hyperlink to the selected VAV grahic for further review. If the floor has too many VAV data readings to display for an easy reading the floor plan may be broken into sections so that the view is easily readable.
 - (4) Graphical VAV – The VAV box will be a graphical representation of a VAV box. The data shown on the box will be as follows:
 - i. Box Flow
 - ii. Box Flow Trend hyperlink
 - iii. Box Flow Setpoint
 - iv. Box Flow Trend hyperlink

- v. Box Flow Min Setpoint
 - vi. Box Flow Max Setpoint
 - vii. Box Flow Reheat Min Setpoint (if applicable)
 - viii. Reheat Stage Commands (if applicable)
 - ix. Supply Air Temperature (with reheat)
 - x. Room Setpoint
 - xi. Room Setpoint Trend hyperlink
 - xii. Room Temperature
 - xiii. Room Temperature Trend hyperlink
 - xiv. Room Humidity (If applicable)
 - xv. Room Humidity Trend hyperlink
 - xvi. Room Humidity Setpoint (if applicable)
 - xvii. Room Humidity Setpoint Trend hyperlink
 - xviii. All points above to show a different status color if overridden
- (5) Graphical AHU – The AHU will be a graphical representation of the physical air handling unit specified. The data will be located on the AHU as physically located on the unit. The data on the AHU will be as follows:
- i. Schedule for Unit hyperlink – link to the scheduling editor
 - ii. Schedule for Ventilation hyperlink – link to the scheduling editor.
 - iii. Occupied/Unoccupied status for each schedule
 - iv. Fan command
 - v. Fan status
 - vi. Fan speed
 - vii. Fan VFD alarm
 - viii. Temperature sensors as specified in the control sequence of operation and trending points
 - ix. All setpoints as specified in the sequence of operation
 - 1. Example – VAV AHU will have a supply air temperature and setpoint
 - x. Supply air static and trend hyperlink
 - xi. Supply air static Setpoint and trend hyperlink
 - xii. Return air damper position
 - xiii. Outside air damper position
 - xiv. Outside air flow and trend hyperlink
 - xv. Outside air flow setpoint and trend hyperlink
 - xvi. Outside air heater command
 - xvii. Outside air heater setpoint
 - xviii. Any misc points needed from a sequence of operation
 - xix. All points above to show a different status color if overridden
- (6) Graphical Chiller plant – The plant will be a graphical representation of the physical chiller plant as specified and installed. The data will be located on the graphical screen as physically installed in the plant.
- i. All Chiller interface data
 - ii. Enable/Disable of Chillers and isolation valves
 - iii. Primary pump command and status

- iv. Secondary Pump command, status, speed, and general alarm from the VFD.
 - v. Flow meters
 - vi. Temperature sensors
 - (7) Misc. Points and graphical screens
 - b. Graphical representation of text on these screens – The text blocks will have an opposing color for easier reading
 - c. Graphical representation of the trends – each point to be trended will have a icon next to the point being trended. This icon will hyperlink to the trending chart builder for the individual trend screen. A trend icon on the main building screen will be a trendchart builder. This trend builder will allow to select multiple trends from a list, pick whether recent trending data or archived (in the server), date range, etc. Then after selection the trend chart builder will compile the data and build the trend for viewing or exporting to a spread sheet. This all happens with a standard web browser.
 - d. A text block for an overridable point shall be highlighted when a mouse is scrolled over an object. When the text block and or point is overridden the graphical point will turn to a different color. This allows for easy viewing of which points are overridden on a graphic screen.
 - 1)
- 8. User Access Restriction. Operator sign-on shall require an assignable password. Passwords shall have six (6) levels of system access **or user defined**:
 - a. Level 1 - Trainee: The level shall allow readout of data only. System shall display all operation data base.
 - b. Level 2 - Maintenance 1: This level shall allow all of Level 1 functions plus the changing of all schedules.
 - c. Level 3 - Maintenance 2: This level shall allow performance of Level 2 functions plus the changing of all set points.
 - d. Level 4 - Supervisor: This level shall allow performance of Level 3 functions plus the changing of all system parameters.
 - e. Level 5 - System Programmer: This level shall allow performance of Level 4 functions plus the modifying the system configuration.
 - f. Level 6 - System Manager: This level shall allow performance of Level 5 functions plus the changing of passwords.
- 9. Power Failure/Automatic Restart:
 - a. Power failures shall cause the system to go into an orderly shutdown with no loss of program memory.
 - b. Upon resumption of power, the system shall automatically restart and printout the time and date of the power failure and restoration at the Central Site. “Restart” program shall automatically restart affected field equipment. Operator shall be able to define an automatic power up time delay for each piece of equipment under control.
 - c. User Control Over System Configuration:
 - 1) Database Creation and Modification. All changes shall be done utilizing standard procedures and be capable of being done while the system is on-line and operational. The system shall allow changes to be made through the portable operator terminal and from the central site. To aid the user, instructive prompting software shall be provided.
 - 2) System shall permit the operator, with proper password, to perform as a minimum the following:

- a) Add and delete points.
 - b) Modify point parameters.
 - c) Create and modify control sequences.
 - d) Reconfigure application programs.
 - e) Add and/or modify graphics.
- 3) All data points within the database shall be completely accessible as independent or dependent variables for custom programming, calculation, interlocking, or manipulation.
- 4) Graphics Software:
- a) Graphics software shall permit the easy construction of infinitely variable shapes and sizes through the use of the mouse pointing device.
 - b) A selection of 64 colors and various fill textures, line types and text styles shall all be accessible through the use of the mouse interface. The software shall resemble many of the computer aided design programs currently available and allow graphics to be easily moved, edited, added or deleted.
 - c) Graphics software shall be fully implemented and operational to accomplish the following:
 1. Create a new graphic picture.
 2. Modify a portion of a graphic picture.
 3. Delete a graphic picture, or any portion thereof.
 4. Call up a graphic picture.
 5. Cancel the display of a graphic picture.
 6. Assign conditions which automatically initiate the display.
 7. Overlay alphanumeric and graphics.
 8. Save the graphic picture.
 9. Display latest process data fully integrated with the graphic display
- d. Facility Management Functions:
- 1) Trend Logging:
 - a) System shall be able to trend and display either numerically or graphically any analog or digital points in the system.
 - b) System shall be able to simultaneously graphically display any two trended points within a module function block or any point in the module versus the outside air temperature, enthalpy or relative humidity.
 - c) Each field module shall be capable of storing the most recent 60 samples for each single trend point or the most recent 30 samples for each of two trended points from one module function block.
 - d) Each module shall be capable of automatically uploading on a daily basis all accumulated trend data to the central site for permanent storage on hard disk.
 - 2) Run Time:
 - a) System shall provide run time information for all digital output and input points on command from the operator. Maximum run time limits shall be operator definable and shall be capable of automatically issuing a **visual** when the run time maximum is exceeded. Operator shall be able to reset the run time accumulator.

- b) Run time hours and start time date shall be retained in non-volatile module memory.
- c) Each module shall be capable of automatically uploading all accumulated data to the central site for permanent storage on hard disk.
- 3) Alarm Conditions and Maintenance Messages:
 - a) Central site shall allow receipt of alarms and messages while in a functional mode other than energy management. i.e., Incoming alarms shall be displayed **and generate an audible alarm** while the operator is utilizing another mode such as word processing and allow the operator to automatically return to word processing after the alarm is received.
 - b) System shall distinguish between alarms and messages with alarms having a higher priority.
 - c) System shall be capable of calling up to three different remote locations to deliver an alarm or message **through E-Mail, E-Page or alphanumeric page**. Operator shall determine if alarms or messages are to be based on temperature limit, status or off-normal reporting.
 - d) System shall be capable of printing maintenance messages when run time accumulation maximum limits are exceeded.
 - e) Text for operator alarm and messages shall be operator definable. System shall be capable of storing at least 100 messages each of any length. Generic messages used for multiple points throughout the system shall only count as one message. In the event the central site is powered down, alarms shall be stored in the modules until the central site is restored.
 - f) Central site shall be capable of transferring all alarms to hard disk for storage.
- 4) Reports and Archiving:
 - a) Field modules shall be capable of calling the central site during off peak phone rate hours to automatically upload all current and accumulated data. This shall be delivered to the central site for printing and/or permanent storage on hard disk. The system shall further be capable of transferring hard disk information onto a CD or USB external drive for remote site storage.
 - b) System shall be capable of reporting and archiving the following information as a minimum:
 - 1. Outside air temperature history and degree day history.
 - 2. Electric demand and usage history.
 - 3. All trended points.
 - 4. All alarms and messages.
 - 5. Equipment runtime information.
 - c) The system shall also provide the following additional reports for which archiving is not applicable:
 - 1. All points summary.
 - 2. Building operating schedules.
 - 3. Printout of any graphic screen.
 - d) System shall be capable of providing all points summaries on a hierarchical basis. e.g., only the points associated with a particular graphic shall be selectable and printed. For example, if the operator is viewing an air handling unit (AHU), he may request an all points

summary at this level and receive only the points associated with the AHU. If the building is being viewed and an all points summary selected, all building points will be listed. Similarly, the system shall print building operating schedules pertinent to the graphic level being viewed. e.g., if a zone or tenant zone group is being viewed on the graphic display, then the system shall be capable of printing the building operating schedules for the zone or tenant zone group. If the entire building graphic is being viewed, the system shall be capable of printing schedules at the building level. All systems reports shall be capable of being viewed at the operators' terminal and printed at the operator's discretion.

- e. Direct Digital Control Software:
 - 1) System shall continuously perform DDC functions at the local DDC controller in a stand-alone mode. The operator shall be able to design and modify the control loops to meet the requirements of the system being operated. Operators shall use system provided displays for tuning of PID loops. These displays shall include the past three input variable values, the set point for the loop as well as the sample interval and the results of the proportional, integral and derivative effects of the final output.
 - 2) Each Controller shall perform the following functions:
 - a) Identify and report alarm conditions.
 - b) Execute DDC algorithms.
 - c) Execute all application programs indicated on the I/O Summary table.
 - d) Trend and store data.
 - 3) In the event of a Controller failure, all points under its control shall be commanded to the failure mode.
 - 4) All DDC software shall reside in the respective DDC Controller.
- f. Application Software:
 - 1) Application software shall be as required to produce the sequence of operation specified.

2.5 ELECTRONIC SENSORS

- A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
- B. Temperature Sensors: 10K resistor style.
 - 1. Accuracy: Plus or minus 0.35 deg F (0.2 deg C) at calibration point.
 - 2. Wire: Twisted, shielded-pair cable.
 - 3. Insertion Elements in Ducts: Single point, 8 inches (200 mm) long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (0.84 sq. m).
 - 4. Averaging Elements in Ducts: 36 inches (915 mm) long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft. (1 sq. m).
 - 5. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches (64 mm).
 - 6. Room Sensor Cover Construction: Manufacturer's standard covers.
 - a. Set-Point Adjustment: Exposed but disable.

- b. Set-Point Indication: Exposed.
 - c. Thermometer: Digital temperature display.
 - d. Color: Beige
 - e. Orientation: Vertical.
 - f. Occupancy Override: Exposed only for office and classrooms.
7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
- C. Humidity Sensors: Bulk polymer sensor element.
- 1. Accuracy: 2 percent full range with linear output.
 - 2. Room Sensor Range: 0 to 100 percent relative humidity.
 - 3. Room Sensor Cover Construction: Manufacturer's standard covers.
 - a. Set-Point Adjustment: Concealed.
 - b. Set-Point Indication: Exposed.
 - c. Humidity: Digital humidity display
 - d. Color: Beige.
 - e. Orientation: Vertical.
 - 4. Calibration: Single point.
- D. Pressure Transmitters/Transducers:
- 1. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
 - a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
 - b. Output: 4 to 20 mA.
 - c. Building Static-Pressure Range: 0- to 0.25-inch wg (0 to 62 Pa).
 - d. Duct Static-Pressure Range: 0- to 5-inch wg (0 to 1240 Pa).
 - 2. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig (1034-kPa) operating pressure; linear output 4 to 20 mA.
 - 3. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig (1034-kPa) operating pressure and tested to 300-psig (2070-kPa); linear output 4 to 20 mA.
 - 4. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
 - 5. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.
- E. Room sensor accessories include the following:
- 1. Guards: Metal wire, tamperproof for sensors located in gymnasiums, locker room, corridors, cafeteria, media center and multipurpose rooms.

2.6 STATUS SENSORS

- A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg (0 to 1240 Pa).

- B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig (55 to 414 kPa), piped across pump.
- C. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.
- D. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
- E. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.

2.7 GAS DETECTION EQUIPMENT

- A. Carbon Dioxide Sensor and Transmitter: Single detectors using solid-state infrared sensors; suitable over a temperature range of 23 to 130 deg F (minus 5 to plus 55 deg C) and calibrated for 0 to 2 percent, with continuous or averaged reading, 4- to 20-mA output, for wall mounting.

2.8 FLOW MEASURING STATIONS

- A. Duct Airflow Station: Thermal Dispersion Technology.
 - 1. Manufacturers:
 - a. Ebtron.
 - b. Tekair.
 - 2. Each measuring device shall consist of one or more multi-point measuring probes and single microprocessor-base transmitter. Each transmitter shall have an LCD display capable of displaying airflow and temperature. Airflow shall be field configurable to display as a velocity or volumetric rate. Each transmitter shall operate at 24V.
 - 3. Each sensing point shall independently determine the airflow rate and temperature, which shall be equally weighted and average by the transmitter prior to the output. Devices, which average multiple non-linear sensing points signals, are not acceptable. Pitot tubes arrays are not acceptable.
 - 4. The operation air flow range shall be 0 – 5,000 FPM.
 - 5. The operation temperature range for the measuring probes shall be -20°F to 160°F.
 - 6. Accuracy: Each independent airflow sensor shall have a laboratory accuracy of $\pm 2\%$ and each independent temperature sensor shall have a laboratory accuracy of $\pm 0.15^\circ\text{F}$.
 - 7. The transmitter shall be capable of communicating with the host controls using the following interface options:
 - a. Linear analog output signal: Field selectable, fuse protected and isolated, 0-10VDC and 4-20mA (4-wire).
 - b. LonWorks Free Topology.
 - 8.

- B. Pipe Flow Meter: Electromagnetic Flow Meter.
 - 1. Manufacturer:
 - a. Onicon.
 - 2. Accuracy: $\pm 1.0\%$ of reading at calibration velocity.
 - 3. Sensing Method: Electromagnetic sensing (no moving parts).
 - 4. Pipe Size Range: 3" through 72".
 - 5. Supply Voltage: 24 V AC/DC at 250 mA.
 - 6. Liquid Temperature Range: 15°F to 250°F peak.
 - 7. Operating Pressure: 400 psi.

2.9 ENERGY METER

- A. BTU Meter.
 - 1. Manufacturer:
 - a. Onicon
 - 2. Accuracy: Differential temperature accuracy $\pm 0.15^\circ\text{F}$.
 - 3. Memory: Non-volatile EEPROM memory retains all parameters and totalized values in the event of power loss.
 - 4. Flow meter: Flow meter by Onicon. Flow meter shall meet the requirements of section 2.7.C on these specifications.
 - 5. Temperature sensors: Solid state sensors.
 - 6. Temperature Range: 32°F to 200°F.
 - 7. Display: Alphanumeric LCD display total energy, total flow, energy rate, flow rate, supply temperature and return temperature.
 - 8. Output Signal: LonWorks or BACnet.

2.10 THERMOSTATS

- A. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating of 125% of service equipment; with exposed set-point adjustment, 55 to 85 deg F (13 to 30 deg C) set-point range, and 2 deg F (1 deg C) maximum differential.

2.11 ACTUATORS

- A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
 - 1. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - 2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
 - 3. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).

4. Spring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).
 5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
 6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).
- B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
1. Manufacturers:
 - a. Belimo Aircontrols (USA), Inc.
 - b. Schneider Electric Dura Drive
 2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
 3. Dampers: Size for running torque calculated as follows:
 - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. (86.8 kg-cm/sq. m) of damper.
 - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. (62 kg-cm/sq. m) of damper.
 - c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft (49.6 kg-cm/sq. m) of damper.
 - d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. (37.2 kg-cm/sq. m) of damper.
 - e. Dampers with 2- to 3-Inch wg (500 to 750 Pa) of Pressure Drop or Face Velocities of 1000 to 2500 fpm (5 to 13 m/s): Increase running torque by 1.5.
 - f. Dampers with 3- to 4-Inch wg (750 to 1000 Pa) of Pressure Drop or Face Velocities of 2500 to 3000 fpm (13 to 15 m/s): Increase running torque by 2.0.
 4. Coupling: V-bolt and V-shaped, toothed cradle.
 5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
 7. Power Requirements (Two-Position Spring Return): 24-V ac.
 8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
 9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
 10. Temperature Rating: Minus 22 to plus 122 deg F (Minus 30 to plus 50 deg C).
 11. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F (Minus 30 to plus 121 deg C).
 12. Run Time: 12 seconds open, 5 seconds closed.

2.12 CONTROL VALVES

- A. Manufacturers:

1. Belimo.
 2. Schneider Electric
- B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
- C. Butterfly Valves: 200-psig (1380-kPa), 150-psig (1034-kPa) maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
1. Body Style: Wafer or Grooved.
 2. Disc Type: Nickel-plated ductile iron.
 3. Sizing: 1-psig (7-kPa) maximum pressure drop at design flow rate.
- D. Terminal Unit Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.
1. Rating: Class 125 for service at 125 psig (860 kPa) and 250 deg F (121 deg C) operating conditions.
 2. Sizing: 3-psig (21-kPa) maximum pressure drop at design flow rate, to close against pump shutoff head.
 3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

2.13 DAMPERS

- A. Dampers: AMCA-rated, parallel-blade for return air damper and opposed blade for outside air and relief air design; 0.108-inch- (2.8-mm-) minimum thick, galvanized-steel or 0.125-inch- (3.2-mm-) minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- (1.6-mm-) thick galvanized steel with maximum blade width of 8 inches (200 mm) and length of 48 inches (1220 mm).
1. Secure blades to 1/2-inch- (13-mm-) diameter, zinc-plated axles using zinc-plated hardware, with oil-impregnated sintered bronze blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
 2. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).
 3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
 4. Edge Seals, Low-Leakage Applications: Use replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. (50 L/s per sq. m) of damper area, at differential pressure of 4-inch wg (1000 Pa) when damper is held by torque of 50 in. x lbf (5.6 N x m); when tested according to AMCA 500D.

2.14 CONTROL CABLE

- A. Electronic and fiber-optic cables for control wiring are specified in Division 27 Section "Data Communications Integrations."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that power supply is available to control units and operator workstation.

3.2 INSTALLATION

- A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.
- B. Connect and configure equipment and software to achieve sequence of operation specified.
- C. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches (1220 mm) above the floor.
 - 1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- D. Install automatic dampers according to Division 23 Section "Air Duct Accessories."
- E. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
- F. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."
- G. Install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."
- H.
- I. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.
- J. Install electronic and fiber-optic cables according to Division 27 Section "Communications Horizontal Cabling."

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."
- B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Install signal and communication cable according to Division 27 Section "Communications Horizontal Cabling."
 - 1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.

2. Install exposed cable in raceway.
 3. Install concealed cable in raceway.
 4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
 5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
 6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
 7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
- D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
- E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
 2. Test and adjust controls and safeties.
 3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
 4. Test each point through its full operating range to verify that safety and operating control set points are as required.
 5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
 6. Test each system for compliance with sequence of operation.
 7. Test software and hardware interlocks.
- C. DDC Verification:
1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
 2. Check instruments for proper location and accessibility.
 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
 4. Check instrument tubing for proper fittings, slope, material, and support.
 5. Check installation of air supply for each instrument.
 6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
 7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
 8. Check temperature instruments and material and length of sensing elements.

9. Check control valves. Verify that they are in correct direction.
 10. Check DDC system as follows:
 - a. Verify that DDC controller power supply is from emergency power supply, if applicable.
 - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
 - c. Verify that spare I/O capacity has been provided.
 - d. Verify that DDC controllers are protected from power supply surges.
- D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:
 - a. Check analog inputs at 0, 50, and 100 percent of span.
 - b. Check analog outputs using milliamper meter at 0, 50, and 100 percent output.
 - c. Check digital inputs using jumper wire.
 - d. Check digital outputs using ohmmeter to test for contact making or breaking.
 - e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
5. Flow:
 - a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
 - b. Manually operate flow switches to verify that they make or break contact.
6. Pressure:
 - a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
 - b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
7. Temperature:
 - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
 - b. Calibrate temperature switches to make or break contacts.

8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
 9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
 10. Provide diagnostic and test instruments for calibration and adjustment of system.
 11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.
- B. Adjust initial temperature and humidity set points.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 230900

SECTION 231123 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Valves.
 - 5. Pressure regulators.
 - 6. Mechanical sleeve seals.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig (690 kPa) minimum unless otherwise indicated.
 - 2. Service Regulators: 65 psig (450 kPa) minimum unless otherwise indicated.
- B. Natural-Gas System Pressure within Buildings: More than 2 psig (13.8 kPa) but not more than 5 psig (34.5 kPa).

1.5 SUBMITTALS

- A. Product Data: For each type of the following:

1. Piping specialties.
 2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
 3. Pressure regulators. Indicate pressure ratings and capacities.
 4. Dielectric fittings.
 5. Mechanical sleeve seals.
 6. Escutcheons.
- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
1. Shop Drawing Scale: 1/4 inch per foot (1:50).
 2. Detail mounting, supports, and valve arrangements for service meter assembly and pressure regulator assembly.
- C. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.
- D. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.
- E. Qualification Data: For qualified professional engineer.
- F. Welding certificates.
- G. Field quality-control reports.
- H. Operation and Maintenance Data: For pressure regulators to include in emergency, operation, and maintenance manuals.
- 1.6 QUALITY ASSURANCE
- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
 - C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- D. Protect stored PE pipes and valves from direct sunlight.

1.8 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:
 - 1. Notify Owner no fewer than two days in advance of proposed interruption of natural-gas service.
 - 2. Do not proceed with interruption of natural-gas service without Owner's written permission.

1.9 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.

- b. End Connections: Threaded or butt welding to match pipe.
 - c. Lapped Face: Not permitted underground.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
- B. Annealed-Temper Copper Tube: Comply with ASTM B 88, Type K (ASTM B 88M, Type A).
- 1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
 - 2. Flare Fittings: Comply with ASME B16.26 and SAE J513.
 - a. Copper fittings with long nuts.
 - b. Metal-to-metal compression seal without gasket.
 - c. Dryseal threads complying with ASME B1.20.3.
 - 3. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch (0.56 mm) thick.

2.2 PIPING SPECIALTIES

- A. Y-Pattern Strainers:
- 1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
 - 2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
 - 3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
- B. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

- A. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig (862 kPa).
 2. Threaded Ends: Comply with ASME B1.20.1.
 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
 6. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.
- B. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) and Larger: Comply with ASME B16.38.
1. CWP Rating: 125 psig (862 kPa).
 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
 2. Body: Bronze, complying with ASTM B 584.
 3. Ball: Chrome-plated bronze.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 8. CWP Rating: 600 psig (4140 kPa).
 9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- D. Valve Boxes:
1. Cast-iron, two-section box.
 2. Top section with cover with "GAS" lettering.
 3. Bottom section with base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.

4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 MOTORIZED GAS VALVES

A. Automatic Gas Valves: Comply with ANSI Z21.21.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ASCO Power Technologies, LP; Division of Emerson.
 - b. Dungs, Karl, Inc.
 - c. Eaton Corporation; Controls Div.
 - d. Eclipse Combustion, Inc.
 - e. Honeywell International Inc.
 - f. Johnson Controls.
2. Body: Brass or aluminum.
3. Seats and Disc: Nitrile rubber.
4. Springs and Valve Trim: Stainless steel.
5. Normally closed.
6. Visual position indicator.
7. Electrical operator for actuation by appliance automatic shutoff device.

B. Electrically Operated Valves: Comply with UL 429.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ASCO Power Technologies, LP; Division of Emerson.
 - b. Dungs, Karl, Inc.
 - c. Eclipse Combustion, Inc.
 - d. Goyen Valve Corp.; Tyco Environmental Systems.
 - e. Magnatrol Valve Corporation.
 - f. Parker Hannifin Corporation; Climate & Industrial Controls Group; Skinner Valve Div.
 - g. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
2. Pilot operated.
3. Body: Brass or aluminum.
4. Seats and Disc: Nitrile rubber.
5. Springs and Valve Trim: Stainless steel.
6. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
7. NEMA ICS 6, Type 4, coil enclosure.
8. Normally closed.
9. Visual position indicator.

2.6 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller; flanged for regulators NPS 2-1/2 (DN 65) and larger.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Actaris.
 - b. American Meter Company.
 - c. Eclipse Combustion, Inc.
 - d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
 - e. Invensys.
 - f. Maxitrol Company.
 - g. Richards Industries; Jordan Valve Div.
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 2 psig (13.8 kPa).

2.7 DIELECTRIC FITTINGS

A. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.

- c. Hart Industries International, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
 - f. Wilkins; Zurn Plumbing Products Group.
2. Minimum Operating-Pressure Rating: 150 psig (1034 kPa).
 3. Combination fitting of copper alloy and ferrous materials.
 4. Insulating materials suitable for natural gas.
 5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.
- B. Dielectric Flanges:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
 - d. Wilkins; Zurn Plumbing Products Group.
 2. Minimum Operating-Pressure Rating: 150 psig (1034 kPa).
 3. Combination fitting of copper alloy and ferrous materials.
 4. Insulating materials suitable for natural gas.
 5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.
- C. Dielectric-Flange Kits:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 2. Minimum Operating-Pressure Rating: 150 psig (1034 kPa).
 3. Companion-flange assembly for field assembly.
 4. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or PE bolt sleeves, phenolic washers, and steel backing washers.
 5. Insulating materials suitable for natural gas.
 6. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.8 SLEEVES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.9 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
 - 3. Pressure Plates: Stainless steel.
 - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

2.10 ESCUTCHEONS

- A. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube, and OD that completely covers opening.
- B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Escutcheons: With set screw.
 - 1. Finish: Polished chrome-plated or rough brass.
- D. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated or rough brass.
- E. One-Piece, Floor-Plate Escutcheons: Cast-iron floor plate.
- F. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

2.11 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.12 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to Florida Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with Florida Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

- A. Comply with Florida Fuel Gas Code for installation and purging of natural-gas piping.
- B. Steel Piping:
 - 1. Apply anti-corrosive coating to pipe and joints.
- C. Install fittings for changes in direction and branch connections.

- D. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
- E. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- F. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

3.4 INDOOR PIPING INSTALLATION

- A. Comply with Florida Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Install escutcheons at penetrations of interior walls, ceilings, and floors.
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

- c. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - d. Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
 - f. Piping in Equipment Rooms: One-piece, cast-brass type.
 - g. Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
2. Existing Piping:
- a. Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - b. Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
 - c. Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - d. Piping in Unfinished Service Spaces: Split-casting, cast-brass type with rough-brass finish.
 - e. Piping in Equipment Rooms: Split-casting, cast-brass type.
 - f. Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- M. Verify final equipment locations for roughing-in.
- N. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- O. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
- 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- P. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- Q. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- R. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
 2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches (38 mm) of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
 3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
 4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
 - a. Exception: Tubing passing through partitions or walls does not require striker barriers.
 5. Prohibited Locations:
 - a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - b. Do not install natural-gas piping in solid walls or partitions.
- S. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- T. Connect branch piping from top or side of horizontal piping.
- U. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- V. Do not use natural-gas piping as grounding electrode.
- W. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- X. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."
- 3.5 VALVE INSTALLATION
- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
 - B. Install underground valves with valve boxes.
 - C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
 - D. Install earthquake valves aboveground outside buildings according to listing.

3.6 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
 - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 - 2. Bevel plain ends of steel pipe.
 - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
 - 2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
 - 3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
 - 4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).
 - 5. NPS 4 (DN 100) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 5/8 inch (15.8 mm).
- B. Install hangers for horizontal drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 3/8 (DN 10): Maximum span, 48 inches (1220 mm); minimum rod size, 3/8 inch (10 mm).
2. NPS 1/2 and NPS 5/8 (DN 15 and DN 18): Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).
3. NPS 3/4 and NPS 7/8 (DN 20 and DN 22): Maximum span, 84 inches (2134 mm); minimum rod size, 3/8 inch (10 mm).
4. NPS 1 (DN 25): Maximum span, 96 inches (2440 mm); minimum rod size, 3/8 inch (10 mm).

3.8 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

- A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification. Install detectable warning tape directly above gas piping, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.10 PAINTING

- A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.
- B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 1. Alkyd System: MPI EXT 5.1D.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel (gloss).
 - d. Color: Gray.

- C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex (gloss).
 - d. Color: Gray.
- D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.11 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.12 OUTDOOR PIPING SCHEDULE

- A. Aboveground natural-gas piping shall be one of the following:
 - 1. 2-1/2" and smaller shall be steel pipe with malleable-iron fittings and threaded joints.
 - 2. 3" and above shall be steel pipe with wrought-steel fittings and welded joints.

3.13 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 5.0 PSIG

- A. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be one of the following:
 - 1. Annealed-temper, copper tube with wrought-copper fittings and brazed joints.
 - 2. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping 1-1/4" and above shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.
- C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- D. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.14 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
- B. Valves for pipe sizes NPS 2-1/2 (DN 65) and larger at service meter shall be the following:
1. Two-piece, full-port, bronze ball valves with bronze trim.
- C. Distribution piping valves for pipe sizes NPS 2 (DN 50) and smaller shall be the following:
1. Two-piece, full-port, bronze ball valves with bronze trim.
 2. Bronze plug valve.
- D. Distribution piping valves for pipe sizes NPS 2-1/2 (DN 65) and larger shall be the following:
1. Two-piece, full-port, bronze ball valves with bronze trim.
- E. Valves in branch piping for single appliance shall be the following:
1. Two-piece, full-port, bronze ball valves with bronze trim.
 2. Bronze plug valve.

END OF SECTION 231123

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SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
 - 1. Chilled-water piping.
 - 2. Hot-water piping
 - 3. Condensate-drain piping.
 - 4. Air-vent piping.

1.3 DEFINITIONS

- A. PTFE: Polytetrafluoroethylene.

1.4 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
 - 1. Chilled-Water Piping: 125 psig (862 kPa) at 200 deg F (93 deg C).
 - 2. Condenser-Water Piping: 125 psig (862 kPa) at 150 deg F (66 deg C).
 - 3. Glycol Cooling-Water Piping: 125 psig (862 kPa) at 150 deg F (66 deg C).
 - 4. Makeup-Water Piping: 80 psig (552 kPa) at 150 deg F (66 deg C).
 - 5. Condensate-Drain Piping: 150 deg F (66 deg C).
 - 6. Air-Vent Piping: 200 deg F (93 deg C).

1.5 SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
 - 2. Air control devices.
 - 3. Chemical treatment.
 - 4. Hydronic specialties.

- B. Welding certificates.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.
- E. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.6 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

1.7 EXTRA MATERIALS

- A. Water-Treatment Chemicals: Furnish enough chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.
- B. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B).
- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K (ASTM B 88M, Type A).
- C. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube.
- D. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.
- B. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
- C. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - 1. Material Group: 1.1.
 - 2. End Connections: Butt welding.
 - 3. Facings: Raised face.
- D. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.3 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
- E. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- F. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.4 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Capitol Manufacturing Company.
- b. Central Plastics Company.
- c. Hart Industries International, Inc.
- d. Jomar International Ltd.
- e. Matco-Norca, Inc.
- f. McDonald, A. Y. Mfg. Co.
- g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- h. Wilkins; a Zurn company.

2. Description:

- a. Standard: ASSE 1079.
- b. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
- c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Capitol Manufacturing Company.
- b. Central Plastics Company.
- c. Matco-Norca, Inc.
- d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- e. Wilkins; a Zurn company.

2. Description:

- a. Standard: ASSE 1079.
- b. Factory-fabricated, bolted, companion-flange assembly.
- c. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
- d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

2.5 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "Instrumentation and Control for HVAC."

C. Bronze, Calibrated-Orifice, Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Armstrong Pumps, Inc.

- b. Bell & Gossett Domestic Pump; a division of ITT Industries.
 - c. Flow Design Inc.
 - d. Gerand Engineering Co.
 - e. Griswold Controls.
 - f. Taco.
2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
 3. Ball: Brass or stainless steel.
 4. Plug: Resin.
 5. Seat: PTFE.
 6. End Connections: Threaded or socket.
 7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
 8. Handle Style: Lever, with memory stop to retain set position.
 9. CWP Rating: Minimum 125 psig (860 kPa).
 10. Maximum Operating Temperature: 250 deg F (121 deg C).
- D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong Pumps, Inc.
 - b. Bell & Gossett Domestic Pump; a division of ITT Industries.
 - c. Flow Design Inc.
 - d. Gerand Engineering Co.
 - e. Griswold Controls.
 - f. Taco.
 - g. Tour & Andersson; available through Victaulic Company.
 2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
 3. Ball: Brass or stainless steel.
 4. Stem Seals: EPDM O-rings.
 5. Disc: Glass and carbon-filled PTFE.
 6. Seat: PTFE.
 7. End Connections: Flanged or grooved.
 8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
 9. Handle Style: Lever, with memory stop to retain set position.
 10. CWP Rating: Minimum 125 psig (860 kPa).
 11. Maximum Operating Temperature: 250 deg F (121 deg C).

2.6 AIR CONTROL DEVICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Amtrol, Inc.
 2. Armstrong Pumps, Inc.
 3. Bell & Gossett Domestic Pump; a division of ITT Industries.

4. Taco.

B. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.
3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2 (DN 15).
5. Discharge Connection: NPS 1/4 (DN 8).
6. CWP Rating: 150 psig (1035 kPa).
7. Maximum Operating Temperature: 240 deg F (116 deg C).

C. Diaphragm-Type Expansion Tanks:

1. Tank: Welded steel, rated for 125-psig (860-kPa) working pressure and 375 deg F (191 deg C) maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Diaphragm: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
3. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

D. In-Line Air Separators:

1. Tank: One-piece cast iron with an integral weir constructed to decelerate system flow to maximize air separation.
2. Maximum Working Pressure: Up to 175 psig (1207 kPa).
3. Maximum Operating Temperature: Up to 300 deg F (149 deg C).

2.7 CHEMICAL TREATMENT

A. Bypass Chemical Feeder: Welded steel construction; 125-psig (860-kPa) working pressure; 5-gal. (19-L) capacity; with fill funnel and inlet, outlet, and drain valves.

1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

B. Ethylene and Propylene Glycol: Industrial grade with corrosion inhibitors and environmental-stabilizer additives for mixing with water in systems indicated to contain antifreeze or glycol solutions.

2.8 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.

3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 4. CWP Rating: 125 psig (860 kPa).
- B. Stainless-Steel Bellow, Flexible Connectors:
1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
 2. End Connections: Threaded or flanged to match equipment connected.
 3. Performance: Capable of 3/4-inch (20-mm) misalignment.
 4. CWP Rating: 150 psig (1035 kPa).
 5. Maximum Operating Temperature: 250 deg F (121 deg C).

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Chilled-water and hot-water piping, aboveground, NPS 2 (DN 50) and smaller, shall be the following:
1. Type L (B), drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- B. Chilled-water and hot-water piping, aboveground, NPS 2-1/2 (DN 65) and larger, shall be any of the following:
1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
- C. Makeup-water piping installed aboveground shall be the following:
1. Type L (B), drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- D. Condensate-Drain Piping: Type M (C), drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- E. Air-Vent Piping:
1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
 2. Outlet: Type K (A), annealed-temper copper tubing with soldered or flared joints.

3.2 VALVE APPLICATIONS

- A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.
- B. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.
- C. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.3 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, **NPS 3/4 (DN 20)** ball valve, and short NPS 3/4 (DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."
- Q. Install unions in piping, NPS 2 (DN 50) and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install flanges in piping, NPS 2-1/2 (DN 65) and larger, at final connections of equipment and elsewhere as indicated.

- S. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 (DN 20) nipple and ball valve in blowdown connection of strainers NPS 2 (DN 50) and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2 (DN 50).
- T. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."
- U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."
- V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."
- W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet (6 m) long.
 - 2. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/4 (DN 20): Maximum span, 7 feet (2.1 m); minimum rod size, 1/4 inch (6.4 mm).
 - 2. NPS 1 (DN 25): Maximum span, 7 feet (2.1 m); minimum rod size, 1/4 inch (6.4 mm).
 - 3. NPS 1-1/2 (DN 40): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
 - 4. NPS 2 (DN 50): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (10 mm).
 - 5. NPS 2-1/2 (DN 65): Maximum span, 11 feet (3.4 m); minimum rod size, 3/8 inch (10 mm).
 - 6. NPS 3 (DN 80): Maximum span, 12 feet (3.7 m); minimum rod size, 3/8 inch (10 mm).
 - 7. NPS 4 (DN 100): Maximum span, 12 feet (3.7 m); minimum rod size, 1/2 inch (13 mm).
 - 8. NPS 6 (DN 150): Maximum span, 12 feet (3.7 m); minimum rod size, 1/2 inch (13 mm).
 - 9. NPS 8 (DN 200): Maximum span, 12 feet (3.7 m); minimum rod size, 5/8 inch (16 mm).
 - 10. NPS 10 (DN 250): Maximum span, 12 feet (3.7 m); minimum rod size, 3/4 inch (19 mm).
 - 11. NPS 12 (DN 300): Maximum span, 12 feet (3.7 m); minimum rod size, 7/8 inch (22 mm).
 - 12. NPS 14 (DN 350): Maximum span, 12 feet (3.7 m); minimum rod size, 1 inch (25 mm).
 - 13. NPS 16 (DN 400): Maximum span, 12 feet (3.7 m); minimum rod size, 1 inch (25 mm).

14. NPS 18 (DN 450): Maximum span, 12 feet (3.7 m); minimum rod size, 1-1/4 inches (32 mm).
 15. NPS 20 (DN 500): Maximum span, 12 feet (3.7 m); minimum rod size, 1-1/4 inches (32 mm).
- D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4 (DN 20): Maximum span, 5 feet (1.5 m); minimum rod size, 1/4 inch (6.4 mm).
 2. NPS 1 (DN 25): Maximum span, 6 feet (1.8 m); minimum rod size, 1/4 inch (6.4 mm).
 3. NPS 1-1/2 (DN 40): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
 4. NPS 2 (DN 50): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
 5. NPS 2-1/2 (DN 65): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
 6. NPS 3 (DN 80): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (10 mm).
- E. Support vertical runs at roof, at each floor, and at 10-foot (3-m) intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.6 HYDRONIC SPECIALTIES INSTALLATION

- A. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.
- B. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.

- C. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 (DN 50) and larger.
- D. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches (1200 mm) above the floor. Install feeder in minimum NPS 3/4 (DN 20) bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install NPS 3/4 (DN 20) pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.
- E. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system Project requirements.

3.7 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gages for HVAC Piping."

3.8 CHEMICAL TREATMENT

- A. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling, and to sustain the following water characteristics:
 - 1. pH: 9.0 to 10.5.
 - 2. "P" Alkalinity: 100 to 500 ppm.
 - 3. Boron: 100 to 200 ppm.
 - 4. Chemical Oxygen Demand: Maximum 100 ppm. Modify this value if closed system contains glycol.
 - 5. Corrosion Inhibitor:
 - a. Sodium Nitrate: 1000 to 1500 ppm.
 - b. Molybdate: 200 to 300 ppm.
 - c. Chromate: 200 to 300 ppm.
 - d. Sodium Nitrate Plus Molybdate: 100 to 200 ppm each.
 - e. Chromate Plus Molybdate: 50 to 100 ppm each.
 - 6. Soluble Copper: Maximum 0.20 ppm.
 - 7. Tolyriazole Copper and Yellow Metal Corrosion Inhibitor: Minimum 10 ppm.
 - 8. Total Suspended Solids: Maximum 10 ppm.
 - 9. Ammonia: Maximum 20 ppm.
 - 10. Free Caustic Alkalinity: Maximum 20 ppm.
 - 11. Microbiological Limits:
 - a. Total Aerobic Plate Count: Maximum 1000 organisms/ml.

- b. Total Anaerobic Plate Count: Maximum 100 organisms/ml.
 - c. Nitrate Reducers: 100 organisms/ml.
 - d. Sulfate Reducers: Maximum 0 organisms/ml.
 - e. Iron Bacteria: Maximum 0 organisms/ml.
- B. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.
- C. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.
- D. Fill systems indicated to have antifreeze or glycol solutions with the following concentrations:
- 1. Glycol Cooling-Water Piping: Minimum 25 percent propylene glycol.

3.9 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
- 1. Leave joints, including welds, uninsulated and exposed for examination during test.
 - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 - 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
 - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
 - 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:
- 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
 - 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
 - 3. Isolate expansion tanks and determine that hydronic system is full of water.
 - 4. Subject piping system to hydrostatic test pressure that is not less than 100 psig. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
 - 5. After hydrostatic test pressure has been applied for at least 15 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
 - 6. Prepare written report of testing.
- C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 232113

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SECTION 232116 - HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes special-duty valves and specialties for the following:
 - 1. Chilled-water piping.
 - 2. Condensate-drain piping.
 - 3. Air-vent piping.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
 - 2. Air-control devices.
 - 3. Hydronic specialties.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

1.6 QUALITY ASSURANCE

- A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
 - 1. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
1. Chilled-Water and Hot-Water Piping: 125 psig (860 kPa) at 200 deg F (93 deg C).
 2. Makeup-Water Piping: 80 psig (552 kPa) at 150 deg F (66 deg C).
 3. Condensate-Drain Piping: 150 deg F (66 deg C).
 4. Air-Vent Piping: 200 deg F (93 deg C).
 5. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 VALVES

- A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Section 230523 "General-Duty Valves for HVAC Piping." Section 15112 "General-Duty Valves for HVAC Piping."
- B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Section 230900 "Instrumentation and Control for HVAC."
- C. Bronze, Calibrated-Orifice, Balancing Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bell & Gossett Domestic Pump.
 - b. Flow Design Inc.
 - c. Gerand Engineering Co.
 - d. Griswold Controls.
 - e. Taco.
 2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
 3. Ball: Brass or stainless steel.
 4. Plug: Resin.
 5. Seat: PTFE.
 6. End Connections: Threaded or socket.
 7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
 8. Handle Style: Lever, with memory stop to retain set position.
 9. CWP Rating: Minimum 125 psig (860 kPa).
 10. Maximum Operating Temperature: 250 deg F (121 deg C).
- D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bell & Gossett Domestic Pump.

- b. Flow Design Inc.
 - c. Griswold Controls.
 - d. Taco.
 2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
 3. Ball: Brass or stainless steel.
 4. Stem Seals: EPDM O-rings.
 5. Disc: Glass and carbon-filled PTFE.
 6. Seat: PTFE.
 7. End Connections: Flanged or grooved.
 8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
 9. Handle Style: Lever, with memory stop to retain set position.
 10. CWP Rating: Minimum 125 psig (860 kPa).
 11. Maximum Operating Temperature: 250 deg F (121 deg C).
- E. Diaphragm-Operated, Pressure-Reducing Valves: ASME labeled.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Bell & Gossett Domestic Pump.
 - c. Conbraco Industries, Inc.
 - d. Spence Engineering Company, Inc.
 - e. Watts Regulator Co.
 2. Body: Bronze or brass.
 3. Disc: Glass and carbon-filled PTFE.
 4. Seat: Brass.
 5. Stem Seals: EPDM O-rings.
 6. Diaphragm: EPT.
 7. Low inlet-pressure check valve.
 8. Inlet Strainer: stainless steel, removable without system shutdown.
 9. Valve Seat and Stem: Noncorrosive.
 10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.
- F. Automatic Flow-Control Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Flow Design Inc.
 - b. Griswold Controls.
 - c. Nexus Valve, Inc.
 2. Body: Brass or ferrous metal.
 3. Piston and Spring Assembly: Stainless steel, tamper proof, self-cleaning, and removable.
 4. Combination Assemblies: Include bronze or brass-alloy ball valve.

5. Identification Tag: Marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
8. Minimum CWP Rating: 175 psig (1207 kPa).
9. Maximum Operating Temperature: 200 deg F (93 deg C).

2.3 AIR-CONTROL DEVICES

A. Manual Air Vents:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett Domestic Pump.
 - d. Nexus Valve, Inc.
 - e. Taco, Inc.
2. Body: Bronze.
3. Internal Parts: Nonferrous.
4. Operator: Screwdriver or thumbscrew.
5. Inlet Connection: NPS 1/2 (DN 15).
6. Discharge Connection: NPS 1/8 (DN 6).
7. CWP Rating: 150 psig (1035 kPa).
8. Maximum Operating Temperature: 225 deg F (107 deg C).

B. Automatic Air Vents:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett Domestic Pump.
 - d. Nexus Valve, Inc.
 - e. Taco, Inc.
2. Body: Bronze or cast iron.
3. Internal Parts: Nonferrous.
4. Operator: Noncorrosive metal float.
5. Inlet Connection: NPS 1/2 (DN 15).
6. Discharge Connection: NPS 1/4 (DN 8).
7. CWP Rating: 150 psig (1035 kPa).
8. Maximum Operating Temperature: 240 deg F (116 deg C).

C. Diaphragm-Type Expansion Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett Domestic Pump.
 - d. Taco, Inc.
2. Tank: Welded steel, rated for 125-psig (860-kPa) working pressure and 375 deg F (191 deg C) maximum operating temperature. Factory test after taps are fabricated and supports installed and are labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Diaphragm: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
4. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

D. Tangential-Type Air Separators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett Domestic Pump.
 - d. Taco, Inc.
2. Tank: Welded steel; ASME constructed and labeled for 125-psig (860-kPa) minimum working pressure and 375 deg F (191 deg C) maximum operating temperature.
3. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.
4. Tangential Inlet and Outlet Connections: Threaded for NPS 2 (DN 50) and smaller; flanged connections for NPS 2-1/2 (DN 65) and larger.
5. Blowdown Connection: Threaded.
6. Size: Match system flow capacity.

E. Air Purgers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett Domestic Pump.
 - d. Taco, Inc.
2. Body: Cast iron with internal baffles that slow the water velocity to separate the air from solution and divert it to the vent for quick removal.
3. Maximum Working Pressure: 150 psig (1035 kPa).
4. Maximum Operating Temperature: 250 deg F (121 deg C).

2.4 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: Stainless-steel, 20-mesh strainer, or perforated stainless-steel basket.
4. CWP Rating: 125 psig (860 kPa).

B. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch (20-mm) misalignment.
4. CWP Rating: 150 psig (1035 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

C. Spherical, Rubber, Flexible Connectors:

1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
3. Performance: Capable of misalignment.
4. CWP Rating: 150 psig (1035 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

- A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.
- B. Install calibrated-orifice, balancing or automatic balancing valves at each branch connection to return main.
- C. Install calibrated-orifice or automatic, balancing valves in the return pipe of each heating or cooling terminal.
- D. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- E. Install pressure-reducing valves at make-up-water connection to regulate system fill pressure.

3.2 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

- B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.
- C. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.
- D. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.
- E. Install expansion tanks on the floor. Vent and purge air from hydronic system and ensure that tank is properly charged with air to suit system Project requirements.

END OF SECTION 232116

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SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Double-wall rectangular ducts and fittings.
3. Single-wall round ducts and fittings.
4. Double-wall round and flat-oval ducts and fittings.
5. Sheet metal materials.
6. Sealants and gaskets.
7. Hangers and supports.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:

1. Sealants and gaskets.

- B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.

3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations for selecting hangers and supports.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Perimeter moldings.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 - 2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.
- B. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Maximum Thermal Conductivity: at 75 deg F mean temperature.
 - 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 - 3. Coat insulation with antimicrobial coating.
 - 4. Cover insulation with polyester film complying with UL 181, Class 1.
- F. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch- diameter perforations, with overall open area of 23 percent.
- G. Formed-on Transverse Joints (Flanges): Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Traverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- H. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.
- B. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
 - 1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
 - 2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials

involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 - b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch- diameter perforations, with overall open area of 23 percent.
- D. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
1. Maximum Thermal Conductivity: at 75 deg F mean temperature.
 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 3. Coat insulation with antimicrobial coating.
 4. Cover insulation with polyester film complying with UL 181, Class 1.

2.4 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
1. Galvanized Coating Designation: G90 .
 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches .

2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Water-Based Joint and Seam Sealant:
 - 1. Application Method: Brush on.
 - 2. Solids Content: Minimum 65 percent.
 - 3. Shore A Hardness: Minimum 20.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. VOC: Maximum 75 g/L (less water).
 - 7. Maximum Static-Pressure Class: 10-inch wg , positive and negative.
 - 8. Service: Indoor or outdoor.
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- C. Flanged Joint Sealant: Comply with ASTM C 920.
 - 1. General: Single-component, acid-curing, silicone, elastomeric.
 - 2. Type: S.
 - 3. Grade: NS.
 - 4. Class: 25.
 - 5. Use: O.
 - 6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- E. Round Duct Joint O-Ring Seals:
 - 1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
 - 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 - 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 , "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round and flat-oval ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch , plus allowance for insulation thickness.

- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches .
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

- A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.
- B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 20 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.
- C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 , "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet .
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 2. Test the following systems:
 - a. Supply Ducts with a Pressure Class of 3-Inch wg or Higher: Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.
 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 4. Test for leaks before applying external insulation.
 5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
 6. Give seven days' advance notice for testing.
- C. Duct system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- 3.9 START UP
- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."
- 3.10 DUCT SCHEDULE
- A. Supply Ducts:
1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive 1-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 2. Ducts Connected to Constant-Volume Air-Handling Units:
 - a. Pressure Class: Positive 2-inch wg .
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
 3. Ducts Connected to Variable-Air-Volume Air-Handling Units:
 - a. Pressure Class: Positive 3-inch wg .
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.

B. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 1-inch wg .
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.

C. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 1-inch wg .
 - b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
2. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.
 - a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
 - b. Concealed: Carbon-steel sheet.
 - c. Welded seams and joints.
 - d. Pressure Class: Positive or negative 3-inch wg .
 - e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
 - f. SMACNA Leakage Class: 3.
3. Ducts Connected to Dishwasher Hoods:
 - a. Type 304, stainless-steel sheet.
 - b. Exposed to View: No. 4 finish.
 - c. Concealed: No. 2D finish.
 - d. Welded seams and flanged joints with watertight EPDM gaskets.
 - e. Pressure Class: Positive or negative 3-inch wg .
 - f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
 - g. SMACNA Leakage Class: 3.

D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 1-inch wg .
 - b. Minimum SMACNA Seal Class: C.

- c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 - 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg .
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
- E. Intermediate Reinforcement:
 - 1. Galvanized-Steel Ducts: Galvanized steel.
 - 2. Stainless-Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Match duct material.
- F. Double-Wall Duct Interstitial Insulation:
 - 1. Supply Air Ducts: 1 inch thick.
 - 2. Return Air Ducts: 1 inch thick.
 - 3. Exhaust Air Ducts: 1 inch thick.
- G. Elbow Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm :
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-

1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Radius-to Diameter Ratio: 1.5.

- b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
- c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

H. Branch Configuration:

- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
- 2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm : Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Backdraft dampers.
 - 2. Barometric Relief Damper
 - 3. Manual-volume dampers.
 - 4. Fire dampers.
 - 5. Flexible ducts.
 - 6. Flexible connectors.
 - 7. Duct accessory hardware.
 - 8. Flange Connectors
 - 9. Duct Mounted Access Door

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Backdraft dampers.
 - 2. Barometric Relief Damper
 - 3. Manual-volume dampers.
 - 4. Fire and smoke dampers.
 - 5. Flexible ducts.
 - 6. Flange Connector
 - 7. Duct Mounted Access Door
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, location, and size of each field connection. Detail the following:
 - 1. Special fittings and manual- and automatic-volume-damper installations.
 - 2. Fire- and smoke-damper installations, including sleeves and duct-mounted access doors and panels.
- C. Product Certificates: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static-pressure loss, dimensions, and weights.

1.4 QUALITY ASSURANCE

- A. NFPA Compliance: Comply with the following NFPA standards:
 - 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
 - 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

- A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653, G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.
- B. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets, commercial quality, with oiled, exposed matte finish.
- C. Aluminum Sheets: ASTM B 209, Alloy 3003, Temper H14, sheet form; with standard, one-side bright finish for ducts exposed to view and mill finish for concealed ducts.
- D. Extruded Aluminum: ASTM B 221, Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT DAMPERS

- A. Description: Suitable for horizontal or vertical installations.
- B. Frame: 0.052-inch thick, galvanized, sheet steel, with welded corners and mounting flange.
- C. Blades: 0.050-inch thick aluminum sheet.
- D. Blade Seals: Vinyl 01, Neoprene.
- E. Blade Axles: Galvanized steel.
- F. Tie Bars and Brackets: Galvanized steel.
- G. Return Spring: Adjustable tension.

2.3 BAROMETRIC RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cesco Products; a division of Mestek, Inc.
 2. Greenheck Fan Corporation.
 3. Nailor Industries Inc.
 4. Ruskin Company.
- B. Suitable for horizontal or vertical mounting.
- C. Maximum Air Velocity: 1250 fpm (6.4 m/s).
- D. Maximum System Pressure: 2-inch wg (0.5 kPa).
- E. Frame: Hat-shaped, 0.05-inch- (1.3-mm-) thick, galvanized sheet steel, with welded corners or mechanically attached.
- F. Blades:
1. Multiple, 0.025-inch- (0.6-mm-) thick, roll-formed aluminum.
 2. Maximum Width: 6 inches (150 mm).
 3. Action: Parallel.
 4. Balance: Gravity.
 5. Eccentrically pivoted.
- G. Blade Seals: Neoprene.
- H. Blade Axles: Galvanized steel.
- I. Tie Bars and Brackets:
1. Material: Aluminum.
 2. Rattle free with 90-degree stop.
- J. Return Spring: Adjustable tension.
- K. Bearings: Synthetic.
- L. Accessories:
1. Flange on intake.
 2. Adjustment device to permit setting for varying differential static pressures.
- 2.4 MANUAL-VOLUME DAMPERS
- A. General: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
1. Pressure Classifications of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

- B. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
- C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, and suitable for horizontal or vertical applications.
 - 1. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of 16 gauge, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
 - 2. Roll-Formed Steel Blades: 16 gauge, galvanized, sheet steel.
 - 3. Blade Axles: Plated steel.
 - 4. Tie Bars and Brackets: Galvanized steel.
- D. Low-Leakage Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
- E. Low-Leakage Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, and suitable for horizontal or vertical applications.
 - 1. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of 16 gauge, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
 - 2. Roll-Formed Steel Blades: 16 gauge, galvanized, sheet steel, air foil shaped.
 - 3. Blade Seals: Neoprene.
 - 4. Blade Axles: Plated steel.
 - 5. Tie Bars and Brackets: Galvanized steel.
- F. High-Performance Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
 - 1. Aluminum Frames: Hat-shaped, 0.125-inch thick, extruded-aluminum channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
 - 2. Extruded-Aluminum Blades: Minimum of 0.081-inch thick, 6063T extruded aluminum.
 - 3. Blade Seals: Dual-durometer vinyl on blade edges; metallic compression on jambs.
 - 4. Blade Axles: Plated steel.
 - 5. Tie Bars and Brackets: Aluminum.
- G. Jackshaft: 1-inch diameter, galvanized steel pipe rotating within a pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - 1. Length and Number of Mountings: Appropriate to connect linkage of each damper of a multiple-damper assembly.
- H. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.5 FIRE DAMPERS

- A. General: Labeled to UL 555.
- B. Fire Rating: One and one-half hours.
- C. Fire Rating: One and one-half and three hours.
- D. Frame: SMACNA Type A with blades in airstream; fabricated with roll-formed, 0.034-inch thick galvanized steel; with mitered and interlocking corners.
- E. Frame: SMACNA Type B with blades out of airstream; fabricated with roll-formed, 0.034-inch thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory- or field-installed galvanized, sheet steel.
 - 1. Minimum Thickness: 0.052 inch or 0.138 inch thick as indicated, and length to suit application.
 - 2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, 0.034-inch thick, galvanized, sheet steel. In place of interlocking blades, use full-length, 0.034-inch thick, galvanized steel blade connectors.
- I. Horizontal Dampers: Include a blade lock and stainless-steel negator closure spring.
- J. Fusible Link: Replaceable, 165 or 212 deg F rated as indicated.

2.6 FLEXIBLE CONNECTORS

- A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- B. Standard Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 2-3/4-inch wide, 0.028-inch thick, galvanized, sheet steel or 0.032-inch aluminum sheets. Select metal compatible with connected ducts.
- C. Conventional, Indoor System Flexible Connector Fabric: Glass fabric double coated with polychloroprene.
 - 1. Minimum Weight: 26 oz./sq. yd.
 - 2. Tensile Strength: 480 lbf/inch in the warp, and 360 lbf/inch in the filling.
- D. Conventional, Outdoor System Flexible Connector Fabric: Glass fabric double coated with a synthetic-rubber, weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 530 lbf/inch in the warp, and 440 lbf/inch in the filling.

2.7 FLEXIBLE DUCTS

- A. General: Comply with UL 181, Class 1.
- B. Flexible Ducts, Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-1/2-inch thick, glass-fiber insulation around a continuous inner liner.
 1. Reinforcement: Steel-wire helix encapsulated in inner liner.
 2. Outer Jacket: Glass-reinforced, silver Mylar with a continuous hanging tab, integral fibrous-glass tape, and nylon hanging cord.
 3. Inner Liner: Polyethylene film.
 4. Flexible Duct: Technaflex, Flexmaster.
- C. Flexible Duct Acoustical: Factory-fabricated insulated round duct with an outer jacket enclosing 1-1/2 inch thick, glass-fiber insulation around an acoustically transparent nylon inner liner.
 1. Reinforcement: Steel-wire helix encapsulated in inner liner.
 2. Outer Jacket: Glass-reinforced, silver Mylar with a continuous hanging tab, integral fibrous-glass tape, and nylon hanging cord.
 3. Inner Liner: Acoustically transparent nylon fabric.
 4. Acoustical flexible duct shall be Flexmaster Type 6 or equal.
- D. Pressure Rating: 6-inch wg positive, 1/2-inch wg negative.

2.8 ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments, and length to suit duct insulation thickness.
- B. Splitter Damper Accessories: Zinc-plated damper blade bracket; 1/4-inch, zinc-plated operating rod; and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.
- C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches to suit duct size.
- D. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.9 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.10 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Elgen Manufacturing.
5. Flexmaster U.S.A., Inc.
6. Greenheck Fan Corporation.
7. McGill AirFlow LLC.
8. Nailor Industries Inc.
9. Pottorff.
10. Ventfabrics, Inc.
11. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch (25-by-25-mm)butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches (300 mm) Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches (460 mm) Square: Continuous and two sash locks.

- c. Access Doors up to 24 by 48 Inches (600 by 1200 mm): Continuous and two compression latches with outside and inside handles.
 - d. Access Doors Larger Than 24 by 48 Inches (600 by 1200 mm): Continuous and two compression latches with outside and inside handles.
- 4.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and NAIMA's "Fibrous Glass Duct Construction Standards" for fibrous-glass ducts.
- B. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install volume dampers in lined duct; avoid damage to and erosion of duct liner.
- F. Provide test holes at fan inlet and outlet and elsewhere as indicated.
- G. Install fire dampers according to manufacturer's UL-approved written instructions.
 - 1. Install fusible links in fire dampers.
- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct electric heater.
 - 2. Upstream from duct filters.
 - 3. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - 4. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 5. At each change in direction and at maximum 50-foot (15-m) spacing.
 - 6. Control devices requiring inspection.
 - 7. Elsewhere as indicated.

I. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
5. Body Access: 25 by 14 inches (635 by 355 mm).
6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).

J. Install flexible connectors to connect ducts to equipment.

K. Label access doors according to Division 23 Section "Mechanical Identification."

L. Ductwork flexible connectors are not required for internally isolated equipment.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

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SECTION 233423 - POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Centrifugal roof ventilators.
 - 2. Ceiling-mounting ventilators.
 - 3. In-line centrifugal fans.
 - 4. Propeller fans.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on actual Project site elevations.
- B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material thickness and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Roof curbs.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
 - 2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

- C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Roof framing and support members relative to duct penetrations.
 - 2. Size and location of initial access modules for acoustical tile.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Acme Engineering & Mfg. Corp.
 2. Aerovent; a Twin City Fan Company
 3. American Coolair Corp.
 4. Ammerman; General Resource Corp.
 5. Breidert Air Products.
 6. Broan Mfg. Co., Inc.
 7. Carnes Company HVAC.
 8. Central Blower Co.
 9. Dayton Electric Manufacturing Co.; a division of W. W. Grainger, Inc.
 10. Delhi Industries Inc.
 11. Greenheck.
 12. Hartzell Fan, Inc.
 13. JencoFan; Div. of Breidert Air Products.
 14. Loren Cook Company.
 15. NuTone Inc.
 16. Penn Ventilation.
 17. Quietaire Corporation.
- B. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.
- C. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains and grease collector.
 2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.
- D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- E. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:
1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
 4. Fan and motor isolated from exhaust airstream.
- F. Accessories:
1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
 2. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.

3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
- G. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.
1. Configuration: Self-flashing without a cant strip, with mounting flange.
 2. Overall Height: 12 inches (300 mm).

2.2 CEILING-MOUNTING VENTILATORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. American Coolair Corp.
 2. Ammerman; General Resource Corp.
 3. Breidert Air Products.
 4. Broan Mfg. Co., Inc.
 5. Carnes Company HVAC.
 6. Dayton Electric Manufacturing Co.; a division of W. W. Grainger, Inc.
 7. FloAire.
 8. Greenheck.
 9. JencoFan; Div. of Breidert Air Products.
 10. Loren Cook Company.
 11. NuTone Inc.
 12. Penn Ventilation.
- B. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.
- C. Housing: Steel, lined with acoustical insulation.
- D. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- E. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- G. Accessories:
1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 2. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
 3. Isolation: Rubber-in-shear vibration isolators.
 4. Manufacturer's standard roof jack or wall cap, and transition fittings.

2.3 IN-LINE CENTRIFUGAL FANS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Acme Engineering & Mfg. Corp.
 2. American Coolair Corp.
 3. Ammerman; General Resource Corp.
 4. Bayley Fans; a division of Lau Industries, Inc.
 5. Breidert Air Products.
 6. Carnes Company HVAC.
 7. FloAire.
 8. Greenheck.
 9. Hartzell Fan, Inc.
 10. JencoFan; Div. of Breidert Air Products.
 11. Loren Cook Company.
 12. Madison Manufacturing.
 13. Penn Ventilation.
 14. Quietaire Corporation.
- B. Description: In-line, direct or belt-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.
- C. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- D. Direct-Driven Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
- E. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
- F. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- G. Accessories:
1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
 3. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

2.4 PROPELLER FANS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Acme Engineering & Mfg. Corp.
 2. Aerovent; a Twin City Fan Company.

3. Airmaster Fan Co.
 4. American Coolair Corp.
 5. Ammerman; General Resource Corp.
 6. Bayley Fans; a division of Lau Industries, Inc.
 7. Breidert Air Products.
 8. Carnes Company HVAC.
 9. Chicago Blower Corporation.
 10. Cincinnati Fan.
 11. Dayton Electric Manufacturing Co.; a division of W. W. Grainger, Inc.
 12. Hartzell Fan, Inc.
 13. Howden Buffalo Inc.
 14. Industrial Air; a division of Lau Industries, Inc.
 15. JencoFan; Div. of Breidert Air Products.
 16. King Co. (The); King Air Systems.
 17. Loren Cook Company.
 18. Madison Manufacturing.
 19. Moffitt Corporation, Inc.
 20. New York Blower Company (The).
 21. NuTone Inc.
 22. Penn Ventilation.
 23. Quietaire Corporation.
 24. Stanley Fans.
- B. Description: Direct- or belt-driven propeller fans consisting of fan blades, hub, housing, orifice ring, motor, drive assembly, and accessories.
- C. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.
- D. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.
- E. Belt-Driven Drive Assembly: Resiliently mounted to housing, statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
1. Service Factor Based on Fan Motor Size: 1.4.
 2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - a. Ball-Bearing Rating Life: ABMA 9, L_{10} of 100,000 hours.
 4. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
 5. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 6. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 7. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.
- F. Accessories:

1. Gravity Shutters: Aluminum blades in aluminum frame; interlocked blades with nylon bearings.
2. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
3. Wall Sleeve: Galvanized steel to match fan and accessory size.
4. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

2.5 MOTORS

- A. Comply with requirements in Division 23 Section "Motors."
- B. Enclosure Type: Totally enclosed, fan cooled.

2.6 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 7 Section "Roof Accessories" for installation of roof curbs.
- C. Install units with clearances for service and maintenance.
- D. Label units according to requirements specified in Division 23 Section "Mechanical Identification."

3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.

- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Connect wiring according to Division 26 Section "Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Adjust belt tension.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verify lubrication for bearings and other moving parts.
 - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - 10. Shut unit down and reconnect automatic temperature-control operators.
 - 11. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION 233423

SECTION 233600 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Single-duct air terminal units.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, include rated capacities, furnished specialties, sound-power ratings, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Include a schedule showing unique model designation, room location, model number, size, and accessories furnished.
 - 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structure.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- D. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data" include the following:
 - 1. Instructions for resetting minimum and maximum air volumes.
 - 2. Instructions for adjusting software set points.

1.4 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air terminal units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. NFPA Compliance: Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

1.5 COORDINATION

- A. Coordinate layout and installation of air terminal units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SINGLE-DUCT AIR TERMINAL UNITS

- A. Available Manufacturers:
 - 1. METALAIRE, Inc.; Metal Industries Inc.
 - 2. Price Industries.
 - 3. Titus.
 - 4. Trane Co. (The); Worldwide Applied Systems Group.
 - 5. Carrier.
- B. Configuration: Volume-damper assembly inside unit casing with control components located inside a protective metal shroud.
- C. Casing: 0.032-inch (0.8-mm) galvanized steel.
 - 1. Casing Lining: 1-inch- (25-mm-) thick, coated, fibrous-glass duct liner complying with ASTM C 1071; secured with adhesive.
 - 2. Casing Lining: Adhesive attached, 3/4-inch- (19-mm-) thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-

- spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
3. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
 4. Air Outlet: S-slip and drive connections.
- D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
1. Maximum Damper Leakage: ARI 130 rated, 2 percent of nominal airflow at 3-inch wg (750-Pa) inlet static pressure.
 2. Damper Position: Normally open.
- E. Hot-Water Heating Coil: Copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 200 psig (1380 kPa); and factory installed.
- F. Electric Heating Coil: Slip-in-type, open-coil design with integral control box factory wired and installed. Include the following features:
1. Primary and secondary overtemperature protection.
 2. Nickel chrome 80/20 heating elements.
 3. Airflow switch.
 4. Noninterlocking disconnect switch.
 5. Fuses (for coils more than 48 A).
 6. Mercury contactors.
 7. Pneumatic-electric switches and relays.
 8. Magnetic contactor for each step of control (for three-phase coils).
- G. DDC Controls: Bidirectional damper operators and microprocessor-based controller and room sensor shall be compatible with temperature controls specified in Division 23 Section "Instrumentation and Control for HVAC" and shall have the following features:
1. Damper Actuator: 24 V, powered closed, spring return open.
 2. Terminal Unit Controller: Pressure-independent, variable-air-volume controller with electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes, and having the following features:
 - a. Proportional, plus integral control of room temperature.
 - b. Time-proportional reheat-coil control.
 - c. Occupied and unoccupied operating mode.
 - d. Remote reset of airflow or temperature set points.
 - e. Adjusting and monitoring with portable terminal.
 - f. Communication with temperature-control system specified in Division 23 Section "Instrumentation and Control for HVAC."
 3. Room Sensor: Wall mounting, with temperature set-point adjustment and access for connection of portable operator terminal.

2.3 SOURCE QUALITY CONTROL

- A. Identification: Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

- B. Verification of Performance: Rate air terminal units according to ARI 130.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to air terminal units to allow service and maintenance.
- C. Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.
- D. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts."
- E. Ground units with electric heating coils according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
 - 2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 - a. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
 - b. Verify that controls and control enclosure are accessible.
 - c. Verify that control connections are complete.
 - d. Verify that nameplate and identification tag are visible.
 - e. Verify that controls respond to inputs as specified.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 233600

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SECTION 233713 – DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Diffusers.
- B. Diffuser boots.
- C. Registers/grilles.
- D. Door grilles.
- E. Roof hoods.
- F. Goosenecks.

1.2 REFERENCES

- A. ADC 1062 - Certification, Rating and Test Manual.
- B. ANSI/NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- C. ARI 650 - Air Outlets and Inlets.
- D. ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.
- E. SMACNA - Low Pressure Duct Construction Standard.

1.3 QUALITY ASSURANCE

- A. Test and rate performance of air outlets and inlets in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.

1.4 REGULATORY REQUIREMENTS

- A. Conform to ANSI/NFPA 90A.

1.5 SUBMITTALS

- A. Provide product data for items required for this project.
- B. Submit schedule of outlets and inlets indicating type, size, location, application, and noise level.

- C. Review requirements of outlets and inlets as to size, finish, and type of mounting prior to submitting product data and schedules of outlets and inlets.
- D. Submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - CEILING DIFFUSERS

- A. Titus
- B. Tuttle and Bailey
- C. Price

2.2 RECTANGULAR CEILING DIFFUSERS

- A. Rectangular, adjustable pattern, fixed blade, stamped, multicore type diffuser to discharge air in 360 degree pattern with sectorizing baffles where indicated; Model TMSAA manufactured by Titus.
- B. Provide surface mount, snap-in, or inverted T-bar type frame. In plaster ceilings, provide plaster frame and ceiling frame.
- C. Fabricate of aluminum with baked enamel off-white finish.

2.3 ACCEPTABLE MANUFACTURERS - CEILING REGISTERS/GRILLES

- A. Price.
- B. Tuttle and Bailey.
- C. Titus.

2.4 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

- A. Streamlined aluminum construction, 3/4 inch spacing, 35 degree fixed blades, 1-inch thick filter with ¼ turn fasteners, horizontal face; Model 355FF1 manufactured by Titus.
- B. Fabricate 1-1/4 inch margin frame with concealed mounting.
- C. Fabricate of aluminum with 20 gage minimum frame, or aluminum extrusions, with factory baked enamel off-white finish.
- D. Where not individually connected to exhaust fans, provide integral, gang-operated opposed blade dampers with removable key operator, operable from face.

- E. All ceiling exhaust and return air register/grilles installed in a room with T-bar drop ceiling shall be T-bar drop in type.

2.5 ROOF HOODS

- A. Fabricate air inlet or exhaust hoods in accordance with SMACNA Low Pressure Duct Construction Standards.
- B. Fabricate of galvanized steel, minimum 16 gage base and 20 gage hood, or aluminum, minimum 16 gage base and 18 gage hood; suitably reinforced; with removable hood; bird screen with 1/2 inch square mesh for exhaust and 3/4 inch for intake, and factory baked enamel finish.
- C. Mount unit on minimum 12 inch high curb base with insulation between duct and curb.
- D. Make hood outlet area minimum of twice throat area.

2.6 GOOSENECKS

- A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards of minimum 18 gage galvanized steel.
- B. Mount on minimum 12 inch high curb base where size exceeds 9 x 9 inch.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install items in accordance with manufacturers' instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, regardless of whether dampers are specified as part of the diffuser, or grille and register assembly.
- E. Paint ductwork visible behind air outlets and inlets matte black.
- F. All grilles and diffusers in gyms must be protected by screen guards.
- G. Insulate the top side of all T-bar lay-in grilles and diffusers.
- H. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

- I. Form closely fitted joints with exposed connections accurately located and secured.
- J. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- K. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- L. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

END OF SECTION 233713

SECTION 233723 - HVAC GRAVITY VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Roof hoods.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design ventilators, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.
- B. Structural Performance: Ventilators shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of ventilator components, noise or metal fatigue caused by ventilator blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Water Entrainment: Limit water penetration through unit to comply with ASHRAE 62.1-2007.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For gravity ventilators. Include plans, elevations, sections, details, ventilator attachments to curbs, and curb attachments to roof structure.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
- C. Delegated-Design Submittal: For shop-fabricated ventilators indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Detail fabrication and assembly of shop-fabricated ventilators.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof framing plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
1. Structural members to which roof curbs and ventilators will be attached.
 2. Sizes and locations of roof openings.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.7 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 (Z275) zinc coating, mill phosphatized.
- B. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.
1. Use types and sizes to suit unit installation conditions.
 2. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
- C. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors made from stainless-steel components, with capability to sustain without failure a load equal to 4 times the loads imposed for concrete, or 6 times the load imposed for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

- A. Factory or shop fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.
- B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.
- D. Fabricate supports, anchorages, and accessories required for complete assembly.
- E. Perform shop welding by AWS-certified procedures and personnel.

2.3 ROOF HOODS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Loren Cook Company.
- B. Factory fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 5-6 and 5-7.
- C. Materials: Galvanized-steel sheet, minimum 0.064-inch- (1.62-mm-) thick base and 0.040-inch- (1.0-mm-) thick hood; suitably reinforced.
- D. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to fit roof opening and ventilator base.
 - 1. Configuration: Self-flashing without a cant strip, with mounting flange.
 - 2. Overall Height: 16 inches (400 mm).
- E. Bird Screening: Galvanized-steel, 1/2-inch- (12.7-mm-) square mesh, 0.041-inch (1.04-mm) wire. Provide for intake and relief application
- F. Insect Screening: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) wire. Provide only for relief applicaion.
- G. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.
- H. Damper: for relief hoods provide gravity damper with a system pressure of 0.03 inch wg with adjustable spring return.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.
- B. Install gravity ventilators with clearances for service and maintenance.
- C. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- D. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Section 079200 "Joint Sealants" for sealants applied during installation.
- E. Label gravity ventilators according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in Section 233113 "Metal Ducts" and Section 233116 "Nonmetal Ducts." Drawings indicate general arrangement of ducts and duct accessories.

END OF SECTION 233723

SECTION 237413 - PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:
 - 1. Direct-expansion cooling.
 - 2. Hot-gas reheat.
 - 3. Gas furnace.
 - 4. Economizer outdoor- and return-air damper section.
 - 5. Integral, space temperature controls.
 - 6. Roof curbs.

1.3 DEFINITIONS

- A. DDC: Direct-digital controls.
- B. ECM: Electrically commutated motor.
- C. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
- D. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
- E. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.
- F. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.
- G. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

- H. VVT: Variable-air volume and temperature.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design RTU supports to comply with [wind] [and] [seismic] performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Wind-Restraint Performance:
 - 1. Basic Wind Speed: 153 MPH.
 - 2. Building Classification Category: III.
 - 3. Minimum 10 lb/sq. ft (48.8 kg/sq. m) multiplied by the maximum area of the mechanical component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

1.5 SUBMITTALS

- A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Delegated-Design Submittal: For RTU supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
 - 2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
 - 3. Wind-Restraint Details: Detail fabrication and attachment of wind and seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
- D. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Structural members to which RTUs will be attached.
 - 2. Roof openings
 - 3. Roof curbs and flashing.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

- G. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. ARI Compliance:

1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
2. Comply with ARI 270 for testing and rating sound performance for RTUs.

B. ASHRAE Compliance:

1. Comply with ASHRAE 15 for refrigeration system safety.
2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
3. Comply with ASHRAE/IESNA 90.1 for minimum efficiency of heating and cooling.

C. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

D. UL Compliance: Comply with UL 1995.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion.
3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
4. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.
5. Warranty Period for Condenser and Evaporator Coils: Manufacturer's standard, but not less than five years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan Belts: One set for each belt-driven fan.
2. Filters: One set of filters for each unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carrier Corporation.
 2. Daikin.
 3. Trane; American Standard Companies, Inc.
 4. YORK International Corporation.

2.2 CASING

- A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
- B. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
1. Exterior Casing Thickness: 0.052 inch (1.3 mm) thick.
- C. Inner Casing Fabrication Requirements:
1. Inside Casing: Galvanized steel, 0.034 inch (0.86 mm) thick.
- D. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
1. Materials: ASTM C 1071, Type I.
 2. Thickness: 1 inch (25 mm) with minimum R-8 insulation value.
 3. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
 4. Liner Adhesive: Comply with ASTM C 916, Type I.
- E. Condensate Drain Pans: Formed sections of stainless-steel sheet, a minimum of 2 inches (50 mm) deep, and complying with ASHRAE 62.
1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
 2. Drain Connections: Threaded nipple both sides of drain pan.

2.3 FANS

- A. Direct-Driven Supply-Air Fans: Double width, plenum-type, centrifugal; with permanently lubricated, motor resiliently mounted in the fan inlet. Aluminum wheels, and galvanized fan scrolls.
- B. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.

- C. Relief-Air Fan: Forward curved, shaft mounted on permanently lubricated motor.
- D. Fan Motor: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.4 COILS

- A. Supply-Air Refrigerant Coil:
 - 1. Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
 - 2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
 - 3. Coil Split: Interlaced.
 - 4. Baked phenolic coating.
 - 5. Condensate Drain Pan: Stainless steel formed with pitch and drain connections complying with ASHRAE 62.
- B. Outdoor-Air Refrigerant Coil:
 - 1. Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
 - 2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
 - 3. Baked phenolic coating.

2.5 REFRIGERANT CIRCUIT COMPONENTS

- A. Number of Refrigerant Circuits: Two.
- B. Compressor: Hermetic, reciprocating, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.
- C. Refrigeration Specialties:
 - 1. Refrigerant Charge: R-410A.
 - 2. Expansion valve with replaceable thermostatic element.
 - 3. Refrigerant filter/dryer.
 - 4. Manual-reset high-pressure safety switch.
 - 5. Automatic-reset low-pressure safety switch.
 - 6. Minimum off-time relay.
 - 7. Automatic-reset compressor motor thermal overload.
 - 8. Brass service valves installed in compressor suction and liquid lines.
 - 9. Low-ambient kit high-pressure sensor.

2.6 AIR FILTRATION

- A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. Pleated: MERV 8.

2.7 GAS FURNACE

- A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47 and NFPA 54.
 1. CSA Approval: Designed and certified by and bearing label of CSA.
- B. Burners: Stainless steel with a minimum thermal efficiency of 80 percent.
 1. Fuel: Natural gas.
 2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.
- C. Heat-Exchanger and Drain Pan: Stainless steel.
- D. Venting: Gravity vented.
- E. Safety Controls:
 1. Gas Control Valve: Modulating.
 2. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

2.8 DAMPERS

- A. Outdoor-Air Damper: Linked damper blades, for 0 to 25 percent outdoor air, with motorized damper filter.
- B. Outdoor- and Return-Air Mixing Dampers: Opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.
 1. Damper Motor: Modulating with adjustable minimum position.
 2. Relief-Air Damper: Gravity actuated with bird screen and hood.

2.9 ELECTRICAL POWER CONNECTION

- A. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.10 CONTROLS

- A. Control equipment and sequence of operation are specified in Division 23 Section "Instrumentation and Control for HVAC."
- B. DDC Controller:

1. Controller shall have volatile-memory backup.
 2. Safety Control Operation:
 - a. Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire alarm control panel.
 - b. Fire Alarm Control Panel Interface: Provide control interface to coordinate with operating sequence described in Division 28 Section "Fire Detection and Alarm."
 - c. Low-Discharge Temperature: Stop fan and close outdoor-air damper if supply air temperature is less than 40 deg F (4 deg C).
 - d. Defrost Control for Condenser Coil: Pressure differential switch to initiate defrost sequence.
 3. Scheduled Operation: Occupied and unoccupied periods on 365-day clock with a minimum of four programmable periods per day.
 4. Unoccupied Period:
 - a. Heating Setback: 10 deg F (5.6 deg C).
 - b. Cooling Setback: System off.
 - c. Override Operation: Two hours.
 5. Supply Fan Operation:
 - a. Occupied Periods: Run fan continuously.
 - b. Unoccupied Periods: Cycle fan to maintain setback temperature.
 6. Refrigerant Circuit Operation:
 - a. Occupied Periods: Cycle or stage compressors, and operate hot-gas bypass to match compressor output to cooling load to maintain discharge temperature and room humidity. Cycle condenser fans to maintain maximum hot-gas pressure. Operate low-ambient control kit to maintain minimum hot-gas pressure.
 - b. Unoccupied Periods: Compressors off.
 - c. Switch reversing valve for heating or cooling mode on air-to-air heat pump.
 7. Gas Furnace Operation:
 - a. Occupied Periods: Modulate burner to maintain discharge temperature.
 - b. Unoccupied Periods: Cycle burner to maintain setback temperature.
- C. Interface Requirements for HVAC Instrumentation and Control System:
1. Interface relay for scheduled operation.
 2. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
 3. Provide BACnet compatible interface for central HVAC control workstation for the following:
 - a. Adjusting set points.
 - b. Monitoring supply fan start, stop, and operation.
 - c. Inquiring data to include outdoor-air damper position, supply- and room-air humidity.

- d. Monitoring occupied and unoccupied operations.
- e. Monitoring constant and variable motor loads.
- f. Monitoring variable-frequency drive operation.
- g. Monitoring cooling load.
- h. Monitoring air-distribution static pressure and ventilation air volume.

2.11 ACCESSORIES

- A. Low-ambient kit using staged condenser fans for operation down to 35 deg F (1.7 deg C).
- B. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.
- C. Coil guards of painted, galvanized-steel wire.
- D. Hail guards of galvanized steel, painted to match casing.
- E. Concentric diffuser with white louvers and polished aluminum return grilles, insulated diffuser box with mounting flanges, and interior transition.
- F. Condenser and evaporator coils coating by Bygold. Coating type shall be aluminum pigmented polyurethane.
- G. Exterior casing anti-corrosive coating

2.12 ROOF CURBS

- A. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
 - 1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 - a. Materials: ASTM C 1071, Type I or II.
 - b. Thickness: 1-1/2 inches (38 mm).
 - 2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
 - a. Liner Adhesive: Comply with ASTM C 916, Type I.
 - b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
 - c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
 - d. Liner Adhesive: Comply with ASTM C 916, Type I.
- B. Curb Height: 24 inches (610 mm).

- C. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match RTU, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for wind-load requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.
- B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- C. Examine roofs for suitable conditions where RTUs will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Division 07 Section "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.
- B. Install wind restraints according to manufacturer's written instructions.

3.3 CONNECTIONS

- A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
- B. Install piping adjacent to RTUs to allow service and maintenance.
 - 1. Gas Piping: Comply with applicable requirements in Division 23 Section "Facility Natural-Gas Piping" Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.
- C. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 - 1. Install ducts to termination at top of roof curb.
 - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.

3. Connect supply ducts to RTUs with flexible duct connectors specified in Division 23 Section " Air Duct Accessories."
4. Install return-air duct continuously through roof structure.
5. Install 6" batt insulation inside roof curb above roof metal deck.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.
- C. Tests and Inspections:
 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.

3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 1. Inspect for visible damage to unit casing.
 2. Inspect for visible damage to furnace combustion chamber.
 3. Inspect for visible damage to compressor, coils, and fans.
 4. Inspect internal insulation.
 5. Verify that labels are clearly visible.
 6. Verify that clearances have been provided for servicing.
 7. Verify that controls are connected and operable.
 8. Verify that filters are installed.
 9. Clean condenser coil and inspect for construction debris.
 10. Clean furnace flue and inspect for construction debris.
 11. Connect and purge gas line.
 12. Remove packing from vibration isolators.
 13. Verify lubrication on fan and motor bearings.

14. Adjust fan belts to proper alignment and tension.
15. Start unit according to manufacturer's written instructions.
 - a. Start refrigeration system.
 - b. Do not operate below recommended low-ambient temperature.
 - c. Complete startup sheets and attach copy with Contractor's startup report.
16. Inspect and record performance of interlocks and protective devices; verify sequences.
17. Operate unit for an initial period as recommended or required by manufacturer.
18. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency.
 - a. Measure gas pressure on manifold.
 - b. Inspect operation of power vents.
 - c. Measure combustion-air temperature at inlet to combustion chamber.
 - d. Measure flue-gas temperature at furnace discharge.
 - e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
 - f. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
19. Calibrate temperature sensor.
20. Adjust and inspect high-temperature limits.
21. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
22. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F (8 deg C) above return-air temperature:
 - a. Coil leaving-air, dry- and wet-bulb temperatures.
 - b. Coil entering-air, dry- and wet-bulb temperatures.
 - c. Outdoor-air, dry-bulb temperature.
 - d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
23. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
24. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
 - a. Supply-air volume.
 - b. Return-air volume.
 - c. Relief-air volume.
 - d. Outdoor-air intake volume.
25. Simulate maximum cooling demand and inspect the following:
 - a. Compressor refrigerant suction and hot-gas pressures.
 - b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.
26. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:

- a. High-temperature limit on gas-fired heat exchanger.
 - b. Low-temperature safety operation.
 - c. Filter high-pressure differential alarm.
 - d. Economizer to minimum outdoor-air changeover.
 - e. Relief-air fan operation.
 - f. Smoke alarms.
27. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.6 CLEANING AND ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.
- B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 237413

SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes split-system air-conditioning consisting of separate evaporator-fan and compressor-condenser components.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.6 MATERIALS MAINTENANCE SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) for each air-handling unit.

1.7 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
 2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.8 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."
- B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
 1. Warranty Period:
 - a. For Compressor: Five year(s) from date of Substantial Completion.
 - b. For Parts: Five year(s) from date of Substantial Completion.
 - c. For Labor: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Carrier Corporation; Home Comfort and HVAC Building & Industrial Systems.
 2. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division.

3. Trane; a business of American Standard companies.

2.2 INDOOR UNITS 5 TONS OR LESS

A. Floor-Mounted, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect.
 - a. Insulation: Faced, glass-fiber duct liner.
 - b. Drain Pans: Galvanized steel, with connection for drain; insulated.
2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
3. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
4. Fan: Direct drive, centrifugal.
5. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
6. Air Filtration Section:
 - a. General Requirements for Air Filtration Section:
 - 1) Comply with NFPA 90A.
 - 2) Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
 - 3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.
 - b. Disposable Panel Filters:
 - 1) Factory-fabricated, viscous-coated, flat-panel type.
 - 2) Thickness: 1 inch .
 - 3) Arrestance according to ASHRAE 52.1: 80.
 - 4) Merv according to ASHRAE 52.2: 5.

B. Wall-Mounted, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.

2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
3. Fan: Direct drive, centrifugal.
4. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
 - c. Enclosure Type: Totally enclosed, fan cooled.
 - d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
 - e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
 - f. Mount unit-mounted disconnect switches on exterior of unit.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
6. Condensate Drain Pans:
 - a. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
 - 2) Depth: A minimum of 1 inch deep.
 - b. Single-wall, stainless-steel sheet.
 - c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
7. Air Filtration Section:
 - a. General Requirements for Air Filtration Section:
 - 1) Comply with NFPA 90A.
 - 2) Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
 - 3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.
 - b. Disposable Panel Filters:
 - 1) Factory-fabricated, viscous-coated, flat-panel type.
 - 2) Thickness: 1 inch .

2.3 OUTDOOR UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - a. Compressor Type: Scroll.
 - b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - c. Refrigerant Charge: R-410A.
 - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 210/240.
3. Fan: Aluminum-propeller type, directly connected to motor.
4. Motor: Permanently lubricated, with integral thermal-overload protection.
5. Low Ambient Kit: Permits operation down to 45 deg F .
6. Mounting Base: Polyethylene.

2.4 ACCESSORIES

- A. Thermostat: Low voltage with subbase to control compressor and evaporator fan.
- B. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install ground-mounted, compressor-condenser components on 4-inch- thick, reinforced concrete base that is 4 inches larger, on each side, than unit. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.
- D. Install ground-mounted, compressor-condenser components on polyethylene mounting base.
- E. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
 - 1. Remote, Water-Cooled Condenser Connections: Comply with requirements specified in Division 23 Section "Hydronic Piping" Connect hydronic piping to supply and return connections with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.
- C. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts" Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories."

3.3 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.
- C. Prepare test and inspection reports.

3.4 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126

SECTION 260000 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. General Electrical Requirements.
 2. Work Included in Contract.
 3. Definitions.
 4. Dimensions and Equipment Location.
 5. Owner Supplied Products.
 6. Work by Owner.
 7. Pre-Installation Meetings.
 8. Demonstration and Training Meetings.
 9. Product Data.
 10. Shop Drawings.
 11. Test Reports.
 12. Manufacturer's Certificates.
 13. Manufacturer's Instructions.
 14. Manufacturer's Field Reports.
 15. Quality Assurance and Control of Installation.
 16. Temporary Facilities and Controls.
 17. Delivery, Storage, and Handling Requirements.
 18. Product Options.
 19. Product Substitution Procedures.
 20. Final Cleaning and Painting.
 21. Starting of Systems.
 22. Demonstration and Instructions.
 23. Project Record Documents.
 24. Extra Material and Spare Parts.
 25. Operation and Maintenance Manuals.
 26. Warranties.
 27. Pre-bid Survey.

1.2 GENERAL ELECTRICAL REQUIREMENTS

- A. Mention of any article, operation or method requires that Contractor shall provide same and perform each operation in complete accordance with conditions stated.
- B. Contractor shall provide all material, labor, equipment and transportation as necessary to complete project in compliance with Contract Documents.
- C. In general, this work includes everything essential for a complete electrical system in operating order as shown on drawings and indicated in specifications.
- D. Work shall be installed in accordance with National, State, and Local codes, ordinances, laws, and regulations. Comply with all applicable OSHA regulations.

- E. Materials shall have a UL or ETL label where a UL or ETL standard or testing requirement exists.
- F. All work shall be installed in accordance with recommendations of manufacturer whose equipment is to be supplied and installed under this Contract.
- G. Before submitting a bid, each bidder shall examine all specifications and drawings relating to their work and shall become fully informed as to extent and character of work required and its relation to other work within project area.
- H. Contractor, in conjunction with Engineer's representative, shall establish exact locations of all materials and equipment to be installed. Consideration shall be given to construction features, equipment of other trades and requirements of equipment proper.
- I. All materials shall be suitably stored and protected prior to installation and all work shall be protected after installation, during construction and prior to acceptance.
- J. Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for delivery, erection and installation of all equipment and apparatus required to be installed by Contractor. All such equipment shall be removed by Contractor upon completion of project.
- K. Refer to Division 01 – General Requirements for temporary electrical service.

1.3 WORK INCLUDED IN CONTRACT

- A. Contractor shall provide auxiliary contacts, buttons, and switches on starters as required.
- B. Contractor shall provide power wiring (120 V or greater) to control panels, motor starters, variable frequency drives, motors, electric actuators, electric devices and smoke detectors.

1.4 DEFINITIONS

- A. Exposed: Exposed to view in any room, corridor, stairway, or from the building's exterior.
- B. Code: National, State and Local Electrical codes including OSHA requirements.
- C. Provide, furnish, install, and wire ready for service.
- D. Signal Voltage: NEC class 1, 2, or 3 remote control, signaling, or power limited circuits.
- E. Low Voltage: 50 to 600 volts.
- F. Medium Voltage: 601 to 35,000 volts.
- G. High Voltage: 35,001 volts and greater.
- H. Substitution: Manufacturer or method other than those listed by name in these specifications, on the Drawings, or in an Addendum.

1.5 DIMENSIONS AND EQUIPMENT LOCATION

- A. Drawings depicting electric work are diagrammatic and show, in their approximate location, symbols representing electrical equipment and devices.
- B. Exact locations of such equipment and devices shall be established in field in accordance with instructions from Engineer/Architect as established by manufacturer's installation drawings and details.
 - 1. Contractor shall refer to shop drawings and submittal drawings for all equipment requiring electrical connections to verify rough-in and connection locations.
 - 2. Unless specifically stated, no measurement of an electric drawing derived by scaling shall be used as a dimension to work by.
 - 3. Dimensions noted on electric drawings are subject to measurements of adjacent and previously completed work.
 - 4. All measurements shall be performed prior to actual installation of equipment.

1.6 OWNER SUPPLIED PRODUCTS

- A. Reference Division 01 – General Requirements for Owner supplied products.

1.7 WORK BY OWNER

- A. Reference Division 01 – General Requirements for work by Owner.

1.8 PRE-INSTALLATION MEETINGS

- A. When required in individual specification sections, convene pre-installation meeting at Project site prior to commencing work of specific section.
- B. Require attendance of parties directly affecting, or affected by, Work of specific section.
- C. Notify Engineer/Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of installation, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two (2) copies to Engineer/Architect, and those affected by decisions made.

1.9 DEMONSTRATION AND TRAINING MEETING

- A. Contractor shall schedule and administer demonstration and training sessions for Owner for each portion of equipment and products that are required to have training in proper operation and maintenance.
- B. Contractor shall schedule representatives of the equipment manufacturer to attend demonstration and training sessions to provide additional information as necessary.

1.10 PRODUCT DATA

- A. Product Data: Submit to Engineer/Architect for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Provide copies and distribute in accordance with Submittal Procedures article in Division 01 – General Requirements and for record documents purposes described in Division 01 – General Requirements.
- C. Submit number of copies Contractor requires, plus three copies Engineer/Architect will retain.
- D. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- E. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- F. After review distribute in accordance with Submittal Procedures article in Division 01 – General Requirements and provide copies for record documents described in Division 01 – General Requirements.

1.11 SHOP DRAWINGS

- A. Shop Drawings: Submit to Engineer/Architect for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. The following shop drawing submittals are required:
 - 1. 26 05 03 Wiring Connections
 - 2. 26 05 19 Building Wire and Cable
 - 3. 26 05 26 Grounding and Bonding
 - 4. 26 05 29 Electrical Hangers and Supports
 - 5. 26 05 33 Raceways and Boxes
 - 6. 26 05 34 Floor Boxes
 - 7. 26 05 53 Electrical Identification
 - 8. 26 05 73 Short Circuit/Coordination/Arc Flash Hazard Analysis Studies
 - 9. 26 05 80 Penetration Firestopping for Electrical
 - 10. 26 09 43 Networked Lighting Controls
 - 11. 26 12 00 Pad-Mounted Transformers
 - 12. 26 22 00 Dry Type Transformers
 - 13. 26 24 16 Panelboards
 - 14. 26 27 16 Cabinets and Enclosures
 - 15. 26 27 26 Wiring Devices
 - 16. 26 28 13 Fuses
 - 17. 26 28 19 Enclosed Switches
 - 18. 26 28 23 Enclosed Circuit Breakers
 - 19. 26 29 13 Enclosed Controllers
 - 20. 26 29 16 Enclosed Contactors
 - 21. 26 29 33 Motor Wiring
 - 22. 26 33 53 Static Uninterruptible Power Supplies
 - 23. 26 35 53 Transient Voltage Surge Suppressor
 - 24. 26 41 00 Facility Lightning Protection

- 25. 26 51 00 Interior Lighting
- 26. 26 56 00 Exterior Lighting
- 27. 26 60 00 Multiplexed Addressable Fire Alarm Detection System

- C. Produce copies and distribute in accordance with Submittal Procedures article in Division 01 – General Requirements and for record documents purposes described in Division 01 – General Requirements.
- D. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- E. Shop drawings shall be submitted in advance of construction and installation so as to not cause delay in other Contractor's work.
- F. Data submitted for Engineer's review shall be numbered consecutively, shall be noted to correlate with electrical drawings and shall bear:
 - 1. Name and location of project.
 - 2. Name of Contractor.
 - 3. Date of submittal.
 - 4. Date of drawings and date of each correction and revision.
 - 5. If more than one type of lighting fixture (or other material) is on submitted sheet, proposed equipment shall be conspicuously checked with red pen by Electrical Contractor.
- G. Shop drawings for different systems and equipment shall, be bound separately by specification section and not bound by manufacturer. Each separate submittal shall be sent under a separate transmittal.
- H. Submittals which contain different specification section systems bound together shall be returned not reviewed and returned to Contractor for re-submittal.
- I. Lighting Fixture shop drawings shall consist of single submittal with all project light fixtures included. Submittals grouped by manufacturer shall not be accepted. Contractor shall be responsible for coordinating drawings from his various suppliers in order to comply with this requirement.
- J. Contractor shall examine shop drawings and equipment brochures prior to submission.
- K. Contractor shall verify that materials and equipment depicted will properly fit into construction.
- L. Contractor shall also review all previously completed work related to installation of equipment depicted to insure that it has been properly installed.
- M. No materials or equipment subject to prior review by Engineer shall be fabricated or installed by Contractor, without approval.
- N. Engineer's review of shop drawings shall not relieve Contractor of responsibility for deviations from requirements of drawings and specifications, unless prior approval for such deviations has been granted.
- O. Submit in electronic PDF format.

- P. After review, Contractor shall maintain copies required for Record Documents described in Division 01 – General Requirements.

1.12 TEST REPORTS

- A. Operation of equipment and electrical systems does not constitute an acceptance of work by Owner.
- B. Final acceptance is to be made after Contractor has adjusted their equipment and demonstrated that it meets or exceeds requirements of drawings and specifications.
- C. After work is completed and prior to acceptance, Contractor shall conduct following tests, tabulate data, date, sign and submit to Engineer:
 - 1. Standard megger insulation test on each feeder.
 - 2. Ground resistance test.
 - 3. Clamp ammeter test on each feeder conductor with all utilization equipment energized.
 - a. Load current in each phase conductor of feeder or portion thereof supplying panel shall not differ from average connected load currents in feeder conductors by more than 7-1/2 percent.
 - b. If load current does differ by more than 7-1/2 percent, Contractor shall change phase loading to same or receive written approval from Engineer that this is not required due to nature of load.
- D. Upon completion of installation, Contractor shall furnish certificates of approval from authorities having jurisdiction.
- E. Contractor shall demonstrate that all work is complete and is in specified operating condition, with raceway and conduit system properly grounded, wiring free from grounds, shorts, and entire installation is free from any physical defects.
- F. In presence of Engineer and Owner, Contractor shall demonstrate proper operation of all systems.
- G. Perform other testing as specifically directed in other sections of specifications for specific equipment.

1.13 MANUFACTURER'S CERTIFICATES

- A. When specified in individual specification sections, submit certification by manufacturer, installation/ application subcontractor, or Contractor to Engineer/Architect, in quantities specified for Product Data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Engineer/Architect.

1.14 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Engineer for delivery to Owner in quantities specified for Product Data.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.15 MANUFACTURER'S FIELD REPORTS

- A. Submit reports for Engineer's benefit as contract administrator or for Owner.
- B. Submit report within 30 days of observation to Engineer/Architect for information.
- C. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.16 QUALITY ASSURANCE/CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship to produce Work of specified quality.
- B. Comply fully with manufacturer's instructions, including each step in sequence.
- C. Should manufacturer's instructions conflict with Contract Documents, request clarification from Engineer/Architect before proceeding.
- D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform Work by persons qualified to produce workmanship of specified quality.
- F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.17 TEMPORARY FACILITIES AND CONTROLS

- A. Reference Division 01 – General Requirements for temporary facilities and control requirements.

1.18 PRODUCT DELIVERY, STORAGE AND HANDLING REQUIREMENTS

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

- D. Store and protect products in accordance with manufacturer's instructions.
- E. Store with seals and labels intact and legible.
- F. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- G. For exterior storage of fabricated products, place on sloped supports above ground.
- H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- I. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- J. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.19 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and meeting specifications; no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with following article.
- D. Materials and equipment required shall be of new manufacture.
- E. Items specified shall be of latest type or model produced by manufacturer specified. If model number is obsolete, substitute current manufacturer's product.

1.20 PRODUCT SUBSTITUTION PROCEDURES

- A. Substitutions will not be allowed. Where the Contractor wishes to use equipment or methods other than those listed by name, that equipment must be approved by the Engineer. To gain approval for equipment not listed, the Contractor shall follow the substitution request procedures outlined in the following paragraphs.
- B. Substitutions may be considered when a product becomes unavailable through no fault of Contractor.
- C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents, and specifically indicating where equipment differs from equipment specified.
- D. A request constitutes a representation that Contractor:
 - 1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.

2. Will provide same warranty for Substitution as for specified product.
 3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
 4. Waives claims for additional costs or time extension that may subsequently become apparent.
 5. Will reimburse Owner and Engineer/Architect for review or redesign services associated with re-approval by authorities having jurisdiction.
- E. Substitutions will not be considered when they are indicated or implied on shop drawings or product data submittals, without separate written request, or when acceptance will require revision to Contract Documents.
- F. Substitution Submittal Procedure:
1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
 2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
 3. Lighting Fixtures: Request for substitutions shall include photometric test reports performed by an independent testing laboratory.
 4. Contractor shall provide samples of proposed equipment for Engineer's review, if requested by Engineer.
 5. Contractor shall furnish any other information or materials as requested by Engineer to establish equality.
 6. Engineer will notify Contractor in writing of decision to accept or reject request.
- G. Equipment and materials submitted without proper documentation shall be rejected without review.
- H. Contractor's submitting equipment for approval as an equal, shall include in their bid all incidental costs that may result from use of approved equipment.
- I. Such costs shall include, but not be limited to, additional costs that may be incurred by other contractors whose scope of work is affected by use of "equal" products.
- J. Electrical Contractor shall be responsible for those costs even if they do not become evident until after bidding.
- K. Only one request for substitution will be considered for each product.
- L. When substitution is not accepted, provide specified product.
- M. Submittals shall be received to allow for sufficient time to incorporate the acceptance into the bid documents through an addendum. Substitution submittals received after the issuance of the final addendum will not be considered.

1.21 FINAL CLEANING AND PAINTING

- A. Rubbish resulting from work shall be removed and disposed of on a daily basis in such manner as to be acceptable to Architect.

- B. Contractor shall clean all exposed iron work, interior and exterior of cabinets and pull boxes, etc., and remove rubbish and debris resulting from work.
- C. Where painted surfaces of equipment have been damaged or rusted during construction, Contractor shall paint same to match final.
- D. Clean other equipment as indicated in other sections of specification for specific equipment.

1.22 STARTING OF SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Engineer/Architect and Owner seven days prior to start-up of each item.
- C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.
- E. Verify wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable manufacturer's representative in accordance with manufacturer's instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

1.23 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.
- B. Demonstrate Project equipment and instruct in classroom environment located at project site and instructed by manufacturer's representative who is knowledgeable about the Project.
 - 1. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
 - 2. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
 - 3. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at designated location.
 - 4. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
 - 5. Required instruction time for each item of equipment and system is specified in individual sections.

1.24 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of following electrical record documents; record actual revisions to the Work:
 - 1. Locations of all buried conduit or similar items. Include buried depth.
 - 2. Field changes of dimension or detail.
 - 3. Changes made by field order or change order.
 - 4. Details not on original contract drawings.
 - 5. Changes to circuit numbers.
 - 6. Junction box locations and conduit runs, with trade sizes indicated, for all lighting, power, and electrical systems installed.
 - 7. Master-share light fixture ballasting arrangements.
 - 8. Locations of all feeders and pullboxes.
 - 9. Record documents include:
 - a. Drawings.
 - b. Specifications.
 - c. Addenda.
 - d. Change Orders and other modifications to the Contract.
 - e. Reviewed Shop Drawings, Product Data, and Samples.
 - f. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress, not less than weekly.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including following:
 - 1. Manufacturer's name and product model and serial number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish first main floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4. Field changes of dimension and detail.
 - 5. Details not on original Contract drawings.
- G. Submit documents to Engineer/Architect for review. Documents shall be submitted in both electronic and hard copy formats.

1.25 EXTRA MATERIAL AND SPARE PARTS

- A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.

- B. Deliver to Project site and place in location as directed by Owner; obtain receipt prior to final payment.

1.26 OPERATION AND MAINTENANCE MANUALS

- A. Electrical Contractor shall assemble and submit to Architect for subsequent submission to Owner, three complete sets of a Manual of Operation and Maintenance for each of electrical and communications systems.
- B. Each manual shall consist of a 3-ring binder volume instructing Owner's personnel in operation and maintenance of system in question.
- C. All information shall be bound and secured in manual.
- D. Manual shall cover all phases of operation of equipment and shall be illustrated with photographs, drawings, and wiring diagrams.
- E. Manuals shall accurately describe operation, construction and adjustable features of complete system and its component parts.
- F. Manual shall be complete with an equipment parts listing to facilitate ordering of spare and replacement parts.
- G. Each manual shall contain two sets of final shop drawings depicting equipment as installed.

1.27 WARRANTIES

- A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
- B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.
- C. Verify documents are in proper form, contain full information, and are notarized.
- D. Co-execute submittals when required.
- E. Include Table of Contents and assemble in three D side ring heavy duty binder with durable plastic cover.
- F. Time of Submittals:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.
 - 2. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

1.28 PREBID SURVEY

- A. Before submitting their bid, Contractor shall tour project site and review following items:

1. Exact configuration of areas requiring demolition, temporary power, relocating, etc.
 2. Site conditions such as material storage, staging areas, parking, etc.
 3. Problems with work sequence.
- B. Any conditions found that are not shown on drawings or stated within project manual that may affect scope of work shall be reported to Engineer.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Sleeves: ASTM A53, Schedule 40 galvanized steel pipe.

2.2 ACCESS PANELS

- A. Access panels required by code or otherwise to electrical service equipment shall be supplied and installed by Electrical Contractor.

PART 3 - EXECUTION

3.1 FIRESTOPPING

- A. Openings in fire rated construction and annular spaces around conduits, cable trays, and other penetrating items shall be protected in accordance with NEC Article 300.21 and in accordance with Wisconsin Administrative Code, Department of Commerce Chapter 51.049. Fire rating of protective seal shall be at least that of floor or wall into which it is installed, so that original fire rating of construction is maintained.
- B. Wall or floor penetration openings shall be as small as possible.
- C. Openings and annular spaces required by code to be protected, shall be protected.
- D. Installation of materials and assemblies shall be in strict accordance with manufacturer's instructions.

3.2 SLEEVES

- A. Where conduits, cables trays, or other electrical raceways must pass through floors or walls that are to be constructed of poured in place concrete, contractor shall provide sleeves in formwork prior to concrete pour. It shall be Electrical Contractor's responsibility to provide all sleeves for his work unless specifically indicated otherwise on drawings. Prior to installing sleeves, contractor shall prepare drawings indicating locations, quantities, sizes, and spacings of all sleeves anticipated. Drawings shall be forwarded to structural engineer for approval.
- B. Floor sleeves shall extend minimum of 2 inches above finished floor.

END OF SECTION 260000

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SECTION 260501 - ELECTRICAL DEMOLITION AND ALTERATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Removal of existing electrical equipment, wiring, and conduit in areas to be remodeled.
2. Removal of designated construction; dismantling, cutting and alterations for completion of Work.
3. Disposal of materials.
4. Storage of removed materials.
5. Identification of utilities.
6. Salvaged items.
7. Protection of items to remain as scheduled at end of section and as indicated on Drawings.
8. Relocate existing equipment to accommodate construction.

B. Related Sections:

1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
2. Section 26 00 00 – Basic Electrical Requirements.
3. Division 02 – Existing Conditions.
4. Division 08 – Openings: Execution requirements for access doors and panels specified by this section.

1.2 CLOSEOUT SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for closeout submittals.
- B. Section 26 00 00 – Basic Electrical Requirements: Record actual locations of capped utilities and conduits and equipment abandoned in place.

1.3 QUALITY ASSURANCE

- A. Contractor shall notify the Engineer of any existing code violations observed during the course of performing his work. The Engineer will decide if corrective action needs to be taken. Corrective actions that change the scope of the work will be considered a change order and will be processed accordingly.

1.4 SEQUENCING

- A. Division 01 – General Requirements: Requirements for sequencing.

1.5 SCHEDULING

- A. Division 01 – General Requirements: Requirements for scheduling.
- B. Existing buildings shall remain in service during construction.
- C. Prior to demolition or alteration of structures, the following shall be accomplished:
 1. Owner release of such structure.

2. Disconnection of electrical power to equipment and circuits removed or affected by demolition work.
 3. Electrical services rerouted or shut off outside area of demolition.
 4. Coordinate sequencing with Owner and other Contractors.
 5. Survey and record condition of existing facilities to remain in place that may be affected by demolition operations.
- D. Power outages and interruptions in building systems shall be held to a minimum and shall be done at a time convenient to Owner. Time of all outages shall be scheduled with Owner and all other trades affected by outage at least ten working days in advance.
- E. Perform noisy, malodorous, or dusty work:
1. Between hours of 5:00 p.m. and 10:00 p.m.
- F. Cease operations immediately when structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

1.6 COORDINATION

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Coordinate demolition work with the general contractor and other trades.
- C. Coordinate and sequence demolition so as not to cause shutdown of operation of surrounding areas.
- D. Shut-down Periods:
1. Arrange timing of shut-down periods of in-service panels with Owner. Do not shut down any utility without prior written approval.
 2. Keep shut-down period to minimum or use intermittent period as directed by the Owner.
 3. Maintain life-safety systems in full operation in occupied facilities.
- E. Identify salvage items in cooperation with Owner. Owner may keep any equipment in demolition areas. Contractor shall deliver equipment owner wants salvaged to area in building designated by owner. Contractor shall remove all materials in demolished area not salvaged from site. Contractor shall obtain release of all materials before disposition.
- F. After demolition operations are completed, survey conditions and restore existing facilities to their pre-demolition condition.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify of existing conditions before starting work.
- B. Verify wiring and equipment indicated to be demolished serve only abandoned facilities.

- C. Verify termination points for demolished services.

3.2 PREPARATION

- A. Erect, and maintain temporary safeguards, including warning signs and lights, barricades, and similar measures, for protection of public, Owner, Contractor's employees, and existing improvements to remain.
- B. Temporary egress signage and emergency lighting.

3.3 DEMOLITION

- A. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Architect/Engineer before disturbing existing installation.
- B. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- C. Remove conduit, wire, boxes, and fastening devices to avoid any interference with new installation.
- D. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- E. Reconnect equipment being disturbed by renovation work and required for continued service to nearest available panel.
- F. Disconnect or shut off service to areas where electrical work is to be removed. Remove electrical fixtures, equipment, and related switches, outlets, conduit and wiring which are not part of final project.
- G. Install temporary wiring and connections to maintain existing systems in service during construction.
- H. Perform work on energized equipment or circuits with experienced and trained personnel.
- I. Remove, relocate, and extend existing installations to accommodate new construction.
- J. Repair adjacent construction and finishes damaged during demolition and extension work.
- K. Remove exposed abandoned grounding and bonding components, fasteners and supports, and electrical identification components, including abandoned components above accessible ceiling finishes. Cut embedded support elements flush with walls and floors.
- L. Clean and repair existing equipment to remain or to be reinstalled.
- M. Protect and retain power to existing active equipment remaining.
- N. Electrical equipment in conflict with construction shall be removed or relocated as indicated on drawings, as directed, or required.

3.4 MODIFICATIONS

- A. Feeders, branch circuits, and other system wiring which are to remain in-service, but which are presently routed through areas being demolished shall be rerouted around demolition area.
- B. Where existing branch circuits are to be extended or modified, existing conduit may be reused at Contractor's discretion. Existing conduits that are removed from their existing location shall be reused.
- C. Existing wiring may be spliced and used to extent that it was not removed. Any existing conductors removed shall not be re-pulled and then reused.

3.5 EXISTING PANELBOARDS

- A. Ring out circuits in existing panel affected by the Work. Where additional circuits are needed, reuse circuits available for reuse. Install new breakers.
- B. Tag unused circuits as spare.
- C. Where existing circuits are indicated to be reused, use sensing measuring devices to verify circuits feeding Project area or are not in use.
- D. Remove existing wire no longer in use from panel to equipment.
- E. Provide new updated directories where more than three circuits have been modified or rewired.

3.6 SALVAGE ITEMS

- A. Remove and protect items requested by Owner to be salvaged and transport to location on site designated by Owner.

3.7 REUSABLE ELECTRICAL EQUIPMENT

- A. Carefully remove equipment, materials, or fixtures which are to be reused. Only items specifically identified as be reused shall be reused.
- B. Disconnect, remove, or relocate existing electrical material and equipment interfering with new installation.
- C. Relocate existing lighting fixtures as indicated on Drawings. Clean fixtures and re-lamp. Test fixture to see if it is in good working condition before installation at new location.

3.8 CLEANING

- A. Provide under provisions of Division 01 - General Requirements.
- B. Remove demolished materials as work progresses. Legally dispose materials.
- C. Keep workplace neat.

3.9 DISPOSAL

- A. Contractor shall tour demolition areas with Owner to determine status of all equipment to be removed during demolition.
- B. All equipment that is to be salvaged for reuse by the Owner shall be removed by Contractor and transported to an Owner designated storage area on site.
- C. Raceway, boxes and supporting devices shall become property of Contractor and shall be removed from site and disposed of by the Contractor.
- D. Removed equipment shall be disposed of by Contractor unless specifically otherwise indicated on drawings or requested by Owner. Contractor shall provide transport for disposal.

3.10 LIGHTING FIXTURE BALLAST DISPOSAL

- A. Contractor shall inspect all ballasts in all light fixtures removed as part of this project and take actions described below.
- B. All ballasts labeled as "NON PCB'S" or "NO PCB'S" shall be handled as described in other sections of these specifications which describe demolition or salvage materials handling. If PCB content is not stated on ballast label, ballast shall be handled as a PCB ballast.
- C. All PCB ballasts shall have wires clipped off and ballasts placed in US DOT approved type 17C or type 17H barrels and placed in storage in a location within building as designated by Owner. Contractor shall provide to Owner, in typewritten form, a total count of these ballasts and where they are stored.
- D. These ballasts are not to be removed from work site by Contractor.
- E. Contractor shall label and mark PCB storage barrels with EPA approved PCB labels and shall mark storage area with signs, marks, and lines to meet regulations of Wisconsin Code NR 157.
- F. Contractor shall provide approved PCB absorbent materials to be stored immediately adjacent to barrel storage area. Do not place loose absorbent material in barrels.
- G. When ballast demolition is completed, and all PCB ballasts are placed in barrels ready to be picked up for disposal, Contractor shall notify Owner in writing so Owner can make arrangements for pick up and disposal of PCB ballasts.

3.11 LIGHTING FIXTURE LAMP DISPOSAL

- A. Contractor shall be responsible for proper removal and recycling of all existing fixture lamps being removed from service in accordance with EPA and State of Wisconsin DNR requirements. Lamps shall not be disposed of in any way except as described herein.
- B. Contractor shall be responsible for arranging for recycling of lamps by a licensed waste lamp and bulb recycler. Cost for recycling of removed lamps shall be included in Contractor's bid.
- C. Contractor shall carefully package removed lamps to prevent breakage. Contractor shall store waste lamps in a secure area, either in container that lamps are shipped in or in other ways so as to eliminate breakage. Both lamp storage area and individual containers should be labeled as

hazardous waste. Store lamps in covered containers to prevent lamps from being broken as a result of other debris being placed on top of them.

3.12 ALTERATIONS

- A. Contractor shall be responsible for coordination of other trades to facilitate installation in existing building.
- B. Work shall include, but is not limited to, cutting, patching, refinishing and all work necessary and required to leave existing building in a condition acceptable to engineer.

3.13 PROTECTION OF FINISHED WORK

- A. Furnish under provisions of Division 01 - General Requirements.
- B. Do not permit traffic over unprotected floor surface.

END OF SECTION 260501

SECTION 260503 - WIRING CONNECTIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Electrical Connections to Equipment.
- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
 - 2. Section 26 05 19 - Building Wire and Cable.
 - 3. Section 26 05 33 - Raceway and Boxes.

1.2 REFERENCES

- A. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA WD 1 - General Requirements for Wiring Devices.
 - 2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.
- B. Product Data: Submit wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
- C. Manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for closeout submittals.
- B. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

1.5 COORDINATION

- A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
- B. Determine connection locations and requirements.
- C. Sequence rough-in of electrical connections to coordinate with installation of equipment.
- D. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 - PRODUCTS

2.1 CORD AND PLUGS

- A. Attachment Plug Construction: Conform to NEMA WD 1.
- B. Configuration: NEMA WD 6; match receptacle configuration at outlet furnished for equipment.
- C. Cord Construction: Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
- D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit over-current protection.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.2 INSTALLATION

- A. Make electrical connections.
- B. Make conduit connections to equipment that is subject to vibration using flexible conduit. Use liquid-tight flexible conduit with watertight connectors in damp or wet locations. Equipment subject to vibration shall include:
 - 1. Transformers.
 - 2. Motors.
 - 3. Packaged HVAC equipment.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- F. Provide disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- G. Provide terminal block jumpers to complete equipment wiring requirements.
- H. Provide interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.
- I. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

3.3 ADJUSTING

- A. Division 01 - General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

3.4 SPECIAL OUTLET AND MOTOR WIRING SCHEDULES

- A. See Drawings.

END OF SECTION 260503

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SECTION 260519 - BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Building Wire.
 - 2. Building Cable.
 - 3. Wiring Connectors.
 - 4. Connections.

- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
 - 2. Section 26 00 00 – Basic Electrical Requirements.
 - 3. Section 26 05 53 – Electrical Identification.

1.2 REFERENCES

- A. International Electrical Testing Association (NETA):
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

- B. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code (NEC).

1.3 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Procedures for closeout submittals.

- B. Project Record Documents: Record actual locations of components and circuits.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years.

1.5 FIELD MEASUREMENTS

- A. Verify field measurements are as indicated on Drawings.

1.6 COORDINATION

- A. Division 01 – General Requirements: Requirements for coordination.

- B. When wire and cable destination is indicated, and routing is not shown, determine routing and lengths required.

- C. Wire and cable routing indicated is approximate unless dimensioned.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

- A. Product Description: Single conductor insulated wire.
- B. Conductor: Copper only. At the Contractor's option, aluminum conductors size #1/0 and larger may be substituted for copper and used for phase and neutral conductors for transformer feeders, switchboard feeders, and panelboard feeders. All ground conductors shall be copper.
 - 1. Aluminum conductors shall not be used for serving individual motors, chillers, VFD's and motor controllers.
 - 2. The following requirements shall be met when aluminum conductors are used:
 - a. Aluminum alloy conductors shall be compact stranded conductors of a recognized Aluminum Association 8000 Series aluminum alloy conductor material (AA-8000 series alloy).
 - b. It is the responsibility of the contractor to increase the size of the conduit, wire gutter, or enclosure, if necessary, to accommodate the aluminum conductors and meet allowable code requirements.
 - c. It is the responsibility of the contractor to increase the size of the aluminum conductor and associated termination lugs to match the ampacity of the copper conductor circuit shown on the Drawings.
 - d. Contractor shall submit a feeder schedule to the Engineer for all conductor substitutions indicating the aluminum conductor wire size and the conduit size. The contractor shall not begin the installation until written approval is granted by the Engineer.
 - e. All aluminum conductors shall terminate on a mechanical screw-type connector or mechanical compression-type connector. Connector shall be dual rated (AL7CU or AL9CU) and Listed by UL for use with aluminum and copper conductors and sized to accept aluminum conductors of the required ampacity. When using compression-type connectors, the lugs shall be marked with wire size, die index, number and location of crimps and shall be suitably color-coded. Using a suitable stripping tool, remove insulation from the required length of the conductor. Wire brush the conductor and apply a Listed joint compound. Tighten or crimp the connection per the connector manufacturer's recommendation. Wipe off any excess joint compound.
 - f. When terminating aluminum conductors to aluminum bus, prepare a mechanical screw-type or compression-type connection. Bolts shall be anodized alloy and conform to current ANSI and ASTM chemical and mechanical property limits. Nuts shall be aluminum alloy and conform to current ANSI standards. Washers shall be flat aluminum alloy, Type A plain, standard wide series conforming to current ANSI standards. Lubricate and tighten the hardware per manufacturer's recommendations
 - g. When terminating aluminum conductors to copper bus, prepare a mechanical screw-type or compression-type connection. Bolts shall be plated or galvanized medium carbon steel; heat treated, quenched and tempered equal to current ASTM standard or SAE grade 5. Nuts shall conform to current ANSI standards. Washers shall be steel, Type A plain, standard wide series conforming to current ANSI standards. Belleville conical spring washers shall be of hardened steel, cadmium plated or silicone bronze. Lubricate and tighten the hardware per manufacturer's recommendations.
 - h. The final tightening torque shall be recorded for all aluminum conductor mechanical screw-type connections and provided in report form, in the completed O&M manuals.
 - i. Contractor shall perform an infrared survey of all aluminum conductor connections after the installation is complete and in normal service. Infrared surveys shall be performed during periods of maximum possible loading with at least 30% of rated load

of the equipment being inspected. All connections with elevated temperatures shall be corrected by the contractor. The infrared survey results shall be provided in report form, in the completed O&M manuals.

- C. Insulation Voltage Rating: 600 volts, rated 75 degrees C unless otherwise noted.
- D. In mechanical rooms, light fixtures, and others high temperature applications, insulation shall be rated 90 degrees C. or greater.
- E. Provide following wiring types:
 - 1. Concealed or exposed dry interior locations: Use only building wire Type THHN/THWN or XHHW insulation in raceway.
 - 2. Above Accessible Ceilings: Use only building wire Type THHN/THWN or XHHW insulation in raceway.
 - 3. Wet or Damp Interior Locations: Use only building wire Type XHHW-2 insulation in raceway.
 - 4. Exterior Locations: Use only building wire Type XHHW-2 insulation in raceway.
 - 5. Underground Locations: Use only building wire Type XHHW-2 or USE insulation, in raceway.
- F. Solid or Stranded conductor for 10 AWG and smaller. Conductor 8 AWG and larger shall be stranded.
- G. Conductor not smaller than 12 AWG for power and lighting circuits.
- H. Conductor not smaller than 14 AWG for control circuits.
- I. All wires shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of manufacturer's stock.

2.2 WIRING CONNECTORS

- A. Conductors No. 10 AWG and Smaller: Scotch 3M - Scotch-lok compression type solderless connectors with plastic cover.
- B. Joints, Taps, and Splices in Conductors No. 8 AWG and Larger: Solderless compression type connectors, tool and die applied, of a type that will not loosen under vibration or normal strains. Burndy "Hy-Dent" type or equivalent as acceptable to Engineer.
- C. Rubber insulating electrical tape: Scotch 3M model 23, 30-mil tape.
- D. Split bolt connectors are not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Install in accordance with manufacturer's written instructions and in accordance with recognized industry practices.
- B. Run wire and cable in conduit, unless otherwise indicated on drawings.

- C. Do not draw conductors into conduits until building is enclosed and watertight and until work that may cause conductor damage has been completed.
- D. Voltage drop for branch circuits and feeder circuit combined shall not exceed requirements of NEC Article 215.
- E. Examine areas and conditions under which conductors are to be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of work.
- F. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 JOINTS, TAPS AND SPLICES

- A. Each tap, joint, or splice in conductors No. 8 AWG and larger shall be taped with two half-lap layers of vinyl plastic electrical tape and a finish wrap of color coding tape, where required by code.
- B. Cable splices shall be made only in distribution and junction boxes.

3.3 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.4 EXISTING WORK

- A. Remove exposed abandoned wire and cable including abandoned wire and cable above accessible ceiling finishes.
- B. Patch surfaces where removed cables pass through building finishes.
- C. Disconnect abandoned circuits and remove circuit wire and cable.
- D. Remove abandoned boxes when wire and cable servicing boxes is abandoned and removed.
- E. Install blank cover for abandoned boxes not removed.
- F. Provide access to existing wiring connections remaining active and requiring access. Modify installation or install access panel.
- G. Extend existing circuits using materials and methods as specified.
- H. For additions to existing buildings, existing conductor color coding schemes shall be followed unless in conflict with codes. If no logical color coding scheme exists, color coding indicated above shall be followed.

3.5 INSTALLATION

- A. Route wire and cable to meet project conditions.
- B. Conductors shall not be installed at temperatures below manufacturer's minimum installation temperature.

- C. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- D. Identify and color code wire and cable under provisions of Section 26 05 53 – Electrical Identification.
- E. Identify each conductor with its panel and circuit number or other designation indicated.
- F. Special Techniques - Building Wire in Raceway:
 - 1. Pull conductors into raceway at same time.
 - 2. Install building wire 4 AWG and larger with pulling equipment.
- G. Special Techniques - Wiring Connections:
 - 1. Clean conductor surfaces before installing lugs and connectors.
 - 2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
 - 3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
 - 4. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
 - 5. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
 - 6. When 10 AWG and smaller stranded conductors are used install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.

3.6 BRANCH CIRCUIT CONDUCTORS

- A. Install branch circuits and switched circuits as required to comply with circuiting, switching, and control functions shown on drawings.
- B. Conductors shall be size 12 AWG minimum, unless otherwise noted, for branch circuit wiring, including motor circuits.
- C. Size 120V branch circuits for length of run on following basis:
 - 1. 0 to 75 ft. run from panelboard to first outlet: No. 12 AWG minimum.
 - 2. 75 to 125 ft. run: increase one wire size, No. 12 AWG becomes No. 10 AWG.
 - 3. 126 to 200 ft run: increase two wire sizes, No. 12 AWG becomes No. 8 AWG.
 - 4. 201 and above: wiring to be sized for 3 percent maximum voltage drop.
- D. Provide individual neutral conductors for all branch circuit phase conductors. Multi-wire branch circuits sharing a common neutral will not be allowed.
- E. Route branch circuits and switch legs as dictated by construction, these specifications, or instruction from Engineer.
- F. Size conduit, outlet boxes, and other raceway system components in accordance with NEC requirements as minimum.
- G. Circuit numbers as shown on drawings are for Contractor to plan their wiring and for estimating purposes and are not necessarily exact circuit numbers to be used in specific panel for particular load.

- H. Exact circuit numbers for each load are to be selected by Contractor at their option.
- I. Balanced load on panelboard bus will be determining factor in arrangement of circuits. Panelboards average load shall not differ from phase to phase by plus or minus 7.5 percent.
- J. Motor and equipment branch wiring.
 - 1. Furnish and install motor circuits in accordance with schedules on drawings and code requirements, from source of supply to associated motor starter, and from starter to motor terminal box, including necessary and required intermediate connections.
 - 2. Conductor and conduit size for motor branch circuits, if shown on drawings, are sized for motor requirement only.
 - 3. Control wiring is not included in conduit sizes shown on drawings.
 - 4. Motors shall have proper conductor sizes as per NEC requirements and nameplate ratings.
 - 5. Contractor shall be responsible for verification of ratings of motors and installing proper branch circuits.
 - 6. Obtain manufacturer's wiring diagrams and shop drawings for equipment requiring electrical connections.
 - 7. Check drawings and specifications of other divisions of work for equipment and work, which shall be included in order to provide a complete electrical installation.
 - 8. Motor connections shall be made by compression type connectors using proper tools and fittings to assure good electrical continuity and low resistance joint.

3.7 FEEDER INSTALLATION

- A. Install in accordance with manufacturer's written instructions, and in accordance with recognized industry practices.
- B. Extend feeders at full capacity from origin to termination.
- C. Feeder conduits shall contain only those conductors constituting a single feeder circuit.
- D. Where feeder conductors are run in parallel, conductors shall be of same length, same material, circular-mil area, insulation type, and terminated in same manner.
- E. Where parallel feeder conductors run in separate raceways, each raceway shall have same physical characteristics.
- F. Feeders shall follow most accessible routes, concealed in construction in finished areas, exposed to minimum temperature gradient and to minimum temperature fluctuation.
- G. Confine feeders to insulated portions of building, unless otherwise specified.
- H. Trapped feeder runs without facilities for continuous drainage are not acceptable.
- I. Feeder conduits shall not be routed in conduit floor slabs or below basement or grade level floor slabs.
- J. Feeder conductors in switchboards, panelboards, pullboxes, gutters, and other open wiring spaces shall be bundled by feeder using plastic tie wraps at intervals not greater than 3 feet on center.

3.8 FIXTURE WIRES

- A. Use conductor with insulation suitable for current, voltage, and temperature to which conductor will be subjected.
- B. Provide minimum No. 12 wire size for conductors supplying power to a single fixture. 600V insulation minimum.
- C. Insulation suitable for operation at 90 degrees C. minimum for lighting fixtures with integral ballast, mogul base sockets, quartz lamps, or otherwise where subject to excessive temperatures.
- D. Fixture wiring shall be continuous wiring system to lampholder or to ballast and from ballast to lampholder.

3.9 IDENTIFICATION AND LABELLING

- A. For materials specified in this section, see specification Section 26 05 53 for identification and labeling requirements.

3.10 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION 260519

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SECTION 260526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Rod electrodes.
 - 2. Wire.
 - 3. Grounding well components.
 - 4. Mechanical connectors.
 - 5. Exothermic connections.

- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
 - 2. Section 26 00 00 – Basic Electrical Requirements.
 - 3. Section 26 05 19 - Building Wire and Cable.

1.2 REFERENCES

- A. Institute of Electrical and Electronics Engineers (IEEE):
 - 1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
 - 2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

- B. International Electrical Testing Association (NETA): NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

- C. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.
 - 2. NFPA 99 - Standard for Health Care Facilities.

1.3 SYSTEM DESCRIPTION

- A. Grounding systems use the following elements as grounding electrodes:
 - 1. Metal underground water pipe.
 - 2. Metal building frame.
 - 3. Concrete-encased electrode.
 - 4. Ground ring.
 - 5. Rod electrode.

1.4 DESIGN REQUIREMENTS

- A. Provide all material, labor and incidentals necessary for the completion of this section of the work.

1.5 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 5 ohms maximum.

1.6 SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.
- B. Product Data: Submit data on grounding electrodes and connections.
- C. Test Reports: Indicate overall resistance to ground. Indicate soil conditions when tests were done including when last rain occurred.

1.7 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Procedures for closeout submittals.
- B. Project Record Documents: Record actual locations of components and grounding electrodes.

1.8 QUALITY ASSURANCE

- A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.
- B. Perform Work in accordance with National Electric Code and state and local code requirements.

1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years' experience.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products under provisions of Division 01 – General Requirements.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.
- D. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.11 COORDINATION

- A. Coordinate complete grounding and bonding of building reinforcing steel prior to concrete placement.

PART 2 - PRODUCTS

2.1 ROD ELECTRODES

- A. Manufacturers:
 - 1. Galvan Industries/Erico Inc.
 - 2. LTV/Copperweld, Inc.
 - 3. Eritech/Erico, Inc.

4. Lyncole XIT Grounding.
5. Harger Lightning and Grounding.

B. Product Description:

1. Material: Copper-clad steel.
2. Diameter: 3/4 inch.
3. Length: 10 feet.

- C. Connector: Connector shall be exothermic welded connection unless otherwise noted. Provide U-bolt clamp in ground test wells and where indicated on drawings.

2.2 WIRE

- A. Material: Stranded copper. Provide tin plated copper where exposed to corrosive environment.
- B. Connection to Electrodes: 2/0 AWG, minimum size.
- C. Grounding Electrode Conductor: Copper conductor, bare.
- D. Bonding Conductor: Copper conductor, bare.

2.3 GROUNDING WELL COMPONENTS

- A. Well Pipe: 8 inches NPS (DN200) by 24 inches long fiberglass pipe with belled end.
- B. Well Cover: Fiberglass with legend "GROUND" embossed on cover.

2.4 MECHANICAL CONNECTORS

A. Manufacturers:

1. Erico, Inc.
2. ILSCO Corporation.
3. O-Z Gedney Co.
4. Thomas & Betts, Electrical.
5. Burndy Electric.

- B. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

- C. Ground clamp fittings shall be interlocking clamp type, fabricated from high strength corrosion resistant metal with high strength silicon bronze u-bolts, nuts, locks, and lock washers.

2.5 EXOTHERMIC CONNECTIONS

A. Manufacturers:

1. Thermoweld.
2. Cadweld, Erico, Inc.
3. Harger Lightning Protection.
4. Exothermic Welding Co.
5. Thomas & Betts, Electrical.

- B. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

2.6 GROUND BUSSES

- A. Copper only.
- B. Cross section shall be 1/4-inch x 2 inches, lengths as shown on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify of existing conditions before starting work.
- B. Verify final backfill and compaction has been completed before driving rod electrodes.

3.2 PREPARATION

- A. Remove paint, rust, mill oils, and other surface contaminants at connection points.

3.3 EXISTING WORK

- A. Modify existing grounding system to maintain continuity to accommodate renovations.
- B. Extend existing grounding system using materials and methods as specified.

3.4 INSTALLATION

- A. Install in accordance with IEEE 142.
- B. Install rod electrodes near location of electric service entrance unless otherwise shown on drawings. Install additional rod electrodes, if required, to achieve specified resistance to ground.
- C. Install interconnecting wire 2 feet below finish grade.
- D. Install grounding and bonding conductors concealed from view.
- E. Install grounding well pipe with cover at rod locations as indicated on Drawings. Install well pipe top flush with finished grade.
- F. Bond together metal siding not attached to grounded structure; bond to ground.
- G. Bond together reinforcing steel and metal accessories in pool and fountain structures.
- H. Install ground grid under access floors as indicated on Drawings. Construct grid of 4 AWG bare copper wire installed on 24-inch centers both ways. Bond each access floor pedestal to grid.
- I. Bond together each metallic raceway, pipe, duct and other metal object entering space under access floors. Bond to underfloor ground grid. Install 2 AWG bare copper bonding conductor.

- J. Bond to lightning protection system. Refer to Division 26.
- K. Install continuous grounding using underground cold-water system, driven ground rods, and building steel as grounding electrode.
- L. Ground electrical systems and equipment as required by code, utility, local ordinances, and to requirements herein.
- M. Install separate code rated grounding conductors to special equipment and activity areas as required by code.
- N. Bond all metallic piping systems and service equipment as required by NEC.
- O. Permanently attach grounding conductors prior to energizing equipment.
- P. Drive ground rods to a depth 4-inches below finished grade.
- Q. Grounding electrode conductor shall be continuous without splice from nearest building grounding electrode. Ground to service equipment. Install bonding jumper around water meter. Attach non-ferrous metal tag to warn against removal. Make connections to ground electrodes with approved molded exothermic weld process.

3.5 EQUIPMENT GROUND

- A. Bond metallic conduits, supports, cabinets, and other equipment so ground will be electrically continuous from service to outlet boxes.
- B. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.
- C. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits.
- D. Size grounding conductors in accordance with NEC.
- E. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment.
- F. Install grounding conductor in nonmetallic and flexible conduit to complete equipment ground continuity.
- G. Ground wire shall be bonded at equipment and at first junction box of conduit system on line side of flexible conduit to the system.
- H. Install grounding conductors to permit shortest and most direct path from equipment to ground.
- I. When grounding conductor runs through metallic conduit, bond to conduit at entrance and exit with a bolted clamp.

- J. Ground neutral at service only.
- K. Install a separate equipment grounding conductor in each conduit containing feeder conductors.
- L. Install a green equipment grounding conductor in all conduits serving branch circuits.
- M. Green ground bar in panels, where required to be similar to neutral bar, except tinted green and bonded to panel tub.
- N. Connections shall be accessible for inspection and checking.
- O. No insulation shall be installed over ground connections.
- P. Ground connection surfaces shall be cleaned, and all connections shall be made so that it is impossible to move them.
- Q. Attach grounds permanently before permanent building service is energized.
- R. Ground metal lighting poles. Install a ground lug on inside wall of pole directly across from handhole.
- S. Install grounding and bonding in patient care areas to meet requirements of NFPA 99.
- T. Ground Busses:
 - 1. Mount to walls with insulated standoffs.
 - 2. At splice points, splice bus shall overlap busses being spliced with a dimension twice the width of the buss being spliced. Splice bus shall be connected to each bus with a minimum of two splice bolts.
 - 3. Bus splice bolts shall utilize Bellevue washers.

3.6 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13. Make final grounding system measurements two days after latest rainfall.
- D. Perform ground resistance testing in accordance with IEEE 142. Contractor shall make ground resistance measurements. Measure in normally dry conditions, not less than 48 hours after rainfall.
- E. Perform leakage current tests in accordance with NFPA 99.
- F. Perform continuity testing in accordance with IEEE 142.
- G. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

END OF SECTION 260526

SECTION 260529 - ELECTRICAL HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Conduit supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Equipment bases and supports.

B. Related Sections

1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
2. Section 03 31 00 – Structural Concrete: Product requirements for concrete for placement by this section.
3. Section 26 00 00 – Basic Electrical Requirements.

1.2 REFERENCES

A. ASTM International (American Society for Testing and Materials):

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

B. FM Global (FM):

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved by Factory Mutual Research For Property Conservation.

C. National Electrical Contractors Association (NECA):

1. Standard of Installation.

D. National Electrical Manufacturers Association (NEMA).

E. National Fire Protection Association (NFPA):

1. NFPA 70 - National Electrical Code.

F. Underwriters Laboratories Inc. (UL):

1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL - Fire Resistance Directory.

G. Intertek Testing Services (Warnock Hersey Listed) (WH):

1. WH - Certification Listings.

1.3 SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.
- B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.
- C. Product Data:
 - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
- D. Design Data: Indicate load-carrying capacity of trapeze hangers and hangers and supports.
- E. Manufacturer's Installation Instructions:
 - 1. Hangers and Supports: Submit special procedures and assembly of components.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with State and Municipality standards.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum five years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products under provisions of Section 26 00 00 – Basic Electrical Requirements.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 26 00 00 – Basic Electrical Requirements: Environmental conditions affecting products on site.

PART 2 - PRODUCTS

2.1 CONDUIT SUPPORTS

- A. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.
- B. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

- C. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.
- D. Conduit clamps - General Purpose: One-hole malleable iron for surface mounted conduits.
- E. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self-locking.

2.2 FORMED STEEL CHANNEL

- A. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.3 SPRING STEEL CLIPS

- A. Product Description: Mounting hole and screw closure.

2.4 SLEEVES

- A. Sleeves for Through Non-fire Rated Floors: 18 gage thick galvanized steel.
- B. Sleeves for Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- C. Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.
- D. Fire-stopping Insulation: Glass fiber type, non-combustible.

2.5 MECHANICAL SLEEVE SEALS

- A. Manufacturers:
 - 1. Link-Seal, Inc.
 - 2. NMP Corporation.
 - 3. Equivalent as acceptable to Engineer.
- B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6 PENETRATIONS OF NON-RATED CONSTRUCTION

- A. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
- B. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify openings are ready to receive sleeves.

3.2 PREPARATION

- A. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- B. Do not drill or cut structural members.
- C. Obtain permission from Architect/Engineer before drilling or cutting structural members.
- D. Install hangers, supports, and anchors only after structural work, where work is to be installed, has been completed. Correct inadequacies such as proper placement of inserts, anchors, and other building structural attachments.
- E. Examine areas and conditions under which equipment and associated components are to be installed and notify Architect, in writing, of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected.

3.3 INSTALLATION - HANGERS AND SUPPORTS

- A. Anchors and Fasteners:
 - 1. Concrete Structural Elements: Provide precast inserts, expansion anchors, powder actuated anchors and preset inserts.
 - 2. Steel Structural Elements: Provide beam clamps, spring steel clips, steel ramset fasteners, and welded fasteners.
 - 3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.
 - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.
 - 5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
 - 6. Sheet Metal: Provide sheet metal screws.
 - 7. Wood Elements: Provide wood screws.
 - 8. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31 and to prevent the transfer of loading and stresses to connected equipment.
 - 9. Installation methods shall be in conformity with the manufacturer's recommendations for maximum holding power, but in no case shall the depth of hole be less than four bolt diameters. Minimum distance between the center of any expansion anchor and an edge of exterior corner of concrete shall be not less than 4-1/2 times the diameter of the hole in which it is installed.
- B. Inserts:
 - 1. Install inserts for placement in concrete forms.
 - 2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut [above] [flush with top of] [recessed into and grouted flush with] slab.
- C. Install conduit and raceway support and spacing in accordance with NEC.
- D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- E. Install multiple conduit runs on common hangers.
- F. Supports:
1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
 2. Install surface mounted cabinets and panelboards with minimum of four anchors.
 3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch (25 mm) off wall.
 4. Support vertical conduit at every floor.

3.4 LIGHTING FIXTURE SUPPORT

- A. Items including (but not limited to) stems, hickies, bar hangers, and clips required to securely attach fixtures to ceilings or walls.
- B. Studs and uni-strut support for fixture outlet and ceiling support.
- C. Fixture grid hangers for mounting surface fluorescent units to exposed grid ceiling.
- D. Drilled expansion insert type anchors rated for load and application requirements including (but not limited to) sleeve anchors, lag shields, and plastic anchors.
- E. Provide auxiliary supports so that fixtures can be drawn up tightly, cannot be tilted or rotated, and will not be affected by vibrations.

3.5 SUPPORT OF CONDUIT

- A. Fasten conduit to structural parts of building in a manner acceptable to Engineer.
- B. Do not use perforated hanger iron.
- C. Install concrete insert channel as required, with spacings as recommended by manufacturer. Install with anchor and caps, insert joiner clips and closer seals as required.
- D. Support conduit as follows:
 1. Single conduit runs vertical surfaces: Galvanized, heavy duty, sheet steel straps; back straps to be provided for all exposed conduit and conduit on exterior walls.
 2. Single conduit runs horizontal surfaces: Galvanized, heavy duty, one-hole malleable iron or 2-hole steel pipe straps.
 3. Multiple conduit runs vertical surfaces: Horizontal or vertical rack channel with conduit straps as required.

4. Multiple conduit runs horizontal surfaces: Single or double rack channel trapeze, complete with conduit straps as required; all supported with threaded hanger rods.
5. Conduit runs through roof: Conduit extending through roof shall pass through a ceiling box at roof lines. Provide 14-gauge minimum copper box complete with watertight soldered seams and flanged to serve as pitch pocket for each conduit. Conduit and pitch pocket shall be installed in advance of roofing work.
6. Vertical Cable Support. Conductors in vertical raceways shall be supported using cable supports. Locate supports so that each 25 feet length of conductor in a vertical raceway is supported.

3.6 INSTALLATION – NON-RATED CONSTRUCTION

- A. Seal opening through non-fire rated wall, partition, floor, ceiling, and roof opening with material matching surface penetrated.
- B. Interior partitions: Seal penetrations at telecommunication rooms and data rooms. Apply sealant to both sides of penetration to completely fill space between surface and conduit.

3.7 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer to Section 03 31 00 – Structural Concrete.
- B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct supports of steel members formed steel channel. Brace and fasten with flanges bolted to structure.

3.8 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with adjustable interlocking rubber links.
- B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.
- C. Set sleeves in position in forms. Provide reinforcing around sleeves.
- D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- E. Extend sleeves through floors one (1) inch above finished floor level. Caulk sleeves.
- F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with [stuffing] [fire stopping] insulation and caulk [airtight]. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- G. Install chrome plated steel plastic stainless steel escutcheons at finished surfaces.

3.9 FIELD QUALITY CONTROL

- A. Section 26 00 00 – Basic Electrical Requirements: Field inspecting, testing, adjusting, and balancing.

3.10 CLEANING

- A. Provide under provisions of Section 26 00 00 – Basic Electrical Requirements.

3.11 PROTECTION OF FINISHED WORK

- A. Provide under provisions of Section 26 00 00 – Basic Electrical Requirements.
- B. Protect adjacent surfaces from damage by material installation.

END OF SECTION 260529

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SECTION 260533 - RACEWAY AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Conduit.
2. Tubing.
3. Raceways.
4. Wireways.
5. Outlet Boxes.
6. Pull Boxes.
7. Junction Boxes.
8. Handholes.

B. Related Sections:

1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
2. Section 26 00 00 - Basic Electrical Requirements.
3. Section 26 05 34 - Floor Boxes.
4. Section 26 05 36 - Cable Trays.
5. Section 26 05 53 - Electrical Identification.
6. Section 26 27 23 - Indoor Service Poles.
7. Section 33 71 19 - Underground Ducts and Manholes.

1.2 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).

B. National Electrical Manufacturers Association (NEMA):

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SUBMITTALS

A. Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.

B. Product Data: Submit for product data following:

1. Flexible metal conduit.

2. Liquid-tight flexible metal conduit.
3. Nonmetallic conduit.
4. Flexible nonmetallic conduit.
5. Nonmetallic tubing.
6. Raceway fittings.
7. Conduit bodies.
8. Surface raceway.
9. Wireway.
10. Pull and junction boxes.
11. Handholes.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements.

D. Include manufacturers' instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.4 CLOSEOUT SUBMITTALS

A. Section 26 00 00 – Basic Electrical Requirements: Procedures for closeout submittals.

B. Project Record Documents:

1. Record actual routing of conduits larger than 2-inch trade size (DN50).
2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and protect products under provisions of Section 26 00 00 – Basic Electrical Requirements.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

1.6 COORDINATION

A. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2 - PRODUCTS

2.1 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 1/2 3/4 inch unless otherwise specified.

2.2 METAL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1.

B. Intermediate Metal Conduit (IMC) or Rigid Metal Conduit (RMC).

- C. Fittings and Conduit Bodies: NEMA FB 1; Fittings for metal raceways shall be steel or malleable iron and shall be zinc galvanized, or cadmium plated. Do not use aluminum or die cast fittings. Threaded and liquid tight.
- D. Box connector bushings shall have insulated throats. Integral grounding lugs shall be provided where required by code, where detailed on the Drawings, or required elsewhere in these specifications.

2.3 PVC COATED METAL CONDUIT

- A. Product Description: NEMA RN 1; rigid steel conduit with external PVC coating, 40 mil thick.
- B. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit, PVC gasketed for mating surfaces

2.4 FLEXIBLE METAL CONDUIT (FMC)

- A. Product Description: Interlocked steel construction.
- B. Fittings: NEMA FB 1. Threaded, grounding type, insulated throat, two screw clamp type with locknuts, externally secured.
- C. Minimum size 1/2-inch with the exception that 3/8-inch diameter may be used in lengths not to exceed 6 foot, to serve individual lighting fixtures installed in a suspended accessible ceiling system.

2.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Product Description: Interlocked steel construction with PVC sunlight resistant jacket.
- B. Fittings: NEMA FB 1. Liquid tight, suitable for grounding, suitable for wet locations, tapered threaded hub, non-metallic materials.

2.6 ELECTRICAL METALLIC TUBING (EMT)

- A. Product Description: ANSI C80.3; galvanized tubing.
- B. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron, compression, threaded, insulated throat, gland compression type, rain and concrete tight type.
- C. Box connector bushings shall have insulated throats. Integral grounding lugs shall be provided where required by code, where detailed on the Drawings, or required elsewhere in these specifications.

2.7 NONMETALLIC CONDUIT

- A. Product Description: NEMA TC 2; Schedule 40 or 80 PVC, UL listed, and as required by NEC. Sunlight resistant.
- B. Rated for 90 degrees C. cable.
- C. Fittings and Conduit Bodies: NEMA TC 3, schedule 40 or 80, to match conduit.

- D. Expansion fittings. PVC material, Carlon series E945 or equivalent.
- E. Expansion straps. PVC material, Carlon series E978 or equivalent.

2.8 MULTI-CELL RIGID CONDUIT AND FITTINGS

- A. Outer duct shall be HW PVC or Rigid Metal Conduit as specified in Section 26 05 33 – Raceway and Boxes.
- B. Three cell schedule 40 factory installed inner ducts within 4 inches outer duct. Each cell shall have a diameter of approximately 1.50 inches.
- C. Inner ducts shall be PVC or nylon as required by Section 26 05 33 – Raceway and Boxes.
- D. Inner ducts shall be pre-lubricated.
- E. Outer markings to assist contractor in proper installation and alignment.
- F. Internal spacers to keep cells straight throughout the run.
- G. Use manufacturer's transition adapters when connecting HW PVC outer duct sections to GRC outer duct sections.

2.9 EXPANSION FITTINGS

- A. Expansion fittings: Copper bonding jumper, Crouse-Hinds Type XJ.
- B. Expansion/deflection fittings: Copper bonding jumper, Crouse-Hinds Type XD.

2.10 SURFACE METAL RACEWAY

- A. Manufacturers:
 - 1. Carlon Electrical Products.
 - 2. Hubbell Wiring Devices.
 - 3. Thomas & Betts Corp.
 - 4. Walker Systems Inc.
 - 5. The Wiremold Co.
- B. Product Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.
- C. Finish: Gray Buff enamel. Stainless steel.
- D. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories; match finish on raceway.

2.11 SURFACE NONMETAL RACEWAY

- A. Manufacturers:
 - 1. Carlon Electrical Products.
 - 2. Hubbell Wiring Devices.
 - 3. Thomas & Betts Corp.

4. Walker Systems Inc.
5. The Wiremold Co.
6. Panduit.

B. Product Description: Plastic Fiberglass channel with fitted cover, suitable for use as surface raceway.

C. Finish: Gray.

D. Fittings, Boxes, and Extension Rings: Furnish manufacturers' standard accessories, finish to match raceway.

2.12 WIREWAY

A. Product Description: General purpose Oiltight and dust-tight Raintight type wireway.

B. Knockouts: Manufacturer's standard None Bottom only.

C. Size: 4 x 4 inch 6 x 6 inch 8 x 8 inch 12 x 12 inch; length as indicated on Drawings.

D. Cover: Hinged Screw cover with full gaskets.

E. Connector: Slip-in Flanged.

F. Fittings: Lay-in type with removable top, bottom, and side; captive screws drip shield.

G. Finish: Rust inhibiting primer coating with gray enamel finish.

2.13 CONVENTIONAL DEVICE OUTLET BOXES FOR FLUSH DEVICES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch (13 mm) male fixture studs where required.
2. Concrete Ceiling Boxes: Concrete type.

B. Cast Boxes: NEMA FB 1, Type FD, aluminum cast ferrous alloy. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.

C. Wall Plates for Finished Areas: As specified in Section 26 27 26 – Wiring Devices.

D. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.14 PULL AND JUNCTION BOXES

A. Outlet Boxes:

1. Interior Wall Outlet Boxes – Flush Mounted: Stamped steel, four-inch square, 2-1/8 inch deep minimum, with square corners. Provide with raised device rings, height to match wall finish thickness. Mounting accessories. Larger width boxes shall be provided for ganging requirements indicated on drawings.
2. Interior Wall Outlet Boxes – Surface Mounted – Dry Location: Stamped steel, four-inch square, 2-1/8 inch deep, with round corners. Provide rounded corner raised box covers with

openings for devices being installed. Refer to Section 260000 for restrictions on exposed conduit systems.

3. Interior Wall Outlet Boxes – Surface Mounted – Damp or Wet Location: Cast malleable iron with threaded conduit hubs. Two inches deep minimum. Internal mounting ears. Boxes shall be coated with electroplated zinc, a dichromate coating, and an aluminum polymer enamel finish. Refer to Section 260000 for restrictions on exposed conduit systems.
4. Exterior Wall Outlet Boxes – Surface Mounted: Cast malleable iron with threaded conduit hubs. Two inches deep minimum. Internal mounting ears. Boxes shall be coated with electroplated zinc, a dichromate coating, and an aluminum polymer enamel finish. Refer to Section 260000 for restrictions on exposed conduit systems.
5. Ceiling Boxes – Flush Mounted – for Surface and Pendant Light Fixtures: Dropped ceiling construction. Stamped steel four-inch octagon box set flush with finished surface, with 3/8-inch fixture stud.
6. Cast in place concrete construction. Stamped steel four inch octagonal, galvanized concrete boxes having a minimum depth of 3 inches, with 3/8-inch fixture stud.
7. Electrical Boxes in Corrosive Locations: PVC coated cast steel boxes compatible with conduit system installed. Coating shall cover both interior and exterior surfaces. See floor plans for identification of corrosive areas.

B. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

C. Hinged Enclosures: As specified in Section 26 27 16 – Cabinets and Enclosures.

D. Surface Mounted Cast Metal Box: NEMA 250, Type 4 4X6; flat-flanged, surface mounted junction box;

1. Material: Galvanized cast iron Cast aluminum.
2. Cover: Furnish with ground flange, neoprene gasket, and stainless-steel cover screws.

E. In-Ground Cast Metal Box: NEMA 250, Type 6, outside inside flanged, recessed cover box for flush mounting;

1. Material: Galvanized cast iron Cast aluminum.
2. Cover: Smooth Nonskid cover with neoprene gasket and stainless-steel cover screws.
3. Cover Legend: "ELECTRIC".

F. Polymer concrete composite Handholes: Die-molded, polymer concrete composite hand holes:

1. Cable Entrance: Pre-cut 6-inch x 6-inch cable entrance at center bottom of each side.
2. Cover: polymer concrete composite, weatherproof cover with nonskid finish. Secure cover with stainless steel hex bolts.

2.15 RECESSED COMBINATION FLAT PANEL TV / POWER OUTLET BOXES

A. Steel boxes, flush mounted with recessed faceplates.

B. TV jack and power outlet recessed so that plugs do not protrude from wall finish.

C. Acceptable Manufacturer: Hubbell.

2.16 SEALS

A. Link seal type as manufactured by Thunderline Corporation or equivalent as acceptable to Engineer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 EXISTING WORK

- A. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces.
- B. Remove concealed abandoned raceway to its source.
- C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.
- D. Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.
- E. Extend existing raceway and box installations using materials and methods compatible with existing electrical installations, or as specified.
- F. Clean and repair existing raceway and boxes to remain or to be reinstalled.
- G. Cutting and Patching:
 - 1. Provisions for openings, holes, and clearances through walls, floors, ceilings, and partitions shall be made in advance of construction.
 - 2. Provide cutting and patching as necessary for installation of electrical systems, subject to approval of Owner.
 - 3. Contractor shall secure the approval of Owner for all anticipated floor sleeves for installation of electrical conduits in existing buildings, prior to starting any such work.
 - 4. Contractor shall locate embedded conduits before core drilling in existing floors. Ground detector systems will be acceptable.
 - 5. Patching of holes and openings resulting from work of this branch shall be responsibility of this Contractor. All painting of patched surfaces shall match existing paint color.
- H. Concealment:
 - 1. Unless specifically noted otherwise, conduits shall be routed concealed in finished spaces and shall not be visible at any point within the finished space or from the building's exterior. This requirement also applies to new conduits installed in existing construction.
 - 2. Exposed raceway may be used on remodeling projects only where physically impossible to route concealed in existing construction. In such cases where exposed conduit is allowed, it shall be equivalent to Wiremold 500 or 700 series as dictated by wiring quantities. In each case, specific raceway type and routing shall be submitted to Architect for approval. Where allowed, general installation requirements are as follows:
 - a. Raceways shall be routed horizontally along corners of walls and ceilings, above edges of base molding at floors, or along tops of window and door frames.
 - b. Raceways shall be routed vertically along corners of adjacent walls and along edges of window and door frames.
 - c. Raceways shall not be routed down or across open wall surfaces except in portions of runs not exceeding 12 inches in length.

- d. Raceways shall be painted to match wall finishes. EC is responsible for painting of raceways.
- e. Fittings and boxes used with raceways shall be specifically designed and approved for use with raceways.
3. At Contractor's option, conduits may be installed concealed below basement floor slabs or below slabs on grade.
4. Conduits may be routed exposed in mechanical equipment rooms and utility rooms.

3.3 RESTRICTIONS

- A. Split, crushed, or scarred conduit is not acceptable.
- B. Welded conduit is not acceptable.
- C. Do not route conduit over boiler, under boiler or in slabs below boiler, incinerator, or other high temperature equipment.
- D. PVC conduit may not be used in the interior of building except at following locations.
 1. PVC conduit may be used for grounding conductors.
 2. Greenhouses.
 3. Pool Equipment Rooms.

3.4 SYSTEM DESCRIPTION

- A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements.
- B. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.
- C. Underground More than 5 feet outside Foundation Wall: Provide schedule 40 nonmetallic conduit, unless otherwise noted on drawings.
- D. Provide cast metal boxes in pavement or sidewalks and nonmetallic handhole in grass areas, unless otherwise noted.
- E. Underground Within 5 feet from Foundation Wall: Provide rigid steel conduit.
- F. In or Under Slab on Grade: Provide schedule 40 nonmetallic conduit. Provide RMC elbows where conduits exit slab and are exposed to view.
- G. Outdoor Locations, Above Grade: Provide rigid steel conduit, unless otherwise noted. Provide cast metal outlet, pull, and junction boxes.
- H. In Slab Above Grade: Feeder conduit shall not be installed in slab. Provide schedule 40 nonmetallic conduit with EMT elbow so any conduit above slab shall be metallic.
- I. Wet and Damp Locations: Provide rigid steel conduit. Provide cast metal junction and pull boxes. Provide flush mounting outlet box in finished areas.

- J. Concealed Dry Locations: Provide rigid steel, intermediate metal conduit or electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
- K. Exposed Dry Locations: Provide rigid steel, intermediate metal conduit or electrical metallic tubing, unless otherwise noted. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
- L. Hazardous Locations: Provide Rigid Metal Conduit.
- M. Conduits embedded in concrete lighting fixture pole bases shall be Rigid Metal Conduit.
- N. Provide separate conduit system for each of the following systems:
 - 1. 208-volt normal power wiring systems.
 - 2. 208-volt code required emergency power wiring systems (load side of transfer switch ____).
 - 3. 208-volt legally required and optional emergency power wiring systems (load side of transfer switch ____).
 - 4. 480-volt normal power wiring systems.
 - 5. 480-volt code required emergency power wiring systems (load side of transfer switch ____).
 - 6. 480 volt legally required and optional emergency power wiring systems (load side of transfer switch).
 - 7. Medium voltage wiring systems.
 - 8. Low voltage lighting control systems.
 - 9. Lightning Protection Systems.
 - 10. Fire alarm systems.
 - 11. Halon 1301 fire suppression systems.
 - 12. Area of rescue assistance call systems.
 - 13. Closed circuit television (CCTV) systems.
 - 14. Electronic Card Key Access System.
 - 15. Clock Systems.
 - 16. Voice/data communications raceway systems.
 - 17. Master antenna television (MATV) systems.
 - 18. Intercom, paging or sound system.
 - 19. Nurse call systems.

3.5 INSTALLATION

- A. Install Work in accordance with State and Municipality standards.
- B. All conduits containing service entrance conductors shall be rigid metal conduits.
- C. Ground and bond raceway and boxes in accordance with Section 26 05 26 – Grounding and Bonding.
- D. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29 – Electrical Hangers and Supports.
- E. Identify raceway and boxes in accordance with Section 26 05 53 – Electrical Identification.
- F. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.6 INSTALLATION - RACEWAY

- A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.
- B. Arrange raceway supports to prevent misalignment during wiring installation.
- C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29 – Electrical Hangers and Supports; provide space on each for 25 percent additional raceways.
- E. Secure conduits in place with malleable corrosion-proof alloy straps or hangers. Conduit straps used in corrosive areas shall be PVC coated.
- F. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports.
- G. Do not attach raceway to ceiling support wires or other piping systems.
- H. Construct wireway supports from steel channel specified in Section 26 05 29 – Electrical Hangers and Supports.
- I. Route exposed raceway parallel and perpendicular to walls and structural members.
- J. Route raceway installed above accessible ceilings parallel and perpendicular to walls and structural members.
- K. Conduits under slab may be routed from point-to-point.
- L. Conduits routed within concrete construction such as poured walls, floor slabs, topping slabs, shall comply with following requirements.
 - 1. Conduits shall be parallel to each other, spaced on center to center distance of at least three times conduit trade diameter, and provided with a minimum of 2 inches of concrete.
 - 2. Contractor shall note that precast planks below topping slabs may camber. Topping slab thickness will be less at high point of camber.
 - 3. Conduits larger than 1-1/4 inch inside diameter shall not be installed in floor slabs. Conduits over 3/4-inch ID shall not be installed in topping slabs.
 - 4. Conduits embedded in a structural frame slab shall comply with applicable provisions of American Concrete Institute (ACI), Standard 318. Refer to structural drawings for locations of structural frames.
 - 5. Conduits used for feeders shall not be embedded in concrete floor slabs or concrete topping slabs.
 - 6. Conduits in poured concrete construction shall not cross other conduits or other piping.
 - 7. Unless specifically indicated on electrical drawings, conduits installed in poured concrete construction shall be approved by Structural Engineer prior to conduit installation.
 - 8. Contractor will be required to submit drawings showing conduit sizes and routings to Structural Engineer for their review. Approval may not be given prior to bidding. Contractors who base their bid on assumption that conduits will be allowed in concrete

- construction do so at their own risk. No changes will be made to contract if, during construction, Structural Engineer prohibits installation of conduit in concrete construction.
9. In areas constructed of precast concrete conduits may be run in cores of planks.
- M. Maintain clearance between raceway and piping for maintenance purposes.
- N. Maintain 12-inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F. Do not route conduit over boiler, incinerator, or other high temperature equipment.
- O. Where conduits must cross or follow the same path as water, steam or other fluid piping, run electrical conduits above such piping wherever possible.
- P. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- Q. Bring conduit to shoulder of fittings; fasten securely.
- R. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.
- S. Install conduit hubs to fasten conduit to cast boxes in damp and wet locations.
- T. Install no more than equivalent of three 90-degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install hydraulic one-shot bender to fabricate or factory elbows for bends in metal conduit larger than 2-inch size.
- U. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.
- V. Provide a watertight conduit system where installed in wet locations such as underground, or where embedded in concrete.
- W. Install fittings to accommodate expansion and deflection where raceway crosses seismic, control and expansion joints. Provide fittings with bonding jumper.
- X. Install suitable pull string or cord in each empty raceway except sleeves and nipples.
- Y. Install suitable caps to protect installed conduit against entrance of dirt and moisture.
- Z. Close ends and unused openings in wireway.
- AA. Conduit runs that extend through areas of different temperature or atmospheric conditions or that are partly indoors and partly outdoors shall be sealed, drained, and installed in a manner that will prevent drainage of condensed or entrapped moisture into cabinets, motors, or equipment enclosures. Install bushings with ground lugs and integral plastic linings at equipment with open-bottom conduit entrances.
- BB. Conduit connections at motors, transformers, and other equipment that vibrates.
1. Flexible metal conduit between 18 inches and 36 inches long for conduit connections at equipment that vibrates.
 2. Liquid-tight flexible metal conduit where flexible connections are required and where conduit will be exposed to moisture, dirt, fumes, oil, corrosive atmosphere, etc. Provide

with connectors to assure a liquid-tight, permanently grounded connection. Locate so it is least subject to physical abuse. Corrosive areas are identified on floor plan.

3. Use double locknuts and insulated bushings with threads fully engaged.

CC. Direct buried underground conduit.

1. Exterior underground direct buried conduits shall be buried at a depth of not less than 30 inches below grade.
2. Provide conduits or ducts terminating below grade with means to prevent entry of dirt or moisture.
3. Underground conduits shall slope 1/8 inch per foot for proper drainage. Conduits shall drain toward manholes and junction boxes, not the electrical equipment.

DD. COVERED PARKING STRUCTURE CONDUITS

1. Provide PVC fittings and PVC cement, which are compatible with the conduit being used and the installation temperature.
2. Provide PVC expansion fittings in all exposed PVC conduit runs longer than 36 inches. Provide every 30 feet for runs longer than 30 feet. Expansion fittings shall have 6 inches of travel. Set expansion fittings for installed ambient temperature, half way at 50 degrees F.
3. Provide special PVC expansion straps. Provide two fasteners at each strap. Conduit supports 3 feet on center maximum.
4. Provide cast iron junction boxes to support light fixtures.

3.7 INSTALLATION - SURFACE RACEWAY

- A. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.
- B. Where exposed raceways and electrical devices are required in existing construction, exposed raceway, fittings and boxes shall be used provided that installation meets following:
 1. Raceways shall be routed horizontally along corner surfaces formed by walls and ceilings, directly above edges of bases at floor, along tops of window mullions and door frames.
 2. Raceways shall be routed vertically along corners formed by adjacent walls and along edges of door frames.
 3. Surface raceways shall not be routed down or across open wall surfaces except in portions of runs not exceeding 12 inches in length.
 4. Surface raceways shall be painted to match wall finishes on which the raceways are routed. If wood backing is required, it shall be continuous and painted to match surrounding surfaces.
 5. If raceways are installed prior to painting, raceways will then be painted as part of painting contract.
 6. Fittings and boxes used with surface metal raceways shall be specifically designed and approved for use with such raceways.

3.8 INSTALLATION - BOXES

- A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings.
- B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.

- C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26 – Wiring Devices.
- D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.
- H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- I. Install stamped steel bridges to fasten flush mounting outlet box between studs.
- J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- K. Install adjustable steel channel fasteners for hung ceiling outlet box.
- L. Do not fasten boxes to ceiling support wires or other piping systems.
- M. Support boxes independently of conduit.
- N. Install gang box where more than one device is mounted together. Do not use sectional box.
- O. Install gang box with plaster ring for single device outlets.

3.9 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with Section 07 84 00 - Firestopping.
- B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified in Division 07 – Thermal and Moisture Protection.
- C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.
- D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.10 ADJUSTING

- A. Section 26 00 00 – Basic Electrical Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Adjust flush-mounting outlets to make front flush with finished wall material.
- C. Install knockout closures in unused openings in boxes.

3.11 CLEANING

- A. Clean interior of boxes to remove dust, debris, and other material.
- B. Clean exposed surfaces and restore finish.

END OF SECTION 260533

SECTION 260534 - FLOOR BOXES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Flush Floor Boxes.
 - 2. Floor Box Service Fittings.
 - 3. Poke-through Floor Outlets.

- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
 - 2. Section 26 00 00 – Basic Electrical Requirements.
 - 3. Section 26 05 33 - Raceway and Boxes.
 - 4. Section 26 27 26 - Wiring Devices: Receptacles for installation in floor boxes.
 - 5. Section 07 84 00 – Firestopping: Firestopping.

1.2 REFERENCES

- A. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

1.3 SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.
- B. Product Data: Submit catalog data for floor boxes service fittings.
- C. Samples: Submit two of each service fitting illustrating size, material, configuration, and finish.

1.4 CLOSEOUT SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for closeout submittals.
- B. Project Record Documents: Record actual locations of each floor box and poke-through fitting.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

1.6 EXTRA MATERIALS

- A. Furnish under provisions of Section 26 00 00 – Basic Electrical Requirements.
- B. Furnish two carpet rings.

PART 2 - PRODUCTS

2.1 FLUSH FLOOR BOXES

- A. Manufacturers:
 - 1. Legrand/Wiremold, RFB4 Series.
 - 2. Equivalent as acceptable to Engineer.
- B. Floor Boxes: NEMA OS 1, 3-7/16 inches deep.
- C. Adjustability: Fully adjustable.
- D. Material:
 - 1. Cast iron for on grade slab installations.
 - 2. Steel for floor slabs above grade.
- E. Shape: Rectangular.
- F. Accessories:
 - 1. Internal brackets and faceplates to accommodate outlet configurations shown on the floor plans.
 - 2. Flanged covers with tile or carpet inserts. Metal cover with finish as selected by the Architect.

2.2 POKE-THROUGH FLOOR OUTLETS

- A. Manufacturers:
 - 1. Wiremold, RC7 Series.
 - 2. Equivalent as acceptable to Engineer.
- B. Product Description: Assembly comprising service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination.
- C. Service Fitting Type: Flush.
- D. Device Plate: Metal or plastic finish to be selected by the Architect.
- E. Configuration: As required to accommodate outlet configurations shown on the floor plans.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify exact locations of floor boxes prior to rough-in.
- B. Verify openings in access floor are in proper locations.

3.2 EXISTING WORK

- A. Disconnect abandoned service fitting devices and remove service fittings. Install blank cover for abandoned floor boxes not removed.

- B. Maintain access to existing floor boxes remaining active and requiring access. Modify installation or provide access panel.
- C. Extend existing service fitting installations using materials and methods compatible with existing electrical installations, or as specified.
- D. Clean and repair existing service fittings to remain or to be reinstalled.

3.3 INSTALLATION

- A. Boxes and fittings are indicated on Drawings in approximate locations unless dimensioned. Adjust box location to accommodate intended purpose.
- B. Floor Box Requirements: Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.
- C. Set floor boxes level.
- D. Install boxes and fittings to preserve fire resistance rating of slabs and other elements, using materials and methods specified in Section 26 00 00 – Basic Electrical Requirements.

3.4 ADJUSTING

- A. Adjust floor box flush with finish flooring material.

3.5 CLEANING

- A. Clean interior of boxes to remove dust, debris, and other material.

END OF SECTION 260534

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SECTION 260553 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Nameplates.
 - 2. Labels.
 - 3. Wire markers.
 - 4. Stencils.
 - 5. Underground Warning Tape.

- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
 - 2. Section 26 00 00 – Basic Electrical Requirements.
 - 3. Division 09 – Finishes: Execution requirements for painting specified by this section.

1.2 SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.

- B. Product Data:
 - 1. Submit manufacturer's catalog literature for each product required.
 - 2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

- C. Samples:
 - 1. Submit two tags, actual size.
 - 2. Submit two labels, actual size.

- D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.3 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Procedures for closeout submittals.

- B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with State and Municipality standards.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.

- B. Installer: Company specializing in performing Work of this section with minimum five years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products under provisions of Division 01 – General Requirements.
- B. Accept identification products on site in original containers. Inspect for damage.
- C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 – General Requirements: Environmental conditions affecting products on site.
- B. Install labels and nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

1.8 EXTRA MATERIALS

- A. Furnish under provisions of Division 01 – General Requirements.

PART 2 - PRODUCTS

2.1 NAMEPLATES

- A. Product Description: Laminated three-layer plastic with engraved black letters on white contrasting background color.
- B. Nameplates shall match identification shown on drawings.
- C. Letter Size:
 - 1. 3/8-inch high letters for identifying voltages, phase and number of wires.
 - 2. 3/4-inch high letters for identifying equipment and loads.
 - 3. Panelboards: Nameplates shall state: panel identification, voltage, phase and number of wires (example: LP1/BH1, 277/480V, 3PH, 4W).
 - 4. Medium voltage cables: nameplates shall be self-extinguishing, resistant to oil, water and solvents. Nameplate shall be minimum size 1-inch X 4-inches. Nameplate shall note: switch feeder from, phase, where feeder starts and where feeder ends.
- D. Minimum nameplate thickness: 1/8 inch.

2.2 LABELS

- A. Labels: Printed adhesive label tags, with 1/8-inch minimum height black letters on white background.

- B. Wiring device labels: Printed adhesive label tags, with 1/8-inch minimum height black letters on clear background.

2.3 WIRE AND CABLE IDENTIFICATION

- A. Different conductor insulation colors and electrical tape colors shall be used to identify the different phases of conductors in a given circuit.
- B. Branch wiring shall be color coded per industry standards. If Owner does not have a pre-established color code, use the following colors unless otherwise required by code.
- C. Code color requirements shall always be followed where applicable.
- D. Following colors shall be as follows unless otherwise required by code:
 - 1. 120/208-volt systems
 - a. A-phase: solid black.
 - b. B-phase: solid red.
 - c. C-phase: solid blue.
 - d. Different colors shall be used to identify switched legs.
 - e. Neutral conductor: solid white. Provide additional markings for neutral conductors in the same raceway as required by code.
 - 2. 480/277-volt systems
 - a. A-phase: Solid brown.
 - b. B-phase: solid orange.
 - c. C-phase: solid yellow.
 - d. Different colors shall be used to identify switched legs.
 - e. Neutral conductor: solid gray. Provide additional markings for neutral conductors in the same raceway as required by code.
 - 3. Ground Conductors: solid green. Provide additional markings for ground conductors in the same raceway as required by code.
 - 4. For additions to existing buildings use existing color code system unless it violates code. If no wire color coding system is used; use color coding system listed above.
- E. Where wires of different systems junction in a common box, each cable shall be grouped with its own system and identified using tags or identification strips.
- F. For 3 phase systems, each phase shall be identified at all terminals using cable markers.
- G. Wire and cable labels:
 - 1. Feeder and branch circuits: label shall indicate panel and circuit number as actually installed.
 - 2. Control Circuits: Control wire number as indicated on shop drawings.

2.4 CONDUIT AND RACEWAY MARKERS

- A. Conduit color/stencil markings:
 - 1. Medium Voltage System: Orange lettering on white background noting: HIGH VOLTAGE - "actual line-to-line voltage".
 - 2. 480 Volt System: Yellow color band.
 - 3. 208 Volt System: Blue color band.
 - 4. Fire Alarm System: Red colored band.
 - 5. Telephone/Data System: Gray colored band.

2.5 STENCILS

- A. Stencils: With clean cut symbols and letters of following size:
 - 1. Up to 2 inches Outside Diameter of Raceway: 1/2-inch high letters.
 - 2. 2-1/2 to 6 inches Outside Diameter of Raceway: 1-inch high letters.
 - 3. 1/2-inch high letters minimum for identifying boxes and other equipment.

2.6 UNDERGROUND WARNING TAPE

- A. Description: 4-inch wide plastic tape, colored yellow with suitable warning legend describing type of buried electrical lines.

2.7 PANELBOARD DIRECTORIES

- A. Suitable for complete description of load served.
- B. Directory shall be removable.
- C. Typewritten card, describing loads served.
- D. Provide steel frame holder on inside cover of door to hold directory.
- E. Directory shall be covered with a clear plastic sheet.

PART 3 - EXECUTION

3.1 GENERAL

- A. Where mixed voltages are used in one building (e.g. 4160-volt, 480-volt, 208-volt) each switch, switchboard, junction box, equipment, etc., on each system must be labeled for voltage in addition to the other requirements listed herein.
- B. All branch circuit and power panels must be identified with the same symbol used in circuit directory in main distribution center.
- C. Stenciling may only be used on equipment fronts in unfinished areas.
- D. Receptacle labels shall identify panel and circuit number feeding receptacle.
- E. Switch label shall indicate equipment controlled by switch. Do not label light switches unless otherwise noted on drawings.

3.2 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Division 09 – Finishes for stencil painting.

3.3 EXISTING WORK

- A. Install identification on existing equipment to remain in accordance with this section.

- B. Re-stencil existing equipment.

3.4 INSTALLATION

- A. Install identifying devices after completion of painting.
- B. Adhesive type labels not permitted except for phase and wire identification.
- C. Hand written labels or embossed tape are not permitted.
- D. Entrance door to primary electrical room shall have porcelain enameled sign lettered "DANGER HIGH VOLTAGE". This same sign shall also be placed on primary switch.
- E. Each distribution and lighting panel shall be equipped with typewritten directory describing loads served. Directory shall be contained in steel frame mounted on inside face of panel's door and shall be covered with sheet of clear plastic.
- F. Switchboards, transformers, switchgear, telephone backboards, transfer switches, panels and cabinets shall be provided with 1/8-inch minimum thickness 5 ply lamecoid plastic nameplates indicating usage, plan designation and voltage where applicable. In Equipment and Mechanical Rooms, this identification may be on exterior of unit, in other areas identification shall be inside door or cover. Nameplates shall be black with white engraved lettering. Lettering shall be 1/2-inch high minimum. Fasten nameplates with escutcheon pins.
- G. Junction and pullboxes smaller than 12-inch x 12-inch shall be identified by using permanent marker on coverplate indicating originating panelboard and circuit(s) or system served.
- H. Junction and pull boxes with dimensions 12-inch x 12-inch and larger shall be stenciled or provided with permanent labels as follows:
 - 1. Lighting and power feeders and branch circuits - 120, 208, 277, 480. Add "EM" for emergency circuits, ex. 120EM, etc.
 - 2. Medium voltage feeders - 5KV, 15KV, etc. as applicable for system voltage.
 - 3. Clock - CLK.
 - 4. Voice/Data communications - V/D COM.
 - 5. Fire Alarm - FA.
 - 6. Signal voltage lighting controls - LVLC.
 - 7. Area of rescue assistance system - RA.
 - 8. Master Antenna Television System - MATV.
 - 9. Nurse call system - NC.
 - 10. Building paging system - PA.
 - 11. Electronic Card Key Access System - CA.
- I. Cover plates for control stations controlling remote equipment shall be engraved to identify device being controlled.
- J. Motor starters, remote control stations, etc., shall be identified with engraved lamecoid nameplates fastened to equipment with escutcheon pins. Nameplates shall be 1/8 -inch 5 ply lamecoid with 1/4-inch white letters on a black background. Adhesive cloth labels, similar to those manufactured by Brady Label Co., may be used on motor switches and controls only, indicating number, designation, size and usage of motor.

- K. On inside of coverplates for light switches, occupancy sensors, receptacles, and special purpose outlets, provide a permanent label identifying panel and circuit number feeding device. Adhesive plastic tape will be permitted for this use.
- L. On light fixtures at wiring entrance point, provide permanent label identifying panel and circuit number feeding fixture. Adhesive plastic tape will be permitted for this use.
- M. Refer to individual specification sections for more specific or additional identification requirements.
- N. Nameplate Installation:
 - 1. Install nameplate parallel to equipment lines.
 - 2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners.
 - 3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners.
 - 4. Secure nameplate to equipment front using screws or rivets.
 - 5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
 - 6. Provide identification for the following:
 - a. Conduit (provide stencil or color band).
 - b. Wires and cables (provide Color code and label).
 - c. Medium voltage cables.
 - d. Junction and pullboxes (provide color code and/or stencil).
 - e. Wiring devices (provide label).
 - f. Equipment (provide nameplates).
 - g. Switchboards (provide nameplate to identify board and each load fed from switchboard)
 - h. Panelboards (provide nameplates and directory).
 - i. Transformers (provide nameplates).
 - j. Motor starters (provide nameplates).
 - k. Motor control centers (provide nameplates).
 - l. Transfer switches (provide nameplates).
 - m. Fire alarm panel (provide nameplates).
 - n. Control panels (provide nameplates).
 - o. Time contactor (provide nameplates).
 - p. Contactor (provide nameplates).
 - q. Disconnect switch (provide nameplates).
- O. Label Installation:
 - 1. Install label parallel to equipment lines.
 - 2. Install label for identification of individual control device stations.
 - 3. Install labels for permanent adhesion.
- P. Wire label Installation:
 - 1. Install wire marker for each conductor at panelboard gutters and outlet or equipment connection. Label shall be within one (1) foot of end of conductor.
- Q. Conduit Marker Installation:
 - 1. Install conduit marker for each conduit longer than 6 feet.
 - 2. Conduit Markers Spacing: 50 feet on center, minimum of one visible in every room.
 - 3. Raceway Painting: Identify conduit using field painting in accordance with Division 09 – Finishes.

- a. Paint colored band on each conduit longer than 6 feet.
 - b. Paint bands 50 feet on center, minimum of one in each room.
- R. Stencil Installation:
- 1. Apply stencil painting in accordance with Division 09 – Finishes.
 - 2. Junction boxes: identify system source and load served.
 - 3. Junction boxes for electrical communications, signal and control systems: Identify system source and equipment serviced, stenciled in black on cover.
 - 4. Junction boxes for Fire Alarm system: Junction box covers shall be painted red with “Fire Alarm” stenciled in black on cover.
- S. Underground Warning Tape Installation:
- 1. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.
- T. Medium Voltage Cable identification:
- 1. Fasten label to cable with nylon tie-wraps.
 - 2. Install cable labels on each conductor at each cable termination, each pullbox, each manhole, and at all other accessible locations.
 - 3. During entire cable installation, phasing of conductors shall be maintained and identified.

END OF SECTION 260553

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SECTION 260573 - SHORT CIRCUIT/COORDINATION/ARC FLASH HAZARD ANALYSIS STUDIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Electrical contractor shall retain the services of an independent third party firm to perform a short circuit/coordination study/arc flash hazard analysis study as described herein.
- B. Submit studies to Design Engineer along with submittal for distribution equipment Shop Drawings prior to release of equipment for manufacture.
- C. Studies shall include all portions of electrical distribution system from normal power source or sources, and emergency/standby sources, down to and including smallest circuit breaker in distribution system. Adequately cover normal system connections and those which result in maximum fault conditions in study.
- D. Firm performing study should demonstrate capability and experience to provide assistance during start up as required.
- E. Perform study and assessment based on SKM's Dapper, Captor and PowerTool software.
- F. Related Sections:
 - 1. Applicable provisions of Division 01 shall govern Work under this Section.
- G. Complete system selective coordination shall be provided including time below 0.01 seconds for following specific systems:
 - 1. Emergency Systems: Per NEC 700.27.
 - 2. Legally Required Standby Systems: Per NEC 701.18.
 - 3. Critical Operations Power Systems: Per NEC 708.54.
 - 4. Essential Electrical Systems: Per NEC 517.26.
 - 5. Elevator Circuits: Per NEC 620.62.
- H. Study shall be stamped and signed by a Professional Engineer (PE). PE shall put statement in summary of report that all systems that are required to be selectively coordinated per NEC are completely coordinated.

1.2 DATA COLLECTION FOR STUDY

- A. Contractor shall provide required data for preparation of the studies. Engineer performing system studies shall furnish Contractor with a listing of required data to be collected immediately after award of the Contract.
- B. Electrical Contractor shall furnish Engineer performing electrical system study wire sizes, insulation types, conduit types, and circuit length for use and verification in study.

1.3 REFERENCES

- A. Perform studies in strict accordance with latest revision of the following standards.
- B. American National Standards Institute (ANSI)

1. ANSI C57.12.59 Guide for Dry-Type Transformer Through-Fault Current Duration.
 2. ANSI/IEEE Std. 141 IEEE Recommended Practice for Electric Power Distribution for Industrial Plants.
 3. ANSI/IEEE Std. 242 “Buff Book” IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
 4. ANSI/IEEE Std. 602 IEEE Recommended Practice for Electric System in Health Care Facilities.
- C. Insulated Cable Engineers Association (ICEA) Standards.
- D. Occupational Safety and Health Administration (OSHA) Standards.
- E. The National Fire Protection Association (NFPA)
1. NFPA 70 – National Electrical Code.
 2. NFPA 70E Standard for Electrical Safety in the Workplace.
- F. Institute of Electrical and Electronics Engineers, Inc. (IEEE)
1. IEEE 1584 Guide for Arc Flash Calculations.

1.4 QUALIFICATIONS

- A. Contractor shall have studies performed by qualified Engineers of electrical distribution equipment manufacturer or by an Owner-approved consultant. Contractor is responsible for providing pertinent information required by preparers of studies.
- B. Firm should be currently involved in high- and low-voltage power system evaluation. Studies shall be performed, stamped and signed by a licensed Professional Engineer in State of Florida. Submit credentials of individual(s) performing studies and background of firm to Engineer for approval prior to start of the Work. A minimum of five (5) years’ experience in power system analysis is required for individual in charge of the project.

1.5 SUBMITTALS

- A. Third party qualifications. Submit qualifications of individual(s) who will perform the Work for approval prior to commencing studies. Use Power Tools software by SKM to perform calculations.
- B. Study Report:
1. Provide studies in conjunction with equipment submittals to verify equipment ratings required.
 2. Summarize results of power system study in a final report. Submit six (6) bound copies of the final report. Provide two (2) PDF copies of study, so that it can be more easily stored and shared. Also, provide two (2) copies (on CD) of report in MS word, and two (2) copies (on CD) of one-line diagram in PDF format.
 3. Report shall include the following sections:
 - a. Overview.
 - b. Short Circuit Study.
 - 1) Purpose.
 - 2) Explanation of Data.
 - 3) Assumptions.
 - 4) Analysis of Results.

- 5) Recommendations.
 - c. Protective Device Coordination Study.
 - 1) Purpose.
 - 2) Explanation of Data.
 - 3) Assumptions.
 - 4) Analysis of Results.
 - 5) Recommendations (Including NEC 700-27 Requirement).
 - 6) CAPTOR Results.
 - 7) Example Drawings.
 - d. Arc Flash Study.
 - 1) Purpose.
 - 2) Explanation of Data.
 - 3) Assumptions.
 - 4) Analysis of Results.
 - 5) Recommendations.
 - 6) SKM Arc Flash Evaluation Report.
 - e. Prioritized Recommendations and Conclusions.
 - f. Appendices
 - 1) DAPPER One-line Diagrams.
 - 2) AutoCAD One-line Diagrams.
 - 3) SKM Protective Device Summaries.
 - 4) Reference Data.
 - 5) Sample Work Permit Form.
 - 6) Copy of Warning Labels, including study date
 4. Above sections shall include the following items in detail:
 - a. Obtain available fault current from local utility company.
 - b. Short circuit studies shall evaluate available fault current at each bus (each change of impedance), including all three-phase motors.
 - c. Coordination study recommendations for relay settings, breaker settings, and motor protection settings.
 - d. Recommendations for improving coordination and/or load distribution, as well as ground fault requirements.
 - e. Arc flash values for two normal cases to define highest values (low short circuit and high short circuit).
 - f. Arc flash values for two maintenance cases, which define arc flash values available at equipment that would be available if instantaneous trip of upstream circuit breaker is set at a minimum value. This is recommended if someone has to work on live equipment.
 - g. IEEE standard one-line diagram with equipment evaluation and circuit breaker setting forms that clearly define system data and are easy to interpret.
 - h. Recommendations to reduce arc flash incident energy in areas that require class 2 and higher PPE.
 - i. Prioritized report summarizing recommendations from this study. This shall include observed NEC code violations and their corrective action.
 - j. Contractor shall provide a one-line diagram that meets IEEE/ANSI standard 141, mounted on 24-inch x 36-inch (minimum) extruded polystyrene backboard. Mount copies of this one-line diagram in each electrical room.

1.6 QUALITY ASSURANCE

- A. Reference standards listed in IEEE "Buff Book", latest edition.

- B. Perform short circuit study in accordance with latest applicable IEEE and ANSI standards.

PART 2 - PRODUCTS – (Not Used)

PART 3 - EXECUTION

3.1 SHORT CIRCUIT AND COORDINATION STUDY

- A. Perform short circuit, coordination, and arc flash hazard studies using SKM Dapper, Captor and PowerTool for Windows software packages.
- B. In short circuit study, provide calculation methods and assumptions, base per unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, and recommendations. Calculate short circuit interrupting and momentary (when applicable) duties for an assumed 3-phase bolted fault at each supply switchgear lineup, unit substation primary and secondary terminals, low voltage switchgear lineup, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard, and other significant locations throughout system. Provide a ground fault current study for same system areas, including associated zero sequence impedance data. Include in tabulations fault impedance, X to R ratios, asymmetry factors, motor contribution, short circuit KVA, and symmetrical and asymmetrical fault currents.
- C. In protective device coordination study, provide time-current curves graphically indicating coordination proposed for system, centered on conventional, full-size, log-log forms. Include with each curve sheet a complete title and one-line diagram with legend identifying specific portion of system covered by that particular curve sheet. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings. Study should clearly demonstrate compliance with NEC selective coordination requirements.
- D. Curve sheets shall include power company relay and fuse characteristics, system medium-voltage equipment relay and fuse characteristics, low-voltage equipment circuit breaker trip device characteristics, pertinent transformer characteristics, pertinent motor and generator characteristics, and characteristics of other system load protective devices. Include at least all devices down to largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in branch panelboards.
- E. Include adjustable settings for ground fault protective devices. Include manufacturing tolerance and damage bands in plotted fuse characteristics. Show transformer full load and 150, 400, or 600 percent currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and significant symmetrical and asymmetrical fault currents. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.
- F. Select each primary protective device required for a delta-wye connected transformer so that its characteristic or operating band is within transformer characteristics, including a point equal to 58 percent of ANSI withstand point to provide secondary line-to-ground fault protection. Where primary device characteristic is not within transformer characteristics, provide a transformer damage curve. Separate transformer primary protective device characteristic curves from

associated secondary device characteristics by a 16 percent current margin to provide proper coordination and protection in the event of secondary line-to-line faults. Separate medium-voltage relay characteristic curves from curves for other devices by at least a 0.4-second time margin.

- G. Include complete fault calculations as specified herein for each proposed and ultimate source combination. Note that source combinations may include present and future supply circuits, large motors, or generators as noted on drawing one-lines.
- H. Utilize equipment load data for study obtained by Contractor from contract documents, including Contract Addendums issued prior to bid opening.
- I. Include fault contribution of motors in the study. Notify Engineer in writing of circuit protective devices not properly rated for fault conditions.
- J. Provide settings for motor starters for motors over 50 horsepower. Include in the study package and comment.
- K. When an emergency generator is provided or existing, include phase and ground coordination of generator protective devices, to meet NEC Articles 700 and 701 requirements. Show generator decrement curve and damage curve along with operating characteristic of protective devices. Obtain information from generator manufacturer and include generator actual impedance value, time constants, and current boost data in study. Do not use typical values for generator.
- L. Evaluate proper operation of ground relays in 4-wire distributions with more than one main service circuit breaker, or when generators are provided, and discuss neutral grounds and ground fault current flows during a neutral to ground fault.
- M. For motor control circuits, show MCC full-load current plus symmetrical and asymmetrical of largest motor starting current to ensure protective devices will not trip major or group operation.

3.2 FIELD SETTINGS

- A. Contractor shall perform field adjustments of protective devices as required to place equipment in final operating condition. Settings shall be in accordance with approved short circuit study, protective device coordination study, and arc flash hazard study.
- B. Contractor shall carry out necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with approved short circuit and protective device coordination study at no additional cost to Owner.

3.3 ARC FLASH HAZARD STUDY

- A. Include arc flash hazard study as part of the short circuit and coordination study. Study shall include the following:
 - 1. Determine and document possible utility and generator/emergency sources that are capable of being connected to each piece of electrical gear. Calculations shall be based on highest possible source connection.
 - 2. Calculations to conform to NFPA 70E calculation standards. Calculate incident energy units in calories per square centimeter.

3. Provide recommended boundary zones and personal protective equipment (PPE) based on calculated incident energy and requirements of NFPA 70E for each piece of electrical gear.
- B. Electrical Contractor shall provide labeling as required by OSHA based upon results of arc flash hazard study. At a minimum, labeling shall contain the following information:
1. PPE level.
 2. Flash Hazard Boundaries.
 3. Flash Protection Boundary
 4. Shock Hazard Boundaries such as Limited Approach Boundary, Restricted Approach Boundary, Prohibited Approach Boundary.
 5. Study date.

END OF SECTION 260573

SECTION 260580 - PENETRATION FIRESTOPPING FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetrations for the passage of cables, conduit, and other electrical equipment through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

B. Related Sections:

1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
2. Section 03 31 00 – Structural Concrete.
3. Section 04 20 00 - Unit Masonry.
4. Section 07 84 00 - Firestopping.
5. Section 07 90 00 - Joint Protection.
6. Section 09 21 16 - Gypsum Board Assemblies: Gypsum board fireproofing.
7. Section 09 23 00 - Gypsum Plastering: Gypsum plaster fireproofing.
8. Section 13 48 00 - Sound, Vibration and Seismic Control.
9. Division 21 - Fire Suppression.
10. Division 22 - Plumbing.
11. Division 23 - Heating, Ventilating, and Air Conditioning (HVAC).
12. Division 27 - Communications.

1.2 DEFINITIONS

- A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

1.3 REFERENCES

A. ASTM International (ASTM):

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E814 - Standard Method of Fire Tests of Through Penetration Fire Stops.
3. ASTM E2174 - Standard Practice for On-site Inspection of Installed Fire Stops.
4. ASTM G21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. International Building Code (IBC 2009).

C. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.

D. National Fire Protection Association (NFPA):

1. NFPA 70 - National Electric Code
2. NFPA 101 - Life Safety Code.

- E. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.
 - 1. UL Fire Resistance Directory:
 - a. Firestop Devices (XHJI).
 - b. Fire Resistance Ratings (BXRH).
 - c. Through-Penetration Firestop Systems (XHEZ).
 - d. Fill, Voids, or Cavity Material (XHHW).
 - e. Forming Materials (XHKU).
- F. Underwriters Laboratories Inc. (UL):
 - 1. UL 1479 - Fire Tests of Through-Penetration Firestops.

1.4 SUBMITTALS

- A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions to comply with Section 26 00 00 – Basic Electrical Requirements.
- B. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineering judgment must include both project name and contractor's name who will install firestop system as described in drawing.
- C. Submit material safety data sheets provided with product delivered to job-site.

1.5 QUALITY ASSURANCE

- A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.
- B. Firestop System installation must meet requirements of ASTM E814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
- D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
- E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Firestop Council.

1.6 INSTALLER QUALIFICATIONS

- A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.
- B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature limitations.
- D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- E. Do not use damaged or expired materials.

1.8 PROJECT CONDITIONS

- A. Do not use materials that contain flammable solvents.
- B. Scheduling:
 - 1. Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
 - 2. Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.
- C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.
- E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 - PRODUCTS

2.1 FIRESTOPPING, GENERAL

- A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service

and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

- B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- C. Penetrations in Fire Resistance Rated Walls: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
 - 1. F-Rating: Not less than the fire-resistance rating of the wall construction being penetrated.
- D. Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E814.
 - 1. F-Rating: Minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
 - 2. T-Rating: when penetrant is located outside of a wall cavity, minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
 - 3. W-Rating: Class 1 rating in accordance with water leakage test per UL 1479.
- E. Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E814.
 - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures.
- F. Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of 0 as determined by ASTM G21.

2.2 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:
 - 1. Hilti, Inc.
 - 2. Dow Corning Co.
 - 3. Fire Trak Corp.
 - 4. International Protective Coatings Corp.
 - 5. 3M Fire Protection Products.
 - 6. Specified Technology, Inc.

2.3 MATERIALS

- A. Use only firestop products that have been UL 1479 or ASTM E 814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- B. Pre-installed firestop devices for use with noncombustible and combustible pipes (closed and open systems), conduit, and/or cable bundles penetrating concrete floors and/or gypsum walls, the following products are acceptable. Equivalent products by other acceptable manufacturers are acceptable.
 - 1. Hilti Cast-In Place Firestop Device (CP 680-P) for use with combustible penetrants.
 - 2. Hilti Cast-In Place Firestop Device (CP 680-M) for use with noncombustible penetrants.

3. Hilti Speed Sleeve (CP 653) for use with cable penetrations.
 4. Hilti Firestop Drop-In Device (CFS-DID) for use with noncombustible and combustible penetrants.
- C. Sealants, foams or caulking materials for use with non-combustible items including rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable. Equivalent products by other acceptable manufacturers are acceptable.
1. Hilti Intumescent Firestop Sealant (FS-ONE).
 2. Hilti Fire Foam (CP 620).
 3. Hilti Flexible Firestop Sealant (CP 606).
 4. Hilti Elastomeric Firestop Sealant (CP 601S).
- D. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including PVC jacketed, flexible cable or cable bundles, and plastic pipe, the following products are acceptable. Equivalent products by other acceptable manufacturers are acceptable.
1. Hilti Intumescent Firestop Sealant (FS-ONE).
- E. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable. Equivalent products by other acceptable manufacturers are acceptable.
1. Hilti Intumescent Firestop Sealant (FS-ONE).
 2. Hilti Fire Foam (CP 620).
 3. Hilti Flexible Firestop Sealant (CP 606).
 4. Hilti Elastomeric Firestop Sealant (CP 601S).
- F. Non-curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable. Equivalent products by other acceptable manufacturers are acceptable.
1. Hilti Firestop Putty Stick (CP 618).
 2. Hilti Firestop Plug (CFS-PL).
- G. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable. Equivalent products by other acceptable manufacturers are acceptable.
1. Hilti Firestop Putty Pad (CP 617).
 2. Hilti Firestop Box Insert.
- H. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable. Equivalent products by other acceptable manufacturers are acceptable.
1. Hilti Firestop Mortar (CP 637).
 2. Hilti Firestop Block (CFS-BL).
 3. Hilti Fire Foam (CP 620).
 4. Hilti Firestop Board (CP 675T).
- I. Non-curing, re-penetrable materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable. Equivalent products by other acceptable manufacturers are acceptable.
1. Hilti Firestop Block (CFS-BL).

2. Hilti Firestop Board (CP 675T).
- J. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable. Equivalent products by other acceptable manufacturers are acceptable.
 1. Hilti Firestop Block (CFS-BL).
 2. Hilti Firestop Plug (CFS-PL).
 - K. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E 814 which is equal to the time rating of construction being penetrated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
 1. Verify penetrations are properly sized and in suitable condition for application of materials.
 2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
 3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
 4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
 5. Do not proceed until unsatisfactory conditions have been corrected.

3.2 COORDINATION

- A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

3.3 INSTALLATION

- A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.
- B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration materials.
 1. Seal all holes or voids made by penetrations to ensure an air and water-resistant seal.
 2. Protect materials from damage on surfaces subjected to traffic.

3.4 FIELD QUALITY CONTROL

- A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.

- C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.
- D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.5 ADJUSTING AND CLEANING

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION 260580

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SECTION 260800 - COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Electrical commissioning description.
 - 2. Electrical commissioning responsibilities.

- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern Work under this Section.
 - 2. Section 01 91 13] – General Commissioning Requirements.
 - 3. Division 21 – Fire Suppression Systems: Fire suppression systems commissioning requirements.
 - 4. Division 22 – Plumbing: Plumbing systems commissioning requirements.
 - 5. Division 23 – Heating, Ventilating and Air Conditioning: HVAC systems commissioning requirements.

1.2 REFERENCES

- A. Associated Air Balance Council:
 - 1. AABC - ACG Commissioning Guideline.

- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE Guideline 0 - The HVAC Commissioning Process.

- C. BCA (Building Commissioning Association) Commissioning Handbook.

1.3 COMMISSIONING DESCRIPTION

- A. Commissioning:
 - 1. Commissioning is a quality-oriented process for achieving, verifying, and documenting that performance of facilities, systems, and assemblies meet defined objectives and criteria.
 - 2. Commissioning process begins at project inception (during pre-design phase) and continues through the life of facility.
 - 3. Commissioning process includes specific tasks to be conducted during each phase in order to verify that design, construction, and training meets Owner's Project Requirements.

- B. Commissioning Team:
 - 1. Members of commissioning team consist of:
 - a. Commissioning Authority (CxA).
 - b. Owner's Representative/Construction Manager (CM).
 - c. General Contractor (GC).
 - d. Architect and Design Engineers.
 - e. Plumbing Contractor (PC).
 - f. Mechanical Contractor (MC).
 - g. Electrical Contractor (EC).
 - h. Testing and Balancing (TAB) Contractor.

- i. Control Contractor (CC).
 - j. Facility Operating Staff
 - k. Other installing subcontractors or suppliers of equipment.
 2. CxA directs and coordinates project commissioning activities and reports to Owner.
 3. All team members work together to fulfill their contracted responsibilities and meet objectives of the Contract Documents.
- C. Electrical commissioning process includes the following tasks:
 1. Testing and startup of Electrical equipment and systems.
 2. Equipment and system verification checks.
 3. Assistance in functional performance testing to verify equipment and system performance.
 4. Provide qualified personnel to assist in commissioning tests.
 5. Complete and endorse functional performance test checklists provided by Commissioning Authority to assure equipment and systems are fully operational and ready for functional performance testing.
 6. Provide equipment, materials, and labor necessary to correct deficiencies found during commissioning process to fulfill contract and warranty requirements.
 7. Provide operation and maintenance information and record drawings to Commissioning Authority for review verification and organization, prior to distribution.
 8. Assist Commissioning Authority to develop, edit, and document system operation descriptions.
 9. Provide training for systems specified in this Section with coordination by Commissioning Authority.
- D. Equipment and Systems to Be Commissioned:
 1. Interior Lighting and Lighting Controls.
 2. Exterior Lighting and Lighting Controls.
 3. Emergency Lighting.
 4. Special Purpose Lighting and Controls.
 5. Lightning Protection System.
 6. Engine Generators.
 7. Transfer Switches.
 8. Variable Frequency Drives.
 9. Power Filter and Conditioners.
 10. Low-Voltage Distribution Equipment.
 11. Low Voltage Transformers.
 12. Medium Voltage Transformers.
 13. Electrical Power Monitoring and Control.
 14. Photovoltaic Collectors.
 15. Battery Equipment.
 16. Electric Terminal Heating Equipment.

1.4 COMMISSIONING SUBMITTALS

- A. Division 01 – General Requirements: Requirements for commissioning submittals.

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 - General Requirements: Execution and Closeout Submittal Procedures: Shop drawings, product data and samples.

- B. Division 01 – General Requirements: Requirements for submittals.
- C. Project Record Documents: Record revisions to equipment and system documentation necessitated by commissioning.
- D. Operation and Maintenance Data: Submit revisions to operation and maintenance manuals for necessary revisions discovered during commissioning.

1.6 COMMISSIONING RESPONSIBILITIES

- A. Equipment or System Installer Commissioning Responsibilities:
 - 1. Attend commissioning meetings.
 - 2. Ensure temperature controls installer performs assigned commissioning responsibilities as specified below.
 - 3. Ensure testing, adjusting, and balancing agency performs assigned commissioning responsibilities as specified.
 - 4. Provide instructions and demonstrations for Owner's personnel.
 - 5. Ensure subcontractors perform assigned commissioning responsibilities.
 - 6. Ensure participation of equipment manufacturers in appropriate startup, testing, and training activities when required by individual equipment specifications.
 - 7. Develop startup and initial checkout plan using manufacturer's startup procedures and functional performance checklists for commissioned equipment and systems.
 - 8. During verification check and startup process, execute electrical related portions of checklists for commissioned equipment and systems.
 - 9. Perform and document completed startup and system operational checkout procedures, providing copy to Commissioning Authority.
 - 10. Provide manufacturer's representatives to execute starting of equipment. Ensure representatives are available and present during agreed upon schedules and attend for duration to complete tests, adjustments, and problem solving.
 - 11. Coordinate with equipment manufacturers to determine specific requirements to maintain validity of warranties.
 - 12. Provide personnel to assist Commissioning Authority during equipment or system verification checks and functional performance tests.
 - 13. Prior to functional performance tests, review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits used during tests.
 - 14. Prior to startup, inspect, check, and verify correct and complete installation of equipment and system components for verification checks included in commissioning plan.
 - 15. When deficient or incomplete work is discovered, ensure to take corrective action and re-check until equipment or system is ready for startup.
 - 16. Provide factory-supervised startup services for equipment and systems specified in Section 26 32 13 – Engine Generators.
 - 17. Coordinate work with manufacturer and Commissioning Authority.
 - 18. Perform verification checks and startup on equipment and systems as specified.
 - 19. Assist Commissioning Authority in performing functional performance tests on equipment and systems as specified.
 - 20. Perform operation and maintenance training sessions scheduled by Commissioning Authority.
 - 21. Conduct electrical system orientation and inspection.
- B. Temperature Controls Installer Commissioning Responsibilities:
 - 1. Attend commissioning meetings.

2. Review design for ability of systems to be controlled including the following:
 - a. Confirm proper hardware requirements exist to perform functional performance testing.
 - b. Confirm proper safeties and interlocks are included in design.
 - c. Confirm sensors selected are within device ranges.
 - d. Review sequences of operation and obtain clarification from Engineer/ Architect.
 - e. Indicate delineation of control between packaged controls and building automation system, listing BAS monitor points and BAS adjustable control points.
 - f. Provide written sequences of operation for packaged controlled equipment. Equipment manufacturers' stock sequences may be included, when accompanied by additional narrative to reflect Project conditions.
3. Inspect, check, and confirm proper operation and performance of control hardware and software provided in other electrical sections.
4. Inspect check and confirm correct installation and operation of automatic temperature control system input and output device operation through point-to-point checks.
5. Perform training sessions to instruct Owner's personnel in hardware operation, software operation, programming, and application in accordance with commissioning plan and requirements.
6. Demonstrate system performance and operation to Commissioning Authority during functional performance tests including each mode of operation.
7. Provide control system technician to assist during Commissioning Authority verification check and functional performance testing.
8. Provide control system technician to assist testing, adjusting, and balancing agency during performance of testing, adjusting, and balancing work.
9. Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.

1.7 COMMISSIONING MEETINGS

- A. Division 01 – General Requirements – General Commissioning Requirements: Requirements for commissioning meetings.
- B. Attend initial commissioning meeting and progress commissioning meetings as required by Commissioning Authority.

1.8 SCHEDULING

- A. Division 01 – General Requirements: Requirements for scheduling.
- B. Prepare schedule indicating anticipated start dates for the following:
 1. Interior lighting control testing.
 2. Exterior lighting control testing.
 3. Engine generator testing and load bank testing.
 4. Equipment and system startups.
 5. Electrical system orientation and inspections.
 6. Operation and maintenance training sessions.
- C. Schedule tests of day lighting equipment and systems during design outdoor conditions to observe performance.
- D. Schedule occupancy sensitive tests of equipment and systems during conditions of both minimum and maximum occupancy or use.

1.9 COORDINATION

- A. Division 01 – General Requirements: Requirements for coordination.
- B. Notify Commissioning Authority minimum of four weeks in advance of the following:
 - 1. Scheduled equipment and system startups.
 - 2. Scheduled automatic temperature control system checkout.
 - 3. Scheduled start of engine generator startup.
- C. Coordinate programming of lighting control system with construction and commissioning schedules.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 FUNCTIONAL TESTING

- A. Place electrical systems and equipment into full operation and continue operation during each working day of commissioning.

3.2 COMMISSIONING

- A. Day Light Sensitive Functional Performance Tests:
 - 1. Test day-lighting controls at varying outdoor conditions.
- B. Be responsible to participate in initial and alternate peak season test of systems required to demonstrate performance.
- C. Occupancy Sensitive Functional Performance Tests:
 - 1. Test equipment and systems affected by occupancy variations at minimum and peak loads to observe system performance.
 - 2. Participate in testing delayed beyond Final Completion to test performance with actual occupancy conditions.

3.3 CONSTRUCTION VERIFICATION CHECKLISTS

- A. Complete the following construction verification checklists for this project. Submit for CxA review and approval.
 - 1. CV-26 05 03: Wiring Connections
 - 2. CV-26 05 19: Building Wire and Cable
 - 3. CV-26 05 26: Grounding and Bonding
 - 4. CV-26 05 29: Electrical Hangers and Supports
 - 5. CV-26 05 33: Raceways and Boxes
 - 6. CV-26 05 34: Floor Boxes
 - 7. CV-26 05 53: Electrical Identification
 - 8. CV-26 05 73: Short Circuit/Coordination/Arc Flash Hazard Analysis Studies
 - 9. CV-26 05 80: Penetration Firestopping for Electrical
 - 10. CV-26 09 43: Networked Lighting Controls

11. CV-26 12 00: Pad-Mounted Transformers
12. CV-26 22 00: Dry Type Transformers
13. CV-26 24 16: Panelboards
14. CV-26 27 16: Cabinets and Enclosures
15. CV-26 27 26: Wiring Devices
16. CV-26 28 13: Fuses
17. CV-26 28 19: Enclosed Switches
18. CV-26 28 23: Enclosed Circuit Breakers
19. CV-26 29 13: Enclosed Controllers
20. CV-26 29 16: Enclosed Contactors
21. CV-26 29 33: Motor Wiring
22. CV-26 33 53: Static Uninterruptible Power Supplies
23. CV-26 35 53: Transient Voltage Surge Suppressor
24. CV-26 41 00: Facility Lightning Protection
25. CV-26 51 00: Interior Lighting
26. CV-26 56 00: Exterior Lighting
27. CV-26 60 00: Multiplexed Addressable Fire Alarm Detection System

3.4 FUNCTIONAL PERFORMANCE TESTS

- A. Complete the following functional performance tests;
 1. FPT-26 32 00: Generator Functional Performance Test.
 2. FPT-26 51 15: Lighting Controls Functional Performance Test.

END OF SECTION 260800

SECTION 260943 - NETWORKED LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Networked lighting control system and components.
- B. Related Sections:
 - 1. Applicable provisions of Division 01 shall govern all work under this Section.
 - 2. Section 26 05 03 - Wiring Connections: Execution requirements for electric connections specified by this section.
 - 3. Section 26 05 33 - Raceway and Boxes: Product requirements for raceway and boxes for placement by this section.
 - 4. Section 26 05 53 – Electrical Identification: Product requirements for electrical identification items for placement by this section.
 - 5. Section 26 27 26 - Wiring Devices: Product requirements for wiring devices for placement by this section.

1.2 REFERENCES

- A. Government Electronics and Information Technology Association (EIA): EIA 709.1 - Control Network Protocol Specification.
- B. National Electrical Manufacturers Association (NEMA): NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- C. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code.
- D. Underwriters Laboratories Inc. (UL):
 - 1. UL 50 - Enclosures for Electrical Equipment.
 - 2. UL 67 - Panelboards.
 - 3. UL 508 - Industrial Control Equipment.
 - 4. UL 916 - Energy Management Equipment.

1.3 SYSTEM DESCRIPTION

- A. Provide networked lighting control system consisting of components manufactured by single source.
- B. Provide networked lighting control system consisting of:
 - 1. Multiple relay panels linked over network wiring using open protocol for communications.
 - 2. Multiple relay panels linked over network wiring using open protocol for communications and be fully compliant with EIA 709.1.
 - 3. Relay panels and programmable switches connected together by networked wiring system extending from panel locations with single communications bus to allow switches to communicate with panels.
 - 4. System connected to single time clock mounted in interior of relay panel.

1.4 SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Requirements for submittals.
- B. Shop Drawings: Indicate dimensioned drawings of lighting control system components and accessories.
 - 1. One Line Diagram: Indicating system configuration indicating panels, number and type of switches, data line, and network time clock.
 - 2. Drawings for each panel showing hardware configuration and numbering.
 - 3. Panel wiring schedules.
 - 4. Include typical wiring diagrams for each component.
- C. Product Data: Submit manufacturer’s standard product data for each system component.
- D. Manufacturer's Installation Instructions: Submit for each system component.
- E. Manufacturer's Certificate: Certify Products meet or exceeds specifications. Submit in writing system has been installed, adjusted, and tested in accordance with manufacturer's recommendations.
- F. Manufacturer's Field Reports: Submit system startup report indicating date of completion and acknowledgment of programming completion. Indicate acceptance of component and equipment installation, interconnecting wiring, and start-up of system software.

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Requirements for submittals.
- B. Project Record Documents: Record the following information:
 - 1. Wiring diagrams reflecting field installed conditions with identified and numbered system components and devices.
 - 2. Drawings for each panel showing hardware configuration and numbering.
- C. Operation and Maintenance Data:
 - 1. Submit manufacturer’s published installation instructions, operating instructions, programming instructions, and operator’s guide.
 - 2. System user's guide and programmer's guide.
 - 3. Instruction books and manufacturer’s printed materials.
 - 4. Recommended renewal parts list.

1.6 QUALITY ASSURANCE

- A. Comply with NFPA 70 as applicable to electrical wiring work.
- B. Comply with NEMA 250 for type of electrical equipment enclosures.
- C. Provide panelboards with UL listing in accordance with UL 50, UL 67, and UL 916.
- D. Provide equipment complying with FCC emissions' standards in part 15 subpart J for Class A application.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing lighting control system listed in this section, with minimum five years' experience.
- B. Installer: Company specializing in performing work of this section with minimum five years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept system components on site in manufacturer's packaging. Inspect for damage.
- C. Protect components by storing in manufacturer's containers indoor protected from weather.

1.9 WARRANTY

- A. Division 01 – General Requirements: Requirements for warranties.

PART 2 - PRODUCTS

2.1 NETWORKED LIGHTING CONTROL SYSTEM

- A. Manufacturers:
 - 1. Acuity Brands – nLight System (Basis of Design)
- B. Product Description: Networked lighting control system consisting of the following components: relay panels, network wiring, programmable network wired switches, programmable clock, software, and capability of integration into building automation system.

2.2 RELAY PANELS

- A. UL listed, NEMA 1 enclosure sized to accept up to number of relays indicated on the relay cabinet schedules.
- B. Power Supply: Transformer assembly with two 40 VA transformers with separate secondaries. Transformers include internal overcurrent protection with automatic reset and metal oxide varistor protection against power line spikes.
- C. Voltage: 120 or 277 VAC, 60 Hertz, plus or minus 10 percent.
- D. Mounting: Surface or Flush as indicated on the plans.
- E. Cover: Hinged, locking configuration with wiring schedule directory card.
- F. Interior: Bracket and intelligence board backplane with factory mounted and tested relays.

- G. Furnish with integral DIN rail mounting bar to allow for installation of system components. Furnish terminals to accept network wiring for connection of switches to system, or to allow network wiring to be run between multiple panels for network communications between panels.
- H. Furnish with individual on-off switches for both panel and network wiring power.
- I. Furnish 8 channels in each interior regardless of size, each with associated pushbutton to toggle channel on-off, and terminal block for separate dry contact input. Each relay in panel capable of being assigned to each channel, with overlapping allowed. Furnish each channel pushbutton with LED state indication.
- J. Furnish each channel pushbutton with LED status indication.
- K. Relays:
 - 1. Type: Momentary-pulsed mechanically latching contactors rated at 20 amps, 120 to 277 VAC attached to interior by plug-in type connector.
 - 2. Locate next to each relay individual override button and LED to indicate status - relay on, relay off, or relay failure.
 - 3. One 0-10 volt dimming output per relay.
 - 4. Furnish screw terminations for each wiring connection.
 - 5. Furnish each channel button's dry control contact input terminal with capability of accepting 2 or 3 wire, maintained or momentary inputs and 2 wire toggling input.
 - 6. Furnish each channel with isolated contact for use with status feedback or pilot light control.
 - 7. Relay Panel records channel wiring assignments and current status of each relay, in non-volatile memory to prevent data loss on power failure.
 - 8. Furnish LED status indication of power supply status. Furnish access to 24 VAC and 24 V rectified power for accessory devices within panel.
 - 9. Interior uses relays with pilot contact to provide individual relay feedback.
 - 10. Switching devices to control relay state. Devices can be either 2 or 3 wire, maintained or momentary inputs. Devices also accept 2 wire toggling input.
 - 11. System to comply with EIA 709.1 lighting controller profile and furnish capability for network connecting to EIA 709.1 compliant building automation system components without use of dry contacts, gateways, protocol converters or additional devices.
- L. Inputs.
 - 1. One programmable input for contact closure or photo-sensor signal.
 - 2. One input for every 8 relays.
 - 3. One maintained over-ride input.

2.3 NETWORK WIRING

- A. CAT 5e cables, T568B wiring convention.
- B. Maximum length: 1,500 feet.
- C. Maximum number of devices: 128 per control zone.

2.4 PROGRAMMABLE NETWORK WIRED SWITCHES

- A. Function: Allow individual controls.

- B. Multiple pushbuttons will comprise a single switch station location. Pushbuttons may consist of;
 - 1. On.
 - 2. Off.
 - 3. On/Off Toggle.
 - 4. Raise.
 - 5. Lower.
 - 6. Numbered for Scene Select.
- C. Configurations: As indicated on the Drawings.
- D. Configured to mount in a single gang box opening.
- E. Shall contain RJ-45 network ports for communications cabling terminations/bus connection.
- F. Features:
 - 1. Equipped with bi-color LED pilot light for individual buttons to indicate status of controlled relay or group of relays.
 - 2. Equipped with locator light.
 - 3. Furnish individual buttons with removable clear cover for labeling controlled loads.
- G. White buttons and white cover-plates.
- H. Acuity nPODM series.

2.5 PROGRAMMABLE CLOCK

- A. From each plug-in point on network wiring, time clock can be used to:
 - 1. Schedule each 8 channel groups in relay panel network.
 - 2. Program network wired switches.
- B. Includes user selectable functions to handle standard lighting control functions for each channel independently. Selectable functions include:
 - 1. Scheduled on and scheduled off.
 - 2. Manual on and scheduled off.
 - 3. Astronomical on and astronomical off with optional offset.
 - 4. Astronomical on and scheduled off with optional offset.
- C. Each channel capable of being assigned the following:
 - 1. Time delay from 1 to 256 minutes.
 - 2. Automatic blinking of lights before turning off to allow occupants opportunity to enter override. Time interval configurable.
- D. Features:
 - 1. Furnish clock with display and user interface.
 - 2. Capable of being adjusted for leap year, daylight savings dates, and holidays.

2.6 SOFTWARE

- A. Furnish plug-in capability for use in system commissioning, programming, monitoring, and control. Software capable of functioning with EIA 709.1 compliant network tool.

- B. After programming of system parameters is completed, system allows each user-definable feature such as schedules, relay groups, switch assignments to be field modified without need for configuration software or system integration expertise.

2.7 BAS INTEGRATION

- A. In addition to hardwired channel inputs, furnish system with capability for integration into building automation and control system direct digital control system without use of dry contact, gateways or protocol converters. Integration accomplished via network connections of EIA 709.1 compliant devices.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount switches, occupancy sensors and photocells as indicated on the Drawings.
- B. Label each low voltage wire clearly indicating connecting relay panel. Refer to Section 26 05 53 – Electrical Identification.
- C. Use only properly color coded, stranded wire. Install wire sizes as indicated on the Drawings.
- D. Mount relay panels as indicated on the Drawings. Wire numbered relays in panel to control power to each load.
- E. Identify power wiring with circuit breaker number controlling load. When multiple circuit breaker panels are feeding into relay panel, label wires to clearly indicate originating panel's designation.
- F. Terminate communication conductors and associated conduits external to factory supplied equipment.
- G. Test relays and switches after installation to confirm proper operation.
- H. Label each low voltage wire with relay number at each switch or sensor.
- I. Install wiring schedule directory card affixed to rear of panel cover to identify circuits, relays, and loads controlled.

3.2 FIELD QUALITY CONTROL

- A. Test relays and switches after installation to confirm proper operation and confirm correct loads are recorded on directory card in each panel.

3.3 MANUFACTURER'S FIELD SERVICES

- A. System Startup: Furnish manufacturer trained, factory authorized technician to confirm proper installation and operation of system components.
- B. Programming:

1. Furnish services of factory trained representative to perform programming of system. Assist Owner's personnel in developing control scenario for each application. Program Owner furnished control scenario.
2. Explain operation of control programs to Owner and conduct demonstration of project.
3. Include a minimum of 24 hours of Owner training on the system functions and programming.

3.4 ADJUSTING

- A. Division 01 – General Requirements: Requirements for starting and adjusting.
- B. Furnish factory trained technicians to functionally test each system component after installation to verify proper operation.

3.5 DEMONSTRATION

- A. Demonstrate operation of the following system components:
 1. Index system to occupied cycle and unoccupied cycle.
 2. Operation of switches.
 3. Operation of each type of occupancy sensors.
 4. Operation of each type of photocell.

END OF SECTION 260943

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SECTION 261200 - PAD-MOUNTED TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Liquid-filled pad-mounted distribution transformers.
 - 2. Dry-type pad-mounted distribution transformers.
- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
 - 2. Section 26 00 00 – Basic Electrical Requirements.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI C37.47 - American National Standard Specifications for Distribution Fuse Disconnecting Switches, Fuse Supports, and Current-Limiting Fuses.
 - 2. ANSI C57.12.26 - Pad-Mounted Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High Voltage, 34 500 Grd Y/19 920 Volts and Below; 2500 kVA and Smaller.
 - 3. ANSI C57.12.28 - Pad-Mounted Equipment - Enclosure Integrity.
 - 4. ANSI C57.12.55 - Dry Type Transformers in Unit Installations, Including Unit Substations-Conformance Standard.
- B. American Society for Testing and Materials (ASTM International):
 - 1. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - 2. ASTM D92 - Flash and Fire Points by Cleveland Open Cup IP Designation: 36/84; AASHTO No.: T 48; DIN51 376.
 - 3. ASTM D117 - Electrical Insulating Oils of Petroleum Origin.
 - 4. ASTM D877 - Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes.
 - 5. ASTM D1535 - Specifying Color by the Munsell System.
 - 6. ASTM D3455 - Compatibility of Construction Material with Electrical Insulating Oil of Petroleum Origin.
 - 7. ASTM D3487 - Mineral Insulating Oil Used in Electrical Apparatus.
- C. Factory Mutual Engineering and Research (FM):
 - 1. FM P7825 - Approval Guide.
- D. Institute of Electrical and Electronics Engineers (IEEE):
 - 1. IEEE C2 - National Electrical Safety Code (IEEE).
 - 2. IEEE 386 - Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600 V.
 - 3. IEEE C37.71 - Three-Phase, Manually Operated Subsurface Load-Interrupting Switches for Alternating-Current Systems (IEEE).
 - 4. IEEE C57.12.00 - Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.

5. IEEE C57.12.26 - Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, (34 500 Grd Y/19 920 V and Below; 2500 kVA and Smaller).
6. IEEE C57.12.80 - Terminology for Power and Distribution Transformers (IEEE).
7. IEEE C57.12.90 - Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and IEEE Guide for Short Circuit Testing of Distribution and Power Transformers.
8. IEEE C57.12.91 - Standard Test Code for Dry-Type Distribution and Power Transformers.
9. IEEE C57.12.98 - Guide for Transformer Impulse Tests (IEEE).
10. IEEE C57.13 - Standard Requirements for Instrument Transformers.
11. IEEE C57.94 - Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type General Purpose Distribution and Power Transformers.
12. IEEE C57.106 - Guide for Acceptance and Maintenance of Insulating Oil in Equipment.
13. IEEE C57.111 - Guide for Acceptance of Silicone Insulating Fluid and Its Maintenance in Transformers.
14. IEEE C57-121 - Guide for Acceptance and Maintenance of Less-Flammable Hydrocarbon Fluid in Transformers.
15. IEEE C62.11 - Metal-Oxide Surge Arresters for AC Power Circuits (> 1 kV) (IEEE).

E. National Electrical Manufacturers Association (NEMA):

1. NEMA 260 - Safety Labels for Padmounted Switchgear and Transformers Sited in Public Areas.
2. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
3. NEMA C37/47 - Distribution Fuse Disconnecting Switches, Fuse Supports, and Current-Limiting Fuses.
4. NEMA C57.12.22 - Transformers - Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers with High-Voltage Bushings, 2500 kVA and Smaller: High Voltage, 34 500 Grd Y/19 920 Volts and Below; Low Voltage, 480 Volts and Below.
5. NEMA C57.12.28 - Pad-Mounted Equipment - Enclosure Integrity.
6. NEMA LI 1 - Industrial Laminating Thermosetting Products.

F. National Fire Protection Association (NFPA):

1. NFPA 70 - National Electrical Code.

G. International Electrical Testing Association (NETA):

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

H. UL - Underwriters Laboratories, Inc. (UL):

1. UL 467 - Grounding and Bonding Equipment.

1.3 SUBMITTALS

A. Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.

B. Shop Drawings: Indicate electrical characteristics and connection requirements, outline dimensions, connection and support points, weight, specified ratings and materials.

1. Manufacturer's published time-current curves (on full size logarithmic paper) of transformer high side fuses.
2. Drawings shall indicate, but not be limited to the following:

- a. An outline drawing, but front, top, and side views.
 - b. ANSI nameplate data.
 - c. Elementary diagrams and wiring diagrams with terminals identified of watt-hour meter and current transformers.
 - d. One-line diagram, including switch(es), current transformers, meters, and fuses.
 - e. Manufacturer's published time-current curves (on full size logarithmic paper) of transformer high side fuses.
3. Transformer Losses
- a. Submit certification from manufacturer indicating conformance with paragraph entitled "Specified Transformer Losses."
- C. Product Data: Submit electrical characteristics and connection requirements, standard model design tests, and options.
- D. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.
- E. Manufacturer's Field Reports: Indicate activities on site, final adjustments and overcurrent protective device coordination curves, adverse findings, and recommendations.

1.4 CLOSEOUT SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for closeout submittals.
- B. Project Record Documents: Include copy of manufacturer's certified drawings.
- C. Operation and Maintenance Data: Submit maintenance procedures for sampling and maintaining fluid.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years' experience.
- B. Testing Agency: Company member of International Electrical Testing Association and specializing in testing products specified in this section with minimum five years' experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products under provisions of Section 26 00 00 – Basic Electrical Requirements.
- B. Protect dry type transformers from moisture by using heaters in accordance with manufacturer's instructions.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.8 MAINTENANCE MATERIALS

- A. Section 26 00 00 – Basic Electrical Requirements: Spare parts and maintenance products.

- B. Furnish two each of special tools required to operate and maintain transformer.

1.9 EXTRA MATERIALS

- A. Section 26 00 00 – Basic Electrical Requirements: Spare parts and maintenance products.
- B. Furnish two of each size and type fuse.

PART 2 - PRODUCTS

2.1 LIQUID-FILLED TRANSFORMERS

- A. Manufacturers:
 - 1. Cooper Power Systems.
 - 2. GE Electrical.
 - 3. Howard Industries.
 - 4. ABB.
 - 5. Equivalent as acceptable to Engineer.
- B. Product Description: ANSI C57.12.26, three phase, pad mounted, self-cooled transformer unit.
- C. Cooling and Temperature Rise; IEEE C57.12.00; Class OA. [55] [65] degrees C, self-cooled.

2.2 THREE-PHASE PAD-MOUNTED TRANSFORMERS

- A. Meet requirements of IEEE C57.12.26, NEMA C57.12.22, and NEMA C57.12.28 and as specified herein.
- B. Compartments:
 - 1. High- and low-voltage compartments shall be separated by steel isolating barriers extending full height and depth of compartments. Compartment doors: Hinged lift-off type with stop in open position and three-point latching.
- C. High Voltage, Dead-Front:
 - 1. High-voltage compartment shall contain incoming line, insulated high-voltage load-break connectors, bushing well inserts, feed-thru inserts, three six high-voltage bushing wells configured for loop radial feed application, load-break switch handle(s), access to oil-immersed fuses, dead-front surge arresters, tap changer handle, connector parking stands with insulated standoff bushings, protective caps, and ground pad.
 - a. Insulated high-voltage load-break connectors: IEEE Std 386, rated 15 kV, 95 kV BIL. Current rating: 200 amperes rms continuous. Short time rating: 10,000 amperes rms symmetrical for time duration of 0.17 seconds. Connector shall have a steel reinforced hook-stick eye, grounding eye, test point, and arc-quenching contact material.
 - b. Bushing well inserts and feed-thru inserts: IEEE Std 386, 200 amperes, 15 kV Class. Provide bushing well insert for each bushing well unless indicated otherwise. Provide feed-thru inserts as indicated.
 - c. Load-break switch:
 - 1) Radial-feed oil-immersed type rated at 15 kV, 95 kV BIL, with a continuous current rating and load-break rating of 200 amperes and make-and-latch rating of

- 10,000 rms amperes symmetrical. Locate switch handle in high-voltage compartment.
- 2) Loop feed sectionalizer switches: Provide three, two-position, oil-immersed type switches to permit closed transition loop feed and sectionalizing. Each switch shall be rated at 15 kV, 95 kV BIL, with a continuous current rating and load-break rating of 200 amperes, and a make-and-latch rating of 10,000 rms amperes symmetrical. Locate switch handles in high-voltage compartment. Operation of switches shall be as follows:
 - d. Provide bayonet oil-immersed, expulsion fuses in series with oil-immersed, partial-range, current-limiting fuses. Bayonet fuse links shall sense both high currents and high oil temperature in order to provide thermal protection to transformer. Coordinate transformer protection with expulsion fuse clearing low-current faults and current-limiting fuse clearing high-current faults beyond interrupting rating of expulsion fuse. In order to eliminate or minimize oil spills, bayonet fuse assemblies shall include an oil retention valve inside housing which closes when fuse holder is removed and an external drip shield. Warning shall be conspicuously displayed within high-voltage compartment cautioning against removing or inserting fuses unless load-break switch is in open position and tank pressure has been released.
 - 1) Bayonet fuse assembly: 150 kV BIL.
 - 2) Oil-immersed current-limiting fuses: NEMA C37.47; 50,000 rms amperes symmetrical interrupting rating at system voltage specified.
 - e. Surge arresters: IEEE C62.11, rated 9 kV, fully shielded, dead-front, metal-oxide-varister, elbow type with resistance-graded gap, suitable for plugging into inserts. Provide three arresters for radial feed circuits. Provide three arresters for loop feed circuits.
 - f. Parking stands: Provide a parking stand near each bushing well. Provide insulated standoff bushings for parking of energized load-break connectors on parking stands.
 - g. Protective caps: IEEE Std 386, 200 amperes, 15 kV Class. Provide insulated protective caps (not shipping caps) for insulating and sealing out moisture from unused bushing well inserts and insulated standoff bushings.
- D. Low Voltage:
1. Low-voltage compartment shall contain low-voltage bushings with NEMA spade terminals, accessories, metering, stainless steel or laser-etched anodized aluminum diagrammatic transformer nameplate, and ground pad.
 - a. Accessories shall include drain valve with sampler device, fill plug, pressure relief device, liquid level gage, pressure-vacuum gage, and dial type thermometer with maximum temperature indicator.
- E. Transformer:
1. Transformer shall be rated as noted on Drawings, 95 kV BIL.
 2. Transformer voltage ratings: As noted on Drawings.
 3. Tap changer shall be externally operated, manual type for changing tap setting when transformer is de-energized. Provide four 2.5 percent full capacity taps, two above and two below rated primary voltage. Tap changers shall clearly indicate which tap setting is in use.
 4. Audible sound levels shall comply with following criteria:

<u>kVA</u>	<u>DECIBELS (MAX)</u>
30-75	51
112.5	55
150	55

225	55
300	55
500	56
750	57
1000	58
1500	60

5. Transformer shall include lifting lugs and provisions for jacking under base. Transformer base construction shall be suitable for using rollers or skidding in any direction. Provide transformer top with an access handhole. Transformer shall have its kVA rating conspicuously displayed on its enclosure. Transformer shall have an insulated low-voltage neutral bushing with NEMA spade terminal, and with removable ground strap.

F. Specified Transformer Losses:

1. No-load losses (NLL) shall be (see table below for maximum losses allowed) at 68 degrees F and load losses (LL) shall be (see table below for maximum losses allowed) at 185 degrees F. Values for specified losses shall be used for comparison with losses determined during routine tests. If routine test values for no-load losses exceed specified no-load losses by more than 10 percent, or total losses exceed specified total losses (sum of no-load and load losses) by more than 6 percent, transformer is unacceptable.
 - a. Maximum transformer losses shall comply with following criteria:

KVA	SEC. VOLT.	NLL (Watts)	LL (Watts)	Min. % Z
30	208Y/120	---	---	4.2
45	480Y/277	---	---	3.3
75	480Y/277	167	742	2.45
300	280Y/120	475	1,872	3.86
500	280Y/120	741	3,017	4.24
750	280Y/120	922	5,272	5.32
1,500	480Y/277	1,363	8,539	5.32

2. Insulating Liquid:
 - a. Insulating liquid shall be mineral oil unless otherwise noted on one-line diagram on Drawings.
 - b. Mineral oil: ASTM D3487, Type II, tested in accordance with ASTM D117. Provide identification of transformer as "non-PCB" and "Type II mineral oil" on nameplate.
 - c. Less-Flammable Transformer Liquids: NFPA 70 and FM P7825 for less-flammable liquids having a fire point not less than 570 degrees F tested per ASTM D92 and a dielectric strength not less than 33 kV tested per ASTM D877. Do not provide non-flammable transformer liquids including askarel and insulating liquids containing polychlorinated biphenyls (PCB's) and tetrachloroethylene (perchloroethylene), chlorine compounds, and halogenated compounds. Provide identification of transformer as "non-PCB" and "manufacturer's name and type of fluid" on nameplate.
 - d. DO NOT provide silicone insulated transformers.

2.3 DRY TYPE TRANSFORMERS

- A. Manufacturers:
 1. Square D.
 2. GE Electrical.
 3. Copper Power Systems.

4. ABB.
5. Equivalent as acceptable to Engineer.

- B. Product Description: ANSI C57.12.55; single three phase, pad-mounted, self-cooled transformer unit with solid-cast or resin-encapsulated windings.
- C. Cooling and Temperature Rise: ANSI C57.12.55; Class AA. 220 degrees C insulation class with 150 degrees C rise over 40 degrees C ambient.

2.4 SERVICE CONDITIONS

- A. Meet requirements for usual service conditions described in IEEE C57.12.00] [ANSI C57.12.55 and for specified unusual service conditions.
- B. Maximum Minimum Ambient Temperature: 95 degrees F.
- C. Altitude: 100 feet.

2.5 RATINGS

- A. As shown on Drawings.
- B. Primary Voltage: As shown on Drawings.
- C. Taps: Standard primary taps.
- D. Secondary Voltage: As shown on Drawings.
- E. Basic Impulse Level: 30 60 75 95 125 kV.

2.6 ACCESSORIES

- A. Accessories: IEEE C57.12.00, ANSI C57.12.55, standard accessories and magnetic liquid level gage, dial type thermometer.
- B. Tap Changer: Externally-operated type.
- C. Primary Terminations: Bushing wells conforming to IEEE 386; furnish three for radial feed. six for loop primary selective feed. Include bushings for insulated loadbreak connectors.
- D. Primary Terminations: Porcelain insulator with clamp-type connector.
- E. Primary Switching: Fused air switch, gang operated.
- F. Primary Switching: Internal liquid-immersed gang-operated load break switch. Furnish two, for primary selective switching loop feed.
- G. Primary Overcurrent Protection: Internally-mounted, liquid-immersed, expulsion fuses. Bayonet-type, liquid-immersed, expulsion fuses. Current-limiting fuses to conforming to ANSI C37.47.
- H. Secondary Terminations: Spade lugs.

- I. Secondary Switching and Overcurrent Protection: Molded case circuit breaker conforming to NEMA AB1.
- J. Other Accessories: Primary lightning arrestors; and secondary current transformers conforming to IEEE C57.13.

2.7 FABRICATION

- A. Conform to requirements of ANSI C57.12.28.

2.8 FACTORY FINISHING

- A. Clean surfaces before applying paint.
- B. Apply corrosion-resisting primer to surfaces.
- C. Apply finish coat of baked enamel paint to 2/4 mils thick.
- D. Finish Color: Manufacturer's standard dark light gray finish.

2.9 SOURCE QUALITY CONTROL (AND TESTS) - DRY TYPE TRANSFORMERS

- A. Provide factory tests conforming to IEEE C57.12.91. Include routine tests as defined in ANSI C57.12.55 and the following other tests:
 - 1. Impedance voltage and load loss.
 - 2. Dielectric tests.
 - 3. Audible sound level.
 - 4. Short circuit capability.
 - 5. Telephone influence factor (TIF).
- B. Make completed transformer available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner and Architect/Engineer at least thirty (30) days before inspection is allowed.
- C. Allow witnessing of factory inspections and tests at manufacturer's test facility. Notify Owner and Architect/Engineer at least thirty (30) days before inspections and tests are scheduled.
- D. Provide minimum 15 calendar days' notice of any changes to schedule dates.

2.10 SOURCE QUALITY CONTROL AND TESTS - LIQUID FILLED TRANSFORMERS

- A. Design Tests: IEEE C57.12.00, and IEEE C57.12.90. Section 5.1.2 in IEEE C57.12.80 states that "design tests are made only on representative apparatus of basically same design." Submit design test reports (complete with test data, explanations, formulas, and results), in same submittal package as catalog data and drawings for each specified transformer(s). Design tests shall have been performed prior to award of contract.
 - 1. Tests shall be certified and signed by a registered professional engineer.
 - 2. Temperature rise: "Basically same design" for temperature rise test means a pad-mounted transformer with same coil construction such as wire wound primary and sheet wound secondary, provide same kVA, provide same cooling type (OA), provide same temperature rise rating, and same insulating liquid as transformer specified.

3. Lightning impulse: "Basically same design" for lightning impulse dielectric test means a pad-mounted transformer with same BIL, same coil construction (such as wire wound primary and sheet wound secondary), and a tap changer, if specified. Design lightning impulse tests shall include both primary and secondary windings of that transformer.
 - a. IEEE C57.12.90, paragraph 10.3 entitled "Lightning Impulse Test Procedures," and IEEE C57.98.
 - b. State test voltage levels.
 - c. Provide photographs of oscilloscope display waveforms or plots of digitized waveforms with test report.
 4. Lifting and moving devices: "Basically same design" requirement for lifting and moving devices test means a test report confirming that lifting device being used is capable of handling weight of specified transformer in accordance with IEEE C57.12.26.
 5. Pressure: "Basically same design" for pressure test means a pad-mounted transformer with tank volume within 30 percent of tank volume of transformer specified.
- B. Routine and Other Tests: IEEE C57.12.00. Routine and other tests shall be performed by manufacturer on each actual transformer(s) prepared for this project to ensure that design performance is maintained in production. Submit test reports, by serial number and receive approval before delivery of equipment to project site. Required tests and testing sequence shall be as follows:
1. Cold resistance measurements (provide reference temperature).
 2. Phase relation.
 3. Ratio.
 4. No-load losses (NLL) and excitation current.
 5. Load losses (LL) and impedance voltage.
 6. Dielectric
 - a. Impulse.
 - b. Applied voltage.
 - c. Induced voltage.
 7. Leak.
- C. Make completed transformer available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner and Architect/Engineer at least thirty (30) days before inspection is allowed.
- D. Allow witnessing of factory inspections and tests at manufacturer's test facility. Notify Owner and Architect/Engineer at least thirty (30) days before inspections and tests are scheduled.
- E. Provide minimum fifteen (15) calendar days' notice of any changes to schedule dates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify pads and supports are suitable for installation.

3.2 EXISTING WORK

- A. Disconnect and remove abandoned pad-mounted transformers. Cut abandoned raceway flush with surface of concrete pad.

- B. Clean and repair existing pad-mounted transformers to remain or to be reinstalled.

3.3 INSTALLATION

- A. Install in accordance with IEEE C57.94.
- B. Install plumb and level on concrete pad.
- C. Install safety labels in accordance with NEMA 260.
- D. Install engraved plastic nameplates in accordance with Section 26 05 53.
- E. Ground and bond substation in accordance with Section 26 05 26.
- F. Electrical installations shall conform to IEEE C2, NFPA 70, and to requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise.

3.4 GROUNDING

- A. NFPA 70 and IEEE C2, except that grounding systems shall have a resistance to solid earth ground not exceeding 5 ohms.

3.5 GROUNDING ELECTRODES

- A. Provide driven ground rods, minimum two, for ground loop around transformer pad. Connect ground conductors to upper end of ground rods by exothermic weld. Provide compression connectors at equipment end of ground conductors.

3.6 PAD-MOUNTED TRANSFORMER GROUNDING

- A. Provide separate copper grounding conductors into Primary and Secondary compartment of transformer and connect ground conductors to ground loop around transformer pad. When work in addition to that indicated or specified is required to obtain specified ground resistance, provision of contract covering "Changes" shall apply.

3.7 CONNECTIONS

- A. Make joints in grounding conductors and loops by exothermic welds.

3.8 GROUND AND BONDING EQUIPMENT

- A. UL 467, except as indicated or specified otherwise.

3.9 TRANSFORMER GROUNDING

- A. Provide a 1/0 bare copper-ground conductor around transformer pad. Ground conductor shall be buried one foot deep and placed 3 feet laterally from transformer enclosure. Connect ground conductor to enclosure at two places using 1/0 copper.

3.10 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES

- A. Mount transformer on concrete slab. Unless otherwise indicated, slab shall be at least 8 inches thick, reinforced with 6 by 6 - W2.9 by W2.9 mesh, placed uniformly 4 inches from top of slab. Slab shall be placed on a 6-inch-thick, well-compacted gravel base. Top of concrete slab shall be approximately 4 inches above finished grade. Edges above grade shall have 1/2-inch chamfer. Slab shall be of adequate size to project at least 8 inches beyond equipment.
- B. Stub up conduits, with bushings, 2 inches into cable wells in concrete pad. Coordinate dimensions of cable wells with transformer cable training areas.

3.11 FIELD QUALITY CONTROL

- A. Performance of Acceptance Checks and Tests: Perform in accordance with manufacturer's recommendations and include following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.
- B. Pad-Mounted Transformers:
 - 1. Visual and mechanical inspection
 - a. Compare equipment nameplate information with specifications and approved shop drawings.
 - b. Inspect physical and mechanical condition. Check for damaged or cracked insulators and leaks.
 - c. Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.
 - d. Verify correct liquid level in tanks.
 - e. Perform specific inspections and mechanical tests as recommended by manufacturer.
 - f. Verify correct equipment grounding.
 - g. Verify presence of transformer surge arresters.
 - 2. Electrical Tests
 - a. Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.
 - b. Perform insulation-resistance tests.
 - c. Perform turns-ratio tests.
 - d. Perform insulation power-factor/dissipation-factor tests on windings.
 - e. Sample insulating liquid. Sample shall be tested for:
 - 1) Dielectric breakdown voltage.
 - 2) Acid neutralization number.
 - 3) Specific gravity.
 - 4) Interfacial tension.
 - 5) Color.
 - 6) Visual condition.
 - 7) Water in insulating liquid.
 - 8) Measure dissipation factor or power factor.
 - f. Perform dissolved gas analysis (DGA).
 - g. Test for presence of PCB.
 - h. Verify that tap-changer is set at specified ratio.
 - i. Verify proper secondary voltage phase-to-phase and phase-to-neutral after energization and prior to loading.
 - j. Test for presence of PCB.
 - k. Verify that tap-changer is set at specified ratio.

1. Verify proper secondary voltage phase-to-phase and phase-to-neutral after energization and prior to loading.
- C. Grounding System:
1. Visual and mechanical inspection
 - a. Inspect ground system for compliance with Drawings and Specifications.
 2. Electrical tests
 - a. Perform ground-impedance measurements utilizing fall-of-potential method. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod, perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground testing megger in accordance with manufacturer's instructions to test each ground or group of grounds. Instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate ground value of ground rod or grounding systems under test.
 - b. Submit measured ground resistance of each ground rod and grounding system, indicating location of rod and grounding system. Include test method and test setup (i.e., pin location) used to determine ground resistance and soil conditions at time measurements were made.
- D. Follow-Up Verification
1. Upon completion of acceptance checks and tests, Contractor shall show by demonstration in service that circuits and devices are in good operating condition and properly performing intended function. As an exception to requirements stated elsewhere in contract, Architect/Engineer shall be given five (5) working days advance notice of dates and times of checking and testing.
- E. Section 26 00 00 – Basic Electrical Requirements: Testing and inspection services; and Division 01 - Execution Requirements: Testing, adjusting, and balancing.
- F. Inspect and test in accordance with NETA ATS, except Section 4.
- G. Perform inspections and tests listed in NETA ATS, Section 7.2. [Include following optional tests:
1. Power factor or dissipation-factor tests.
 2. Winding-resistance tests for each winding at [nominal] [final] tap setting.
 3. Individual excitation current tests on each phase.
 4. Insulating liquid specific gravity, power factor, water content, dissolved gas, and total combustible gas.
 5. Operational test and adjustments on fan and pump controls and alarm functions.
 6. Percent oxygen test on nitrogen gas blanket.
- 3.12 ADJUSTING
- A. Section 26 00 00 – Basic Electrical Requirements: Testing, adjusting, and balancing.
 - B. Adjust primary taps so secondary voltage is above and within 2 percent of rated voltage.

END OF SECTION 261200

SECTION 262200 - DRY TYPE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Dry Type General Purpose Transformers.
- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
 - 2. Section 26 00 00 – Basic Electrical Requirements.

1.2 REFERENCES

- A. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA ST 1 – Specialty Transformers (Except General Purpose Types).
 - 2. NEMA ST 20 - Dry Type Transformers for General Applications.
- B. International Electrical Testing Association (NETA):
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

- A. Product Data: Submit outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.
- B. Test Reports: Indicate loss data, efficiency at 25, 50, 75 and 100 percent rated load, and sound level.

1.4 CLOSEOUT SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for closeout submittals.
- B. Project Record Documents: Record actual locations of transformers.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years' experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products under provisions of Section 26 00 00 – Basic Electrical Requirements.
- B. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.

- C. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.1 GENERAL PURPOSE TRANSFORMERS

- A. Manufacturers:
 - 1. Square D.
 - 2. General Electric.
 - 3. Cutler-Hammer.
 - 4. Siemens.
 - 5. Equivalent as acceptable to Engineer.
- B. Product Description: NEMA ST 20, factory-assembled, air-cooled, dry type transformers, ratings as indicated on Drawings.
- C. Primary Voltage: Ratings indicated on Drawings.
- D. Secondary Voltage: Ratings indicated on Drawings.
- E. Insulation system shall be Class H or better and average winding temperature rise for rated kVA as follows:
 - 1. 1-15 kVA: Class 185 with 80/115 degrees C rise.
 - 2. 16-500 kVA: Class 220 with 80/115/150 degrees C rise.
- F. Case temperature: Do not exceed 35/40/50 degrees C rise above ambient at warmest point at full load.
- G. Winding Taps:
 - 1. Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
 - 2. Transformers 15 kVA and Larger: Two 2-1/2 percent taps above and two 2-1/2 percent taps below.
- H. Sound Levels: Maximum sound levels are as follows: (levels shown shall be measured at 5 feet from the transformer)
 - 1. 1-9 kVA: 40 dB.
 - 2. 10-50 kVA: 45 dB.
 - 3. 51-150 kVA: 50 dB.
 - 4. 151-300 kVA: 55 dB.
 - 5. 301-500 kVA: 60 dB.
 - 6. 501-700 kVA: 62 dB.
 - 7. 701-1000 kVA: 64 dB.
- I. Basic Impulse Level: 10 kV for transformers less than 300 kVA, 30 kV for transformers 300 kVA and larger.
- J. Ground core and coil assembly to enclosure by means of visible flexible copper grounding strap.

- K. Mounting:
 - 1. 1-15 kVA: Suitable for wall mounting.
 - 2. 16-75 kVA: Suitable for wall floor or trapeze mounting.
 - 3. Larger than 75 kVA: Suitable for floor or trapeze mounting.
- L. Cores shall be high grade, non-aging, sheet silicon steel laminations having core-plating insulation on both sides of each lamination.
- M. Coil Conductors: Continuous copper or aluminum windings with terminations brazed or welded. Cores shall be impregnated with non-hygroscopic varnish, and the coil/core shall be bolted to the bottom of the enclosure.
- N. Enclosure: NEMA ST 20, Type 1 Type 3R ventilated non-ventilated. Furnish lifting eyes or brackets.
- O. Isolate core and coil from enclosure using rubber vibration-absorbing mounts. No metal-to-metal contact shall occur between coil/core and enclosure.
- P. Metal Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise. Include manufacturer's name, serial number, type, class, kVA, voltage, frequency, and internal wiring diagram.
- Q. Overload capacity shall be not less than 15 percent for continuous operation for 115 degrees C rise transformers.
- R. Transformer primary and secondary shall be rated for use with copper feeder conductors.
- S. Transformer shall have a UL "K" rating of 4 minimum.
- T. Sizes as indicated on drawings.

2.2 BUCK-AND-BOOST TRANSFORMERS

- A. Product Description: NEMA ST 1, factory-assembled, dry type two winding buck and boost transformers, ratings as indicated on Drawings.
- B. Insulation system and average winding temperature rise for rated kVA as follows:
 - 1. 0.25-2 kVA: Class 185 with 80 degrees C rise.
 - 2. 3-7.5 kVA: Class 220 with 80/115 degrees C rise.
- C. Primary Voltage: As indicated on Drawings.
- D. Secondary Voltage: As indicated on Drawings.
- E. Mounting: Wall.
- F. Coil Conductors: Copper or aluminum Continuous windings.
- G. Lugs: Suitable for terminating conductors sized for full load ampacity of transformer unit when operating in buck-and-boost configuration shown.
- H. Enclosure: NEMA ST 1, Type 1.

- I. Isolate core and coil from enclosure using vibration-absorbing mounts.
- J. Nameplate: Include transformer connection data.

2.3 SOURCE QUALITY CONTROL

- A. Production test each unit according to NEMA ST20.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify mounting supports are properly sized and located including concealed bracing in walls.

3.2 EXISTING WORK

- A. Disconnect and remove abandoned transformers.
- B. Maintain access and adequate ventilation to existing transformers and other installations remaining active and requiring access and ventilation. Modify installation or provide access panel or ventilation grilles.
- C. Clean and repair existing transformers to remain or to be reinstalled.

3.3 INSTALLATION

- A. Set transformer plumb and level.
- B. Use flexible conduit, in accordance with Section 26 05 33 – Raceway and Boxes, 2-foot minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- C. Support transformers in accordance with Section 26 05 29 – Electrical Hangers and Supports.
 - 1. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by manufacturer.
 - 2. Mount floor-mounted transformers on vibration isolating pads suitable for isolating transformer noise from building structure. Floor mount on 3-1/2-inch-high concrete housekeeping pads.
 - 3. Mount trapeze-mounted transformers as indicated on Drawings.
- D. Provide seismic restraints.
- E. Install grounding and bonding in accordance with Section 26 05 26 – Grounding and Bonding.
- F. Touch up scratched or marred surfaces to match original finish.

3.4 FIELD QUALITY CONTROL

- A. Section 26 00 00 – Basic Electrical Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.

1. Prior to energization of transformers, check phase-to-phase and phase-to-ground insulation resistance levels.
2. Check transformers for continuity of circuits and for start circuits.
3. Prior to wire and cable hook-ups, energize transformers and demonstrate functioning.

C. Perform inspections and tests listed in NETA ATS, Section 7.2.1.

3.5 ADJUSTING

- A. Section 26 00 00 – Basic Electrical Requirements: Testing, adjusting, and balancing.
- B. Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION 262200

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SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Distribution Circuit Panelboards.
 - 2. Branch Circuit Panelboards.
 - 3. Electronic Grade Branch Circuit Panelboards.

- B. Related Sections:
 - 1. Applicable provisions of Section 26 00 00 – Basic Electrical Requirements shall govern all work under this Section.
 - 2. Section 26 00 00 – Basic Electrical Requirements.
 - 3. Section 26 05 26 - Grounding and Bonding.
 - 4. Section 26 05 53 - Electrical Identification.

1.2 REFERENCES

- A. Institute of Electrical and Electronic Engineers (IEEE):
 - 1. IEEE C62.41 – Recommended Practice on Surge Voltages in Low Voltage AC Power Circuits.

- B. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
 - 2. NEMA FU 1 – Low Voltage Cartridge Fuses.
 - 3. NEMA ICS 2 – Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
 - 4. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
 - 5. NEMA KS 1 – Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
 - 6. NEMA PB 1 - Panelboards.
 - 7. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

- C. International Electrical Testing Association (NETA):
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

- D. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.

- E. Underwriters Laboratories Inc. (UL):
 - 1. UL 67 - Safety for Panelboards.
 - 2. UL 1283 – Electromagnetic Interference Filters.
 - 3. UL 1449 – Transient Voltage Surge Suppressors.

1.3 SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker arrangement and sizes.
- C. Product Data: Submit catalog data showing specified features of standard products.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.
- B. Operation and Maintenance Data: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years' experience.

1.6 MAINTENANCE MATERIALS

- A. Furnish two of each panelboard key. Panelboards shall be keyed alike.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Do not store panelboards exposed to weather.
- B. Protect panelboards against damage from work of other trades.

PART 2 - PRODUCTS

2.1 DISTRIBUTION PANELBOARDS

- A. Manufacturers:
 - 1. Square D, I-line Series.
 - 2. GE Electrical.
 - 3. Siemens.
 - 4. Cutler-Hammer.
 - 5. Equivalent as acceptable to Engineer.
- B. Product Description: NEMA PB 1, circuit breaker type panelboard.
- C. Panelboard Bus: Copper, current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard. Bus shall be rated per panelboard schedule, 100 amp minimum.

- D. Minimum integrated short circuit rating: 10,000 amperes rms symmetrical for 240- or 208-volt panelboards; 22,000 amperes rms symmetrical for 480-volt panelboards, unless otherwise indicated on Drawings. Panels shall be fully rated; series rating is not acceptable.
- E. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type, circuit breakers with integral thermal and instantaneous magnetic trip handle for all poles. No handle ties of any sort will be approved. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
- F. Circuit Breaker Accessories: Trip units as indicated on Drawings.
- G. Enclosure: NEMA PB 1, Type 1 indoors, 3R outdoor and damp or wet locations, maximum 9.5 inches deep, 42 inches wide, cabinet box.
- H. Provide cabinet front with hinged door with flush lock. Front cover shall allow access to wiring gutters without removal of panel trim. Hinged trim shall be held in place with screw fasteners. Finish in manufacturer's standard gray enamel.
- I. Where indicated on drawings, provide TVSS unit mounted integral to panel. TVSS unit shall meet Section 26 35 53 requirements.

2.2 BRANCH CIRCUIT PANELBOARDS

- A. Manufacturers:
 - 1. Square D, NQOD or NF Series.
 - 2. GE Electrical.
 - 3. Siemens.
 - 4. Cutler-Hammer.
 - 5. Equivalent as acceptable to Engineer.
- B. Product Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.
- C. Panelboard Bus: Copper, current carrying components, ratings as indicated on Drawings, 100 amp minimum. Furnish copper ground bus in each panelboard.
- D. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 208-volt or 240-volt panelboards; 14,000 amperes rms symmetrical for 480-volt panelboards, unless otherwise indicated on Drawings. Panels shall be fully rated; series rating is not acceptable.
- E. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles; no handle ties of any sort will be approved. Type HACR for air conditioning equipment circuits, HID rated for high intensity discharge lighting systems, or as indicated on Drawings.
- F. Provide metal directory holders with clear plastic covers.
- G. Do not use tandem circuit breakers.
- H. Enclosure: NEMA PB 1, Type 1 indoors, Type 3R outdoors and damp or wet locations.
- I. Cabinet Box: 6 inches deep, 20 inches (508 mm) wide.

- J. Where indicated on drawings, provide TVSS units mounted integral to panel. TVSS unit shall meet Section 26 35 53 requirements.
- K. Furnish wiring gutters in accordance with NEC.
- L. Top or bottom feed as required.
- M. Furnish with branch breaker positions and nominal current rating as indicated on Drawings.
- N. Fronts:
 - 1. Dead front safety type.
 - 2. Door shall be built into panel front cover trim which allows access to breakers as well as to trim screw fasteners. Front cover construction with concealed trim screws and door hinges. Breaker access door shall have the following features:
 - a. Concealed piano hinge.
 - b. Flush stainless-steel cylinder tumbler type lock with spring loaded door pulls.
 - c. Locks keyed alike.
 - d. Code gauge steel with rust inhibiting primer and baked enamel finish.
- O. Circuit Directory:
 - 1. Suitable for complete descriptions.
 - 2. Clear plastic cover.
 - 3. Typewritten card, describing the loads served.
 - 4. Provide steel frame holder on inside cover of door to hold directory. Directory shall be covered with a sheet of clear plastic.

2.3 ELECTRONIC GRADE PANELBOARD

- A. Integral Surge Suppressor shall meet requirements of Section 26 35 53 – Voltage Regulators.
- B. Panelboard:
 - 1. Panelboard shall meet all requirements for Branch Circuit Panelboards with additional features listed below.
 - 2. UL 67 listed and TVSS device UL 1449 Component Recognized. TVSS device meets UL 1449. Furnish panelboard markings with clamp voltage at TVSS terminals and clamp voltage at panelboard line terminals.
 - 3. Provide interior with branch circuit breakers. Provide dedicated disconnect for TVSS.
 - 4. 200 percent rated copper neutral bus.

2.4 NAME PLATES

- A. Name Plates:
 - 1. Engraved, laminated plastic type.
 - 2. Letters 3/16-inch high minimum.
 - 3. White letters on black background.
 - 4. Verify panelboard designation with Owner's Representative.

PART 3 - EXECUTION

3.1 EXISTING WORK

- A. Maintain access to existing panelboard remaining active and requiring access. Modify installation or provide access panel.
- B. Clean and repair existing panelboards to remain or to be reinstalled.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's written instruction, applicable requirements of NEC, NECA's "Standard of Installation," NEMA PB1.1, and in accordance with recognized industry practices.
- B. Install flush or surface mounted as specified on drawings and schedules.
- C. Support panel cabinets independently to structure with no weight bearing on conduits.
- D. Install recessed panelboards to allow cover to be drawn tight against wall to provide neat appearance.
- E. Install surface mounted panelboard interior so there is no gap between the panelboard back-box and cover.
- F. Adjacent panel cabinets shall be of same size and mounted in horizontal alignment.
- G. Attach nameplates. Nameplates for panels in public areas shall be attached to the inside face of the cover. Nameplates for panels in equipment rooms and other non-public areas shall be attached to the outside face of the cover.
- H. Install panelboards plumb.
- I. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.
- J. Install filler plates for unused spaces in panelboards.
- K. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes to balance phase loads.
- L. Install engraved plastic nameplates in accordance with Section 26 05 53 – Electrical Identification.
- M. Install spare conduits out of each recessed panelboard to accessible location: (2) 1 inch to above ceiling, (2) 1 inch to floor below. Identify each as SPARE.
- N. Ground and bond panelboard enclosure according to Section 26 05 26 – Grounding and Bonding. Connect equipment ground bars of panels in accordance with NFPA 70.

3.3 FIELD QUALITY CONTROL

- A. Section 26 00 00 – Basic Electrical Requirements: Field inspecting, testing, adjusting, and balancing.

3.4 INSPECTION

- A. Examine area to receive new panelboards to assure adequate clearance for installation.
- B. Start work only after unsatisfactory conditions are corrected.
- C. Inspect and test in accordance with NETA ATS, except Section 4.
- D. Perform circuit breaker inspections and tests listed in NETA ATS, Section 7.6.

3.5 ADJUSTING

- A. Adjust doors and operating mechanisms for free mechanical movement.
- B. Tighten lugs and bus connections.
- C. Clean interior of panelboard.
- D. Sand, prime and paint scratched or marred surfaces to match original finish.
- E. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION 262416

SECTION 262716 - CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Section includes hinged cover enclosures, cabinets, terminal blocks, and accessories.
- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
 - 2. Section 26 00 00 – Basic Electrical Requirements.

1.2 REFERENCES

- A. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks.

1.3 SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.
- B. Product Data: Submit manufacturer's standard data for enclosures, cabinets, and terminal blocks.
- C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.

1.5 EXTRA MATERIALS

- A. Furnish under provisions of Section 26 00 00 – Basic Electrical Requirements.
- B. Furnish two of each key.

PART 2 - PRODUCTS

2.1 HINGED COVER ENCLOSURES

- A. Construction: NEMA 250, Type 1 3R 4 steel stainless steel fiberglass plastic enclosure.
- B. Covers: Continuous hinge, held closed by [flush latch operable by screwdriver key hasp and staple for padlock.

- C. Furnish interior plywood metal panel for mounting terminal blocks and electrical components; finish with white enamel.
- D. Enclosure Finish: Manufacturer's standard enamel None.

2.2 CABINETS

- A. Boxes: Galvanized steel with removable end walls.
- B. Box Size: 24 inches wide x inches high x 6 inches deep.
- C. Backboard: Furnish 3/4-inch thick plywood backboard for mounting terminal blocks. Paint with two coats of flat white paint.
- D. Fronts: Steel, flush surface type with concealed trim clamps, screw cover front, door with concealed hinge, and flush lock keyed to match branch circuit panelboard. Finish with gray baked enamel.
- E. Furnish metal barriers to form separate compartments wiring of different systems and voltages.
- F. Furnish accessory feet for free-standing equipment.

2.3 TERMINAL BLOCKS

- A. Terminal Blocks: NEMA ICS 4.
- B. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600-volts.
- C. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300-volts.
- D. Furnish ground bus terminal block, with each connector bonded to enclosure.

2.4 PLASTIC WIRE MANAGEMENT RACEWAY

- A. Product Description: Plastic channel with hinged or snap-on cover.

PART 3 - EXECUTION

3.1 EXISTING WORK

- A. Remove abandoned cabinets and enclosures, including abandoned cabinets and enclosures above accessible ceiling finishes. Patch surfaces.
- B. Maintain access to existing cabinets and enclosures and other installations remaining active and requiring access. Modify installation or provide access panel.
- C. Extend existing cabinets and enclosures using materials and methods compatible with existing electrical installations, or as specified.

- D. Clean and repair existing cabinets and enclosures to remain or to be reinstalled.

3.2 INSTALLATION

- A. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner in accordance with Section 26 05 29 – Electrical Hangers and Supports.
- B. Install cabinet fronts plumb.

3.3 CLEANING

- A. Section 26 00 00 – Basic Electrical Requirements: Requirements for cleaning.
- B. Clean electrical parts to remove conductive and harmful materials.
- C. Remove dirt and debris from enclosure.
- D. Clean finishes and touch up damage.

END OF SECTION 262716

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SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wall Switches.
 - 2. Wall Dimmers.
 - 3. Receptacles.
 - 4. Multi-Outlet Assembly.
 - 5. Occupancy Sensors.
 - 6. Device Plates.
 - 7. Decorative Box Covers.

- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
 - 2. Section 26 05 33 - Raceway and Boxes.
 - 3. Section 26 05 34 - Floor Boxes.
 - 4. Section 26 05 39 - Underfloor Raceway Assemblies.

1.2 REFERENCES

- A. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA WD 1 - General Requirements for Wiring Devices.
 - 2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.

- B. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

- C. Submit a Lighting Plan marked by manufacturer showing location, orientation and model number of occupancy sensors and power packs. Provide interconnecting wire diagrams and catalog cut sheets of occupancy sensors and power packs.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide all wiring device types from a single manufacturer.

1. Use of a manufacturer's name and model or catalog number is for purpose of establishing standard of quality and general configuration desired.
- B. Devices and Cover Plate Colors:
 1. Device colors shall be white, unless noted otherwise.
 2. Unless noted otherwise, receptacles and light switches controlling emergency or critical loads shall be red in color.
 3. Adjustments in device or cover plate color shall be made in the field without additional compensation.
- C. Unless otherwise indicated acceptable manufacturers are:
 1. Hubbell.
 2. Leviton.
 3. Arrow-Hart, Inc.
 4. Pass & Seymour.

2.2 WALL SWITCHES

- A. Switches:
 1. Single Pole Switch: 20 amps, 120-277-volt, specification grade, back or side wired equal to Hubbell cat. No. HBL1221.
 2. Double Pole Switch: 20-amp, 120-277-volt, specification grade, back or side wired equal to Hubbell cat. No. HBL1222.
 3. Three-way Switch: 20 amps, 120-277-volt, specification grade, back or side wired equal to Hubbell cat. No. HBL1223.
 4. Four-way Switch: 20 amps, 120-277-volt, specification grade, back or side wired equal to Hubbell cat. No. HBL1224.
 5. Pilot Light (lighted) - Single Pole Switch: 20-amp, 120-277-volt, specification grade, clear polycarbonate toggle, back or side wired equal to Hubbell cat. No. HBL1221ILC.
 6. Keyed Single Pole Switch: 20-amp, 120-277-volt, specification grade, back or side wired equal to Hubbell cat. No. HBL1221L. Provide owner with a minimum of 4 keys for switches.
 7. Momentary Contact Switch: 20-amp, 120-277-volt, specification grade, back or side wired, three positions, center off equal to Hubbell cat. No. HBL1557.

2.3 WALL DIMMERS

- A. Manufacturers:
 1. Leviton.
 2. Lutron.
 3. Pass & Seymour.
- B. Product Description: NEMA WD 1, Type I, semiconductor dimmer with ON-OFF switch independent of brightness setting for incandescent lamps.
- C. Body and Handle: Plastic with linear slide. Device colors shall be white unless noted otherwise.
- D. Voltage: 120/277 volts.
- E. Power Rating: Dimmers shall be derated 25 percent to allow next size larger lamp to be installed in lighting fixtures controlled by dimmer, 1000 watts minimum.

F. Accessory Wall Switch: Match dimmer appearance.

2.4 RECEPTACLES

A. General:

1. Receptacles shall be flush mounted.
2. Receptacles shall have full grounding straps and be suitable for side or side and back wiring.
3. Receptacles shall be Hubbell Nos. listed below or equal by approved manufacturer.
4. Unless noted otherwise, receptacles shall be 125-volt, 2-pole, 3 wire grounding.
5. Device colors shall be white, unless noted otherwise.

B. Receptacles

1. Single Convenience Receptacle Where a single receptacle is wired to a dedicated 20 ampere: heavy duty, specification grade, 20-amp, 125-volt, NEMA 5-20R Hubbell cat. No. HBL5361.
2. General use Duplex Convenience Receptacle: heavy duty, specification grade, 15-amp, 125 volt, NEMA 5-15R Hubbell cat. No. HBL5262.
3. Duplex Receptacle Where a single duplex receptacle is wired to a dedicated 20 ampere: heavy duty, specification grade, 20-amp, 125 volt, NEMA 5-20R Hubbell cat. No. 5362.
4. Tamper-Resistant: Commercial specification grade, 20-amp Duplex, 125-volt, NEMA 5-20R, Hubbell cat. No. BR20TR.
5. Weather-Resistant: Corrosion resistant heavy duty, specification grade, 20-amp duplex, 125-volt, NEMA 5-20R, HBL53CM62 (Color – Yellow)
6. GFCI Receptacle: heavy duty, specification grade, self-testing, 20-amp, 125-volt, NEMA 5-20R, UL 2006 compliant, Hubbell cat. No. GFST20.
7. Tamper-Resistant GFCI: Heavy duty commercial grade, 20-amp duplex, 125-volt, NEMA 5-20R, UL 2006 compliant, Hubbell cat. No. GFTR20.
8. Weather-Resistant GFCI: Extra heavy-duty grade, 20-amp duplex, 125-volt, NEMA 5-20R, UL 2006 compliant, Hubbell cat. No. GFR5362.
9. Hospital Use Receptacle: hospital grade, 20-amp, 125 volt, NEMA 5-20R Hubbell cat. No. HBL8300.
10. Clock receptacle: receptacle, clock hanger, and stainless-steel Hubbell Cat. No. HBL5235.
11. Isolated ground duplex receptacle: Orange, heavy duty, specification grade, 20-amp, 125-volt, NEMA 5-20R Hubbell cat. No. IG5362.

C. Weatherproof Cover Plate: Gasketed die cast metal plate with hinged and gasketed device covers. Cover shall allow cords to be plugged in and cover closed. Provide Intermatic WP1010MC for single duplex receptacles or WP1030MC for double (quad) duplex receptacles.

D. Receptacles fed from emergency circuits shall be red.

2.5 SPECIAL PURPOSE OUTLETS

A. Refer to “Special Outlet Schedule” on Drawings.

B. Electrical Contractor shall be responsible for coordinating the following items with actual equipment being furnished for the project prior to installation of outlet.

1. Exact location and orientation of outlet. Field coordinate location of outlet with Engineer/Architect’s field representative, location shall not be scaled off electrical drawings.
2. Electrical characteristics of equipment, including voltage, phasing, ampacity, etc.

3. Physical characteristics of termination, e.g. receptacle configuration, cord-and-plug versus hard-wired equipment, etc.

2.6 WALL PLATES

- A. Provide wall plates for wiring devices, with ganging and cutouts as indicated and with metal screws for securing plates to devices, screw heads colored to match finish of plate.
- B. Decorative Cover Plate for flush mounted devices: Smooth, 302 stainless steel.
- C. Device plates for surface mounted 4-inch square boxes; 1/2-inch raised galvanized steel covers.
- D. Do not use jumbo cover Plates.
- E. Weatherproof Cover Plate: Gasketed die cast metal plate with hinged and gasketed device covers. Cover shall allow cords to be plugged in and cover closed. Provide Intermatic WP1010MC for single duplex receptacles or WP1030MC for double (quad) duplex receptacles.

2.7 MULTIOUTLET ASSEMBLY

- A. Manufacturers:
 1. Wiremold.
 2. Hubbell.
 3. Panduit.
- B. Multi-outlet Assembly: Sheet metal channel with fitted cover, with pre-wired receptacles, suitable for use as multi-outlet assembly.
- C. Size: As indicated on Drawings.
- D. Receptacles: Furnish covers and accessories to accept convenience receptacles specified in this Section.
- E. Receptacles: NEMA WD 6, type 5-20R, duplex receptacle.
- F. Receptacle Spacing: As indicated on Drawings or as required.
- G. Receptacle Color: Coordinate with the Architect.
- H. Channel Finish: Ivory enamel.
- I. Fittings: Furnish manufacturer's standard couplings, elbows, outlet and device boxes, and connectors.

2.8 OCCUPANCY SENSORS

- A. General:
 1. Unit shall have a convenient means to bypass sensor in case of failure, so lighting can be operated manually.
 2. Unit shall be provided with a readily viable test LED to indicate when sensor detects motion.
 3. Sensor sensitivity and time delay shall be adjustable. Time delay shall be adjustable from 1 minute to 30 minutes at a minimum.

4. Unit shall be UL or ETL listed.
 5. Unit shall be provided with a 3-year warranty.
 6. Occupancy sensors may be infrared, ultrasonic or combination type. Chosen manufacturer shall provide optimum technology needed for each space where a sensor is shown.
- B. Manufacturers:
1. Watt Stopper.
 2. Leviton.
 3. MyTech.
 4. Hubbell.
- C. Dual Technology Wall Switch:
1. Sensor shall use passive infrared and ultrasonic detection method for detecting room occupancy. Unit shall fit in/on a standard single gang switch box and require only two wires and a grounded box for operation.
 2. Rated capacity: 1000 watts minimum at 120 volts, 60 Hz, 1200 watts minimum at 277 volts, 60 Hz for fluorescent lamps, larger size to accommodate load as shown on Drawings.
 3. Switch shall have manual on/off button.
 4. Area of coverage shall be 250 square feet minimum, greater range to accommodate room size as shown on Drawings.
 5. Model Watt Stopper: DSW-301 Series.
- D. Ceiling-Mounted Dual Technology Occupancy Sensor:
1. Sensor shall employ both infrared and ultrasonic sensing methods to detect room occupancy. Unit shall fit in/on a standard octagon box.
 2. Rated capacity shall be 20-amps at 120- or 277- volts, for fluorescent lamps.
 3. Area of coverage shall be adjustable. Unit shall be provided with a dip switch to allow either detection technology to be independently configured.
 4. Unit shall be provided with a dip switch to select one of five different sensing modes as dictated by environmental factors.
 5. Model: Watt Stopper: DT-300.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify outlet boxes are installed at proper height.
- B. Verify wall openings are neatly cut and completely covered by wall plates.
- C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

- A. Clean debris from outlet boxes.

3.3 EXISTING WORK

- A. Disconnect and remove abandoned wiring devices.

- B. Modify installation to maintain access to existing wiring devices to remain active.
- C. Clean and repair existing wiring devices to remain or to be reinstalled.

3.4 INSTALLATION

- A. Switches controlling equipment operation of which is not evident from switch position shall include pilot light in conjunction with proper switch.
- B. Each switch shall be complete with engraved plate to identify equipment being controlled. Provide black letters on clear background, 1/8-inch high, minimum.
- C. Do not install devices until after wall finishes have been completely applied.
- D. Any outlets installed prior to walls being finished and used for construction power shall be replaced at time of substantial completion.
- E. Install devices and wall plates plumb and level.
- F. Install switches with OFF position down.
- G. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- H. Do not share neutral conductor on load side of dimmers.
- I. Install receptacles with grounding pole on top.
- J. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.
- K. Route continuous green equipment grounding conductor with branch circuit conductors serving isolated ground receptacles. Terminate equipment ground on isolated ground bus in panelboards.
- L. Install emergency switches, which occur adjacent to normal light switches in separate boxes to maintain systems isolation in accordance with the NEC.
- M. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- N. Connect wiring devices by wrapping solid conductor around screw terminal. Install stranded conductor for branch circuits 10 AWG and smaller.
- O. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.
- P. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- Q. Do not use terminals on wiring devices (hot or neutral) for feed-through connections, looped or otherwise make circuit connections via wire connectors and pigtails.

- R. Provide a layer of electrical tape around perimeter sides of each wiring device so that terminations are insulated.
- S. Where GFI protected receptacles are indicated on Drawings, each receptacle indicated shall be a GFI receptacle. Standard receptacles protected with an upstream GFI receptacle shall not be approved.
- T. Provide arc-fault circuit interrupter (AFCI) for Branch Circuits feeding receptacles in dwelling unit bedrooms. AFCI protection may be provided by an AFCI receptacle or AFCI device in circuit breaker panel feeding dwelling unit bedrooms.
- U. Multiple or Special Switch Stations:
 - 1. Grouped local switches under common cover plate as scheduled or noted on the drawings. Provide pilot lights on all circuits remote from general area or exterior to building. Eight-gang plate maximum - where two plates are required, same shall be equal in size and located one above the other. Switch plates shall include an engraved, Bakelite nameplate to identify function of each switch. Nameplate shall be screwed in place.
- V. Occupancy Sensors:
 - 1. Install sensors within rooms in accordance with manufacturer's guidelines and recommendations.
 - 2. Infrared sensors shall be placed where they will have a direct line of sight to occupied areas.
 - 3. Ultrasonic sensors shall not be placed immediately adjacent to HVAC diffusers. High velocity air movement may result in nuisance tripping of sensor.

3.5 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under Section 26 05 33 – Raceway and Boxes to obtain mounting heights as indicated on Drawings.
- B. Coordinate installation of wiring devices with underfloor raceway service fittings provided under Section 26 05 39 – Underfloor Raceway Assemblies.
- C. Coordinate installation of wiring devices with floor box service fittings provided under Section 26 05 34 – Floor Boxes.

3.6 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect each wiring device for defects.
- C. Operate each wall switch with circuit energized and verify proper operation.
- D. Verify each receptacle device is energized.
- E. Test each receptacle device for proper polarity.
- F. Test each GFCI receptacle device for proper operation.
- G. Occupancy Sensors:

1. Sensitivity Test: After sensor has been energized for at least 15 minutes, walk to middle of room (if conference room) or sit at normal desk position (if an office). Make no motion for 20 seconds. Move one arm up and down slowly. Test LED should blink.
2. Time Delay Test: Set time delay for 10 minutes. Walk into room to activate sensor, then leave room. Sensor must turn lights off at approximately 10 minutes.

H. If a device fails to properly operate, replace at no extra charge to Owner.

3.7 ADJUSTING

- A. Devices and face plates on a common wall with common mounting heights shall be level and square to each other. Adjustments required after installation shall be made without additional compensation.
- B. Mark conductors with panel and circuit number serving device, at device.
- C. Mark panel and circuit number serving device on backside of device plate with a permanent marking system that does not show through front of plate.

3.8 CLEANING

- A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fuses.
- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
 - 2. Section 26 00 00 – Basic Electrical Requirements.

1.2 REFERENCES

- A. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA FU 1 - Low Voltage Cartridge Fuses.

1.3 DESIGN REQUIREMENTS

- A. Select fuses to provide appropriate levels of short circuit and over-current protection for the following components: wire, cable, bus structures, and other equipment. Design system to maintain component damage within acceptable levels during faults.
- B. Select fuses to coordinate with time current characteristics of other over-current protective elements, including other fuses, circuit breakers, and protective relays. Design system to maintain operation of device closest to fault operates.

1.4 FUSE PERFORMANCE REQUIREMENTS

- A. Main Service Switches Larger than 600 amperes: Class L, Bussmann low-peak or equivalent as acceptable to Engineer, bolt in, 200,000 ampere interrupting rating.
- B. Main Service Switches: Class RK1. Bussmann low-peak or equivalent as acceptable to Engineer, one-end rejection, 0-600-amp, 200,000 ampere interrupting rating.
- C. Load Feeder Switches Larger than 600 amperes: Class L. Bussmann low-peak or equivalent as acceptable to Engineer, bolt in, 200,000 ampere interrupting rating.
- D. Load Feeder Switches: Class RK1. Bussmann low-peak or equivalent as acceptable to Engineer, one-end rejection, 0-600-amp, 200,000 ampere interrupting rating.
- E. Motor Load Feeder Switches: Class RK1. Bussmann low-peak or equivalent as acceptable to Engineer, one-end rejection, 0-600-amp, 200,000 ampere interrupting rating.
- F. Motor and general-purpose Branch Circuits: Class RK1. Bussmann low-peak, LPS-R or equivalent as acceptable to Engineer, dual element, time delay with short circuit protection, 200,000 ampere interrupting rating.
- G. Lighting Branch Circuits: Class G.

H. Control Power Transformer Circuits: Class CC.

1.5 SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.
- B. Product Data: Submit data sheets showing electrical characteristics, including time-current curves.

1.6 CLOSEOUT SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for closeout submittals.
- B. Project Record Documents: Record actual sizes, ratings, and locations of fuses.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years' experience.

1.8 MAINTENANCE MATERIALS

- A. Section 26 00 00 – Basic Electrical Requirements: Spare parts and maintenance products.
- B. Furnish two fuse pullers.

1.9 EXTRA MATERIALS

- A. Section 26 00 00 – Basic Electrical Requirements: Requirements for extra materials.
- B. Furnish three spare fuses of each Class, size, and rating installed.

PART 2 - PRODUCTS

2.1 FUSES

- A. Manufacturers:
 - 1. Littlefuse.
 - 2. Cooper, Bussmann Division.
 - 3. Mersen.
 - 4. Equivalent as acceptable to Engineer.
- B. Dimensions and Performance: NEMA FU 1, Class as specified or as indicated on Drawings.
- C. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.2 SPARE FUSE CABINET

- A. Manufacturers:
 - 1. B-Line.
 - 2. Ferraz-Shawmut.

3. Unity Mfg.
 4. Equivalent as acceptable to Engineer.
- B. Product Description: Wall-mounted sheet metal cabinet with shelves, suitably sized to store spare fuses and fuse pullers specified.
 - C. Doors: Hinged, with hasp for Owner's padlock.
 - D. Finish: Gray enamel.

PART 3 - EXECUTION

3.1 EXISTING WORK

- A. Remove fuses from abandoned circuits.
- B. Maintain access to existing fuses and other installations remaining active and requiring access. Modify installation or provide access panel.

3.2 INSTALLATION

- A. Install fuse with label oriented so manufacturer, type, and size are easily read.
- B. Install spare fuse cabinet as indicated on Drawings.

END OF SECTION 262813

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SECTION 262819 - ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fusible and Non-fusible switches.
- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
 - 2. Section 26 28 13 - Fuses.

1.2 REFERENCES

- A. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA FU 1 - Low Voltage Cartridge Fuses.
 - 2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- B. International Electrical Testing Association (NETA):
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements and Division 01 – General Requirements: Procedures for submittals.
- B. Product Data: Submit switch ratings and enclosure dimensions.

1.4 CLOSEOUT SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements and Division 01 – General Requirements: Procedures for closeout submittals.
- B. Project Record Documents: Record actual locations of enclosed switches and ratings of installed fuses.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years' experience.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCH ASSEMBLIES

- A. Manufacturers:

1. Square D.
 2. Cutler Hammer/Eaton.
 3. Siemens.
 4. General Electric.
- B. Product Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Provide means to temporarily override interlock and allow door to be opened with switch on.
- C. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.
- D. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
1. Interior Dry Locations: Type 1.
 2. Exterior Locations: Type 3R.
 3. Wet Locations: Type 4.
- E. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.
- F. Furnish switches with entirely copper current carrying parts.
- G. Provide ANSI/UL Class RK1, dual element, time delay, 600-volt fuses in disconnect switches, sized as shown on drawings.
- H. Quick make and break operator mechanism.
- I. Handle attached to box, not cover.
- J. Handle position indication, ON in up position and OFF in down position.
- K. Padlock provisions for up to three padlocks in OFF position.
- L. UL listed lugs for type and size of wire specified.
- M. Spring reinforced fuse clips for Type R fuses.
- N. Provisions for insulated or grounded neutral.
- 2.2 NONFUSIBLE SWITCH ASSEMBLIES
- A. Same requirements as for fusible switches except that provisions for fuses are to be omitted.
- 2.3 ELEVATOR DISCONNECT SWITCHES
- A. Disconnect switches associated with elevator feeder circuits shall have additional features designed to facilitate code required interface between fire alarm system devices and elevator operations.
- B. Ampacity shall be equal to or greater than the feeder overcurrent device amp rating.
- C. Integral control transformer with primary voltage compatible with elevator feeder voltage.

- D. Shunt trip disconnect switch.
- E. Provide wiring between disconnect and addressable fire alarm control module. Control module will change state to initiate elevator shunt trip. Shunt trip will be a function of the elevator disconnect switch.
- F. Fuses sized per elevator manufacturer's requirements.
- G. Red LED Pilot light.
- H. Relay to be used to monitor shunt trip voltage.
- I. NEMA type 1 enclosure.
- J. Basis of Design is Bussman PS series elevator disconnect.

2.4 SWITCH RATINGS

- A. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.
- B. Short Circuit Current Rating: UL listed for 200,000 rms symmetrical amperes when used with or protected by Class R fuses (30-600 ampere switches employing appropriate fuse rejection schemes).

PART 3 - EXECUTION

3.1 EXISTING WORK

- A. Disconnect and remove abandoned enclosed switches.
- B. Maintain access to existing enclosed switches and other installations remaining active and requiring access. Modify installation or provide access panel.
- C. Clean and repair existing enclosed switches to remain or to be reinstalled.

3.2 INSTALLATION

- A. Provide disconnect switches for loads as required by code. Review HVAC and Plumbing specifications to determine what equipment is furnished with disconnect switches.
- B. Install all loose disconnect switches whether furnished under this contract or not. "Loose" switches are defined as those that are not integral to a piece of equipment and are not installed by the equipment manufacturer.
- C. Electrical Contractor shall determine need for a disconnect switch requirements for each specific load.
- D. Contractor shall include in their bid all disconnect switches required whether indicated on the drawings or not.
- E. Install enclosed switches plumb.

- F. Height: 5 feet to operating handle.
- G. Install fuses for fusible disconnect switches. Refer to Section 26 28 13 - Fuses for product requirements.
- H. Install engraved plastic nameplates in accordance with Section 26 05 53 – Electrical Identification.
- I. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.
- J. Install in accordance with manufacturer’s written instructions, applicable requirements of NEC and NECA’s “Standard of Installation,” and in accordance with recognized industry practices.
- K. Locate disconnect switches as shown on drawings or as required by NEC.
- L. Install on equipment support where feasible, or anchor firmly to wall or structural surface.
- M. Provide control circuit interlock as required by NEC.

3.3 ADJUSTMENT

- A. Adjust covers and operating mechanism for free mechanical movement.
- B. Verify overcurrent protection to provide proper operation and compliance with NEC.
- C. Tighten wire and cable connections.
- D. Clean interior of enclosure.
- E. Touch up scratched or marred surfaces to match original finish.

3.4 FIELD QUALITY CONTROL

- A. Section 26 00 00 – Basic Electrical Requirements and Division 01 – General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA Acceptance Testing Specifications.

END OF SECTION 262819

SECTION 262823 - ENCLOSED CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Molded-case Circuit Breakers.
 - 2. Insulated-case Circuit Breakers.
 - 3. Individual Enclosures.

- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
 - 2. Section 26 00 00 – Basic Electrical Requirements.
 - 3. Section 26 05 29 – Electrical Hangers and Supports.
 - 4. Section 26 05 53 - Electrical Identification.

1.2 REFERENCES

- A. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.

- B. International Electrical Testing Association (NETA):
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.

- B. Product Data: Submit catalog sheets showing ratings, trip units, time current curves, dimensions, and enclosure details.

1.4 CLOSEOUT SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for closeout submittals.

- B. Project Record Documents: Record actual locations and continuous current ratings of enclosed circuit breakers.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

1.6 EXTRA MATERIALS

- A. Furnish extra materials under provisions of Section 26 00 00 – Basic Electrical Requirements.

- B. Furnish three of each size and type of current limiter.

PART 2 - PRODUCTS

2.1 MOLDED CASE CIRCUIT BREAKER

- A. Manufacturers:
 - 1. Equivalent as acceptable to Engineer.
- B. Product Description: Enclosed, molded-case circuit breaker conforming to NEMA AB 1, suitable for use as service entrance equipment where applied.
- C. Service Conditions:
 - 1. Temperature: degrees F.
 - 2. Altitude: feet.
- D. Field-Adjustable Trip Circuit Breaker: Circuit breakers with frame sizes 200 amperes and larger have mechanism for adjusting long time short time continuous current short time long time pickup current setting for automatic operation. Range of Adjustment: seconds. amperes. percent.
- E. Field-Changeable Ampere Rating Circuit Breaker: Circuit breakers with frame sizes 200 amperes and larger have changeable trip units.
- F. Current Limiting Circuit Breaker: Circuit breaker indicated as current-limiting have automatically-resetting current limiting elements in each pole. Let-through Current and Energy: Less than permitted for same size Class RK-5 fuse.
- G. Solid-State Circuit Breaker: Electronic sensing, timing, and tripping circuits for adjustable current settings; ground fault trip with [integral ground fault sensing zero sequence type ground fault sensor; instantaneous trip; and adjustable short time trip.
- H. Current Limiter: Designed for application with molded case circuit breaker.
 - 1. Coordinate limiter size with trip rating of circuit breaker to prevent nuisance tripping and to achieve interrupting current rating specified for circuit breaker.
 - 2. Interlocks trip circuit breaker and prevent closing circuit breaker when limiter compartment cover is removed or when one or more limiter is not in place or has operated.
- I. Accessories: As indicated on Drawings. Conform to NEMA AB 1.
 - 1. Shunt Trip Device: 120 volts, AC DC.
 - 2. Undervoltage Trip Device: 120 volts, AC DC.
 - 3. Auxiliary Switch: 120 volts, AC DC.
 - 4. Alarm Switch: 120 volts, AC DC.
 - 5. Electrical Operator: 120 volts, AC DC.
 - 6. Handle Lock: Provisions for sealing padlocking.
 - 7. [Insulated] Grounding Lug: In each enclosure.
- J. Enclosure: NEMA AB 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel aluminum gray polyester plastic stainless steel.
 - 1. Interior Dry Locations: Type 1.
 - 2. Exterior Locations: Type 3R/4
 - 3. Industrial Locations: Type 4 4X 5 12 12K.
 - 4. Locations: Type.

- K. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.
- L. Multi-phase circuit breakers shall have single handle trips for all phases. Handle ties or other field installed common trip hardware is not permitted.

2.2 INSULATED CASE CIRCUIT BREAKER

- A. Manufacturers:
 - 1. Equivalent as acceptable to Engineer.
- B. Product Description: Enclosed, insulated-case circuit breaker conforming to NEMA AB 1, suitable for use as service entrance equipment where applied.
- C. Service Conditions:
 - 1. Temperature: degrees F.
 - 2. Altitude: feet above sea level.
- D. Trip Unit: Electronic sensing, timing, and tripping circuits for adjustable current settings; ground fault trip with [integral ground fault sensing zero sequence type ground fault sensor; instantaneous trip; and adjustable short time trip.
- E. Accessories: As indicated on Drawings. Conform to NEMA AB 1.
 - 1. Shunt Trip Device: 120 volts, AC DC.
 - 2. Undervoltage Trip Device: 120 volts, AC DC.
 - 3. Auxiliary Switch: 120 volts, AC DC
 - 4. Alarm Switch: 120 volts, AC DC.
 - 5. Electrical Operator: 120 volts, AC DC.
 - 6. Handle Lock: Provisions for sealing padlocking.
 - 7. Insulated Grounding Lug: In each enclosure.
- F. Enclosure: NEMA AB 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel aluminum gray polyester plastic stainless steel.
 - 1. Interior Dry Locations: Type 1.
 - 2. Exterior Locations: Type 3R/4.
 - 3. Industrial Locations: Type 4 4X 5 12 12K.
 - 4. Locations: Type.
- G. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.
- H. Multi-phase circuit breakers shall have single handle trips for all phases. Handle ties or other field installed common trip hardware is not permitted.

PART 3 - EXECUTION

3.1 EXISTING WORK

- A. Disconnect and remove abandoned enclosed circuit breakers.

- B. Maintain access to existing enclosed circuit breakers and other installations remaining active and requiring access. Modify installation or provide access panel.
- C. Clean and repair existing enclosed circuit breakers to remain or to be reinstalled.

3.2 INSTALLATION

- A. Install enclosed circuit breakers plumb. Provide supports in accordance with Section 26 05 29 – Electrical Hangers and Supports.
- B. Height: 5 feet to operating handle.
- C. Locate and install engraved plastic nameplates in accordance with Section 26 05 53 – Electrical Identification.

3.3 FIELD QUALITY CONTROL

- A. Section 26 00 00 – Basic Electrical Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1.

3.4 ADJUSTING

- A. Section 26 00 00 – Basic Electrical Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Adjust trip settings to coordinate circuit breakers with other overcurrent protective devices in circuit.
- C. Adjust trip settings to provide adequate protection from overcurrent and fault currents.

END OF SECTION 262823

SECTION 262913 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manual Motor Controllers.
 - 2. Magnetic Motor Controllers.
 - 3. Individual Enclosures.
- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
 - 2. Section 26 00 00 - Basic Electrical Requirements.
 - 3. Section 26 05 29 – Electrical Hangers and Supports.
 - 4. Section 26 28 13 - Fuses.

1.2 REFERENCES

- A. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
 - 2. NEMA FU 1 - Low Voltage Cartridge Fuses.
 - 3. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
 - 4. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
 - 5. NEMA ICS 6 - Industrial Control and Systems: Enclosures.
 - 6. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- B. International Electrical Testing Association (NETA):
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

- A. Section 26 00 00 - Basic Electrical Requirements: Procedures for submittals.
- B. Product Data: Submit catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
- C. Test Reports: Indicate field test and inspection procedures and test results.

1.4 CLOSEOUT SUBMITTALS

- A. Section 26 00 00 - Basic Electrical Requirements: Procedures for closeout submittals.
- B. Project Record Documents: Record actual locations and ratings of enclosed controllers.
- C. Operation and Maintenance Data: Submit Replacement parts list for controllers.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years' experience.

PART 2 - PRODUCTS

2.1 MANUAL MOTOR CONTROLLER

- A. Manufacturers:
 - 1. Square D.
 - 2. Rockwell-Automation.
 - 3. Cutler-Hammer.
 - 4. General Electric.
 - 5. Equivalent as acceptable to Engineer.
- B. Product Description: NEMA ICS 2, AC general-purpose, Class A, manually operated, full-voltage controller with overload element, NO auxiliary contact, and toggle operator.
- C. Enclosure: NEMA ICS 6, Type 1 indoors, unless otherwise noted.
- D. Starter inoperative, unless thermal unit is in position.
- E. Provision for padlocking in the "off" position.
- F. NEMA standards for size and horsepower rating.
- G. Provisions for resetting starter after overloads trip the starter. Overload shall not automatically reset.

2.2 FRACTIONAL-HORSEPOWER MANUAL CONTROLLER

- A. Manufacturers:
 - 1. Square D.
 - 2. Rockwell-Automation.
 - 3. Cutler-Hammer.
 - 4. General Electric.
 - 5. Equivalent as acceptable to Engineer.
- B. Product Description: NEMA ICS 2, AC general-purpose, Class A, manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, and toggle operator.
- C. Enclosure: NEMA ICS 6, Type 1 indoors, unless otherwise noted.
- D. Starter inoperative, unless thermal unit is in position.
- E. Provision for padlocking in the "off" position.
- F. NEMA standards for size and horsepower rating.

- G. Provisions for resetting starter after overloads trip the starter.

2.3 MOTOR STARTING SWITCH

- A. Manufacturers:
 - 1. Square D.
 - 2. Rockwell-Automation.
 - 3. Cutler-Hammer.
 - 4. General Electric.
 - 5. Equivalent as acceptable to Engineer.
- B. Product Description: NEMA ICS 2, AC general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, without thermal overload unit, with toggle operator.
- C. Enclosure: NEMA ICS 6, Type 1 indoors, unless otherwise noted.

2.4 FULL-VOLTAGE NON-REVERSING CONTROLLERS

- A. Manufacturers:
 - 1. Square D.
 - 2. Rockwell-Automation.
 - 3. Cutler-Hammer.
 - 4. General Electric.
 - 5. Equivalent as acceptable to Engineer.
- B. Product Description: NEMA ICS 2, AC general-purpose Class A magnetic or solid-state controller for induction motors rated in horsepower.
- C. Overload Relay: NEMA ICS 2.
- D. Product Features:
 - 1. Cover Mounted Pilot Devices: NEMA ICS 5, heavy duty oiltight type as indicated in specification and on drawings.
 - 2. Pilot Device Contacts: NEMA ICS 5, Form Z, rated A150.
 - 3. Pushbuttons: Flush type as indicated in specification and on drawings.
 - 4. Indicating Lights: Transformer type as indicated on specification and on drawings.
 - 5. Selector Switches: Rotary type.
 - 6. Relays: NEMA ICS 2.
 - 7. Control Power Transformers.
- E. Combination Controllers: Combine motor controllers with disconnect in common enclosure, using motor circuit protector conforming to NEMA AB 1, with integral instantaneous magnetic trip in each pole. Obtain IEC Class 2 coordinated component protection.
- F. Combination Controllers: Combine motor controllers with disconnect in common enclosure, using fusible switch conforming to NEMA KS 1, enclosed knife switch with externally operable handle. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses. Obtain IEC Class 2 coordinated component protection.
- G. Starter inoperative, unless thermal unit is in position.

- H. Provision for padlocking in the “off” position.
- I. Green pilot light to indicate when motor is running.
- J. NEMA standards for size and horsepower rating.
- K. Provisions for resetting starter after overloads trip the starter. Overloads shall not automatically reset.
- L. Enclosure: NEMA ICS 6, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
 - 1. Interior Dry Locations: Type 1.
 - 2. Exterior Locations: Type 3R.
 - 3. Wet Locations: Type 4.

2.5 TWO-SPEED CONTROLLERS

- A. Manufacturers:
 - 1. Square D.
 - 2. Rockwell-Automation.
 - 3. Cutler-Hammer.
 - 4. General Electric.
 - 5. Equivalent as acceptable to Engineer.
- B. Product Description: NEMA ICS 2, AC general-purpose Class A magnetic or solid-state controller for induction motors rated in horsepower. Include integral time delay transition between FAST and SLOW speeds.
- C. Overload Relay: NEMA ICS 2.
- D. Product Features:
 - 1. Cover Mounted Pilot Devices: NEMA ICS 5, heavy duty oiltight type as indicated in specification and on drawings.
 - 2. Pilot Device Contacts: NEMA ICS 5, Form Z, rated A150.
 - 3. Pushbuttons: Flush type as indicated in specification and on drawings.
 - 4. Indicating Lights: Transformer type as indicated on specification and on drawings.
 - 5. Selector Switches: Rotary type.
 - 6. Relays: NEMA ICS 2.
 - 7. Control Power Transformers.
- E. Combination Controllers: Combine motor controllers with disconnect in common enclosure, using motor circuit protector conforming to NEMA AB 1, with integral instantaneous magnetic trip in each pole. Obtain IEC Class 2 coordinated component protection.
- F. Combination Controllers: Combine motor controllers with disconnect in common enclosure, using fusible switch conforming to NEMA KS 1, enclosed knife switch with externally operable handle. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses. Obtain IEC Class 2 coordinated component protection.
- G. Starter inoperative, unless thermal unit is in position.

- H. Provision for padlocking in the “off” position.
- I. Green pilot light to indicate when motor is running.
- J. NEMA standards for size and horsepower rating.
- K. Provisions for resetting starter after overloads trip the starter. Overloads shall not automatically reset.
- L. Enclosure: NEMA ICS 6, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
 - 1. Interior Dry Locations: Type 1.
 - 2. Exterior Locations: Type 3R.
 - 3. Wet Locations: Type 4.

2.6 FULL-VOLTAGE REVERSING CONTROLLERS

- A. Manufacturers:
 - 1. Square D.
 - 2. Rockwell-Automation.
 - 3. Cutler-Hammer.
 - 4. General Electric.
 - 5. Equivalent as acceptable to Engineer.
- B. Product Description: NEMA ICS 2, AC general-purpose Class A magnetic or solid-state controller for induction motors rated in horsepower. Include electrical interlock [and integral time delay transition] between FORWARD and REVERSE rotation.
- C. Overload Relay: NEMA ICS 2.
- D. Product Features:
 - 1. Cover Mounted Pilot Devices: NEMA ICS 5, heavy duty oiltight type as indicated in specification and on drawings.
 - 2. Pilot Device Contacts: NEMA ICS 5, Form Z, rated A150.
 - 3. Pushbuttons: Flush type as indicated in specification and on drawings.
 - 4. Indicating Lights: Transformer type as indicated on specification and on drawings.
 - 5. Selector Switches: Rotary type.
 - 6. Relays: NEMA ICS 2.
 - 7. Control Power Transformers.
- E. Combination Controllers: Combine motor controllers with disconnect in common enclosure, using motor circuit protector conforming to NEMA AB 1, with integral instantaneous magnetic trip in each pole. Obtain IEC Class 2 coordinated component protection.
- F. Combination Controllers: Combine motor controllers with disconnect in common enclosure, using fusible switch conforming to NEMA KS 1, enclosed knife switch with externally operable handle. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses. Obtain IEC Class 2 coordinated component protection.
- G. Starter inoperative, unless thermal unit is in position.

- H. Provision for padlocking in "off" position.
- I. Green pilot light to indicate when motor is running.
- J. NEMA standards for size and horsepower rating.
- K. Provisions for resetting starter after overloads trip the starter. Overloads shall not automatically reset.
- L. Enclosure: NEMA ICS 6, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
 - 1. Interior Dry Locations: Type 1.
 - 2. Exterior Locations: Type 3R.
 - 3. Wet Locations: Type 4.

2.7 OVERLOAD RELAY - GENERAL APPLICATION

- A. One-piece thermal unit construction.
- B. One bi-metallic or melting alloy type overload relay per phase, manually reset.
- C. Interchangeable thermal units.
- D. Thermal units must be in place to operate starter.
- E. Replaceable overload relay circuit contacts.
- F. Trip at 6 times FLA in 20 seconds.

2.8 OVERLOAD RELAY - SUBMERSIBLE PUMPS AND HERMETICALLY SEALED MOTORS

- A. One-piece thermal unit construction.
- B. One bi-metallic or melting alloy type overload relay per phase, manually reset.
- C. Interchangeable thermal units.
- D. Thermal units must be in place to operate starter.
- E. Replaceable overload relay circuit contacts.
- F. Trip at 6 times LRA in 3-5 seconds.

2.9 NEMA STANDARDS FOR SIZE AND HORSEPOWER RATINGS

- | | | |
|--------------|---------------|---------------|
| A. NEMA Size | Max HP @ 208V | Max HP @ 480V |
|--------------|---------------|---------------|

1	7.5	10
2	10	25
3	25	50
4	40	100
5	75	200
6	150	400

B. NEMA Size 1 minimum, or as noted on drawings.

2.10 CONTROL CIRCUITS (FOR MAGNETIC OR SOLID-STATE CONTROLLERS)

- A. Provide a control transformer mounted in starter enclosure. Verify the control voltage required with the temperature control contractor.
- B. Two fuses on control transformer primary side and single fuse on secondary line. Provide Class CC type fuses.
- C. One secondary line grounded.
- D. Transformer sized for device, accessories connected there to and 25% extra capacity minimum.
- E. Coil Operating Voltage: 120 volts, 60 hertz, unless otherwise noted.

2.11 ACCESSORIES (FOR MAGNETIC OR SOLID-STATE CONTROLLERS)

- A. Overload reset button mounted in enclosure cover.
- B. Heavy duty, oil-tight, green “running” light mounted in enclosure cover.
- C. Heavy duty, oil-tight, Hand-Off-Auto selector switch mounted in enclosure cover.
- D. Furnish two normally open and one normally closed field convertible auxiliary contacts in each starter.

PART 3 - EXECUTION

3.1 EXISTING WORK

- A. Disconnect and remove abandoned enclosed motor controllers.
- B. Maintain access to existing enclosed motor controllers and other installations to remain active and to require access. Modify installation or provide access panel.
- C. Clean and repair existing enclosed motor controllers to remain or to be reinstalled.

3.2 INSTALLATION

- A. Install enclosed controllers plumb. Provide supports in accordance with Section 26 05 29 – Electrical Hangers and Supports.

- B. Height: 5 feet to operating handle.
- C. Install fuses for fusible switches. Refer to Section 26 28 13 - Fuses for product requirements.
- D. Select and install overload heater elements in motor controllers to match installed motor characteristics.
- E. Install engraved plastic nameplates. Refer to Section 26 05 53 – Electrical Identification for product requirements and location.
- F. Neatly type label and place inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place label in clear plastic holder.
- G. Motor starters shall be furnished by Contractor supplying motor requiring a starter, unless otherwise noted.
- H. Contractor shall check drawings and specifications of other trades to determine requirements for motor disconnect switches. Electrical Contractor shall provide, where required by Code and for motors out of sight of the controller, all disconnect switches not specifically supplied by others.
- I. Motors shall be set in place by others and associated motor starters and controllers shall be turned over to Electrical Contractor for installation.
- J. Any contractor supplying starters and controllers shall index same and provide Electrical Contractor with written instructions as to proper location in sufficient time to permit installation of a concealed raceway system.
- K. Review HVAC and plumbing specifications and provide all line voltage wiring and connections to controls and auxiliary equipment specified as to be provided by Electrical Contractor or Division 26.
- L. Verify proper rotation of each motor as it is being wired or before motor is energized for any reason.

3.3 FIELD QUALITY CONTROL

- A. Section 26 00 00 – Basic Electrical Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.16.1.

END OF SECTION 262913

SECTION 262916 - ENCLOSED CONTACTORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Enclosed Contactors for Lighting and General Purposes.

B. Related Sections:

1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
2. Section 26 00 00 - Basic Electrical Requirements.
3. Section 26 05 29 – Electrical Hangers and Supports.
4. Section 26 28 13 - Fuses.

1.2 REFERENCES

A. National Electrical Manufacturers Association (NEMA):

1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
2. NEMA FU 1 - Low Voltage Cartridge Fuses.
3. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
4. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
5. NEMA ICS 6 - Industrial Control and Systems: Enclosures.
6. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

B. International Electrical Testing Association (NETA):

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.

B. Product Data: Submit dimensions, size, voltage ratings and current ratings.

1.4 CLOSEOUT SUBMITTALS

A. Section 26 00 00 – Basic Electrical Requirements: Procedures for closeout submittals.

B. Project Record Documents: Record actual locations and ratings of enclosed contactors.

C. Operation and Maintenance Data: Submit instructions for replacing and maintaining coil and contacts.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

PART 2 - PRODUCTS

2.1 GENERAL PURPOSE CONTACTORS

- A. Manufacturers:
 - 1. Equivalent as acceptable to Engineer.
- B. Product Description: NEMA ICS 2, AC general purpose magnetic contactor.
- C. Coil operating voltage: 120 480 volts, 60 Hertz.
- D. Poles: To match circuit configuration and control function.
- E. Product Features:
 - 1. Cover Mounted Pilot Devices: NEMA ICS 5, standard-duty heavy-duty oiltight type with Form Z contacts, rated A150.
 - 2. Pushbutton: ON/OFF function, with unguarded recessed shrouded shielded covered lockable configuration.
 - 3. Selector Switch: ON/OFF ON/OFF/AUTOMATIC function, with rotary action.
 - 4. Indicating Light: RED GREEN lens, transformer resistor type, with incandescent led neon lamp.
 - 5. Auxiliary Contacts: One, normally open normally closed field convertible in addition to seal-in contact.
 - 6. Relays: NEMA ICS 2.
 - 7. Control Power Transformers: 120 volt secondary, VA minimum, in each enclosed contactor. Furnish fused [primary and] secondary, and bond unfused leg of secondary to enclosure.
- F. Combination Contactors: Combine contactors with thermal magnetic circuit breaker conforming to NEMA AB 1, with integral thermal and instantaneous magnetic trip in each pole.
- G. Combination Contactors: Combine contactors with enclosed knife switch conforming to NEMA KS 1, with externally operable handle and fuse clips designed to accommodate NEMA FU 1, Class R/J fuses.
- H. Enclosure: NEMA ICS 6, to meet conditions. Fabricate enclosure from [steel finished with manufacturer's standard gray enamel aluminum gray plastic].
 - 1. Interior Dry Locations: Type 1.
 - 2. Exterior Locations: Type 3R/4
 - 3. Locations: Type.

2.2 LIGHTING CONTACTORS

- A. Manufacturers:
 - 1. Equivalent as acceptable to Engineer.
- B. Product Description: NEMA ICS 2, magnetic lighting contactor.
- C. Configuration: Electrically held Mechanically held, 2/3 wire control.
- D. Coil operating voltage: 120/480 volts, 60 Hertz.

- E. Poles: To match circuit configuration and control function.
- F. Contact Rating: Match branch circuit overcurrent protection, considering derating for continuous loads.
- G. Accessories:
 - 1. Cover Mounted Pilot Devices: NEMA ICS 5, standard-duty heavy-duty oiltight type with Form Z contacts, rated A150
 - 2. Pushbutton: ON/OFF function, with unguarded recessed shrouded shielded covered lockable configuration.
 - 3. Selector Switch: ON/OFF ON/OFF/AUTOMATIC function, with rotary action.
 - 4. Indicating Light: RED GREEN lens, transformer resistor type, with incandescent led neon lamp.
 - 5. Auxiliary Contacts: One, normally open normally closed field convertible in addition to seal-in contact.
 - 6. Relays: NEMA ICS 2.
 - 7. Control Power Transformers: 120 volt secondary, VA minimum, in each enclosed contactor. Furnish fused primary and secondary, and bond unfused leg of secondary to enclosure.
- H. Combination Contactors: Combine contactors with thermal magnetic circuit breaker conforming to NEMA AB 1, with integral thermal and instantaneous magnetic trip in each pole.
- I. Combination Contactors: Combine contactors with enclosed knife switch conforming to NEMA KS 1, with externally operable handle and fuse clips designed to accommodate NEMA FU 1, Class R/J fuses.
- J. Enclosure: NEMA ICS 6, to meet conditions. Fabricate enclosure from [steel finished with manufacturer's standard gray enamel aluminum gray plastic].
 - 1. Interior Dry Locations: Type 1.
 - 2. Exterior Locations: Type 3R/4
 - 3. Locations: Type.

PART 3 - EXECUTION

3.1 EXISTING WORK

- A. Disconnect abandoned enclosed contactors and remove abandoned enclosed contactors.
- B. Maintain access to existing enclosed contactors and other installations remaining active and requiring access. Modify installation or provide access panel.
- C. Clean and repair existing enclosed contactors to remain or to be reinstalled.

3.2 INSTALLATION

- A. Install enclosed contactors [as indicated on Drawings], in accordance with NECA "Standard of Installation."
- B. Install enclosed contactors plumb. Provide supports in accordance with Section 26 05 29 – Electrical Hangers and Supports.

- C. Height: 5 feet to operating handle.
- D. Install fuses for fusible switches. Refer to Section 26 28 13 - Fuses for product requirements.
- E. Install engraved plastic nameplates. Refer to Section 26 05 53 –Electrical Identification for product requirements and location.

3.3 FIELD QUALITY CONTROL

- A. Section 26 00 00 – Basic Electrical Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.16.1.

END OF SECTION 262916

SECTION 262933 - MOTOR WIRING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Connections and wiring to motors.
- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
 - 2. Section 26 00 00 – Basic Electrical Requirements.
 - 3. Section 26 05 19 - Building Wire and Cable.
 - 4. Section 26 05 26 - Grounding and Bonding.
 - 5. Section 26 05 53 - Electrical Identification.
 - 6. Section 26 28 19 - Enclosed Switches.

1.2 REFERENCES

- A. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electric Code.

1.3 QUALITY ASSURANCE

- A. Installation shall conform to the requirements of the following agencies:
 - 1. National Electrical Code (NEC).
 - a. Including State of Wisconsin and local supplements.
 - 2. National Electrical Contractors Association (NECA).
 - a. NECA - Standard of Installation.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

- A. Motor starters shall be furnished by Contractor supplying motor requiring a starter.
- B. Drawings show anticipated horsepower loads and circuit sizes. Loads and circuit sizes shall be used as a guide to provide final performance requirements. Verify actual requirements with Contractor and install accordingly under this Contract.
- C. Contractor to verify, and correct if necessary, if heater elements in starters match installed motor characteristics.
- D. Contractor shall check drawings and specifications of other trades to determine requirements for motor disconnect switches. In each case, Contractor shall install all required disconnect switches.

- E. Contractor shall provide, where required by Code and for motors out of sight of controller, all disconnect switches not specifically supplied by others.
- F. Unless otherwise indicated on drawings or elsewhere in these specifications, all motors shall be furnished by others.
- G. Motors shall be set in place by others and associated motor starters and controllers shall be turned over to Electrical Contractor for installation.
- H. Contractor supplying starters and controllers shall index same and provide Electrical Contractor with written instructions as to proper location in sufficient time to permit installation of a concealed raceway system.
- I. Control wiring shall be responsibility of HVAC Contractor. Electrical Contractor shall extend circuit to control transformers and make final 120V transformer connections. Transformers will be supplied by HVAC Contractor. Control transformer shall be in starter enclosure.
- J. Review HVAC and plumbing specifications and provide all line voltage wiring and connections to controls and auxiliary equipment specified as to be provided by Electrical Contractor or Division 26.
- K. On motor wiring schedule, column stating "starter wiring" refers to line voltage wiring from starter to motor.
- L. Final conduit connection to motor shall be made with liquid-tight flexible metal conduit or flexible metal conduit, except where prohibited by any other section of these specifications.
- M. All conductors serving motors shall be stranded.
- N. Install a separate green equipment grounding conductor, with circuit conductors, to all motors.
- O. Verify proper rotation of each motor as it is being wired or before motor is energized for any reason.

END OF SECTION 262933

SECTION 263353 - STATIC UNINTERRUPTIBLE POWER SUPPLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Static uninterruptible power supply.
- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
 - 2. Section 26 00 00 – Basic Electrical Requirements.

1.2 REFERENCES

- A. Institute of Electrical and Electronics Engineers (IEEE):
 - 1. IEEE 1184 - Guide for the Selection and Sizing of Batteries for Uninterruptible Power Systems.
- B. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA PE 1 - Uninterruptible Power Systems.
- C. International Electrical Testing Association (NETA):
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.
- B. Shop Drawings: Indicate electrical characteristics and connection requirements. Indicate battery rack dimensions; battery type, size, dimensions, and weight; detailed equipment outlines, weight, and dimensions; location of conduit entry and exit; single-line diagram indicating metering, control, and external wiring requirements; heat rejection and air flow requirements.
- C. Product Data: Submit catalog sheets and technical data sheets to indicate physical data and electrical performance, electrical characteristics, and connection requirements.
- D. Manufacturer's Field Reports: Indicate inspections, findings, and recommendations.

1.4 CLOSEOUT SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for closeout submittals.
- B. Operation and Maintenance Data: Submit description of operating procedures; servicing procedures; list of major components; recommended remedial and preventive maintenance procedures; and spare parts list.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products under provisions of Section 26 00 00 – Basic Electrical Requirements.
- B. Protect equipment from extreme temperature and humidity by storing in conditioned space.
- C. Protect equipment from dust and debris by wrapping unit in dust tight cover and storing away from construction activity.
- D. Deliver batteries no sooner than days before charging.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 26 00 00 – Basic Electrical Requirements: Environmental conditions.

1.8 WARRANTY

- A. Section 26 00 00 – Basic Electrical Requirements: Product warranties and product bonds.
- B. Furnish five-year manufacturer warranty.

1.9 MAINTENANCE SERVICE

- A. Section 26 00 00 – Basic Electrical Requirements: Maintenance service.
- B. Furnish service and maintenance of uninterruptible power supply for one year from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 STATIC UNINTERRUPTIBLE POWER SUPPLY

- A. Manufacturers:
 - 1. Best Power Technology.
 - 2. Liebert Corp.
 - 3. Square D.
 - 4. MGE
 - 5. Equivalent as acceptable to Engineer.
- B. Product Description: [Nonredundant] [Parallel redundant] [Dual redundant] uninterruptible power supply with reverse transfer.
- C. System Ratings and Operating Characteristics:

1. System Continuous Rating: As indicated on Drawings, over entire battery voltage range at specified power factor. Maintain output voltage within specified limits at load from full load to no-load.
2. Battery Capacity: As indicated on Drawings.
3. Voltage Rating: 120/208 277/480 volts, 1 3 phase.
4. Input Voltage Operating Range: Plus or minus 10 percent.
5. Input Frequency Operating Range: 60 Hz. plus or minus 3 Hz.
6. Input Current Limit: Adjustable to maximum of 125 percent required to operate at full load with battery bank on float charge.
7. Current Walk-in: 25 to 100 percent in fifteen seconds.
8. UPS Power Factor Over Full Range of Loads and Input Voltages: 74 to 100 percent, lagging.
9. Harmonic Distortion of Input Current Wave Form: 5 percent maximum at full load.
10. Output Voltage Regulation:
 - a. Plus or minus percent for balanced load, full range of DC input and no load to full load variations.
 - b. Plus or minus percent for 50 percent unbalanced load, full range of DC input and no load to full load variations.
 - c. Plus or minus percent during maximum overload of system.
11. Output Voltage Adjustment: Plus or minus percent.
12. Output Free Running Frequency: 60 Hz Plus or minus 0.5 percent.
13. Frequency Adjustment: Plus or minus Hz.
14. Output Harmonic Distortion: Maximum 5 percent rms total harmonic distortion (THD) and maximum 3 percent any single harmonic, at rated frequency and voltage, from 10 percent load to full load and over battery voltage range, measured into linear load.
15. Voltage Transient Response for Application of 0 to 50 Percent, 50 to 100 Percent, 100 to 50 Percent, and 50 to 0 Percent Step Loads, and Transfer To and From Bypass Line:
 - a. Plus 8, minus 10 percent for maximum of 8.3 milliseconds.
 - b. Plus or minus 5 percent for maximum of 25 milliseconds.
 - c. Plus or minus 3 percent for maximum of 50 milliseconds.
 - d. percent for maximum of milliseconds.
 - e. Recovery to steady state within 100 milliseconds after out-of-tolerance variation.
16. Phase Displacement:
 - a. 120 plus or minus 1 degrees for balanced loads.
 - b. 120 plus or minus 4 degrees for 50 percent unbalanced loads.
 - c. 120 plus or minus degrees for.
17. Three-phase Overload Ratings:
 - a. 1000 percent for 5 cycles; via static switch.
 - b. 150 percent for 10 seconds.
 - c. 125 percent for 10 minutes.
 - d. percent for minutes.
18. Output Current Limit: 150 percent of rated output current.
19. Voltage Unbalance: 3 percent maximum line-line with 100 percent load unbalance.
20. Efficiency: percent at full load, percent at percent load, minimum. Measure efficiency of unit including battery and isolation transformer losses.

D. Design:

1. Inverter Type: Pulse-width modulated Ferroresonant transformer Step-wave design.
2. Designed for capacity expansion by addition of parallel modules in field with minimum downtime.

3. Rectifier/Charger Capacity: Sufficient to supply full load to inverter while recharging fully-discharged battery to 95 percent of full capacity in four hours or less; and within input current limits specified.
4. Furnish means for on-line testing of UPS, including test points to allow adjusting and servicing. Furnish means for testing static switch while load is bypassed to utility.
5. Mean Time Between Failures: 60,000 hours, minimum.
6. Cooling: Forced convection or natural convection. Furnish forced air-cooled unit with redundant cooling so failure of one cabinet cooling fan or fan circuit does not affect continued operation at full load and ambient temperature of 77 degrees F or lower.
7. Operate battery floating, isolated from UPS AC input and AC output. Furnish battery resistance grounded through 5,000 - 10,000 ohms for purpose of ground fault sensing.
8. Do not use continuous moving parts or electron tubes. Accomplish power switching using semiconductor devices.
9. Construct equipment so each power component capable of replacement without soldering iron or special tools.
10. Use front-panel removable plug-in control modules.

E. Controls:

1. AC input circuit breaker.
2. "Inverter operate" switch to initiate inverter operation.
3. "Inverter standby" switch to cause inverter to cease operation.
4. "Static switch transfer" switch to permit manual actuation of static transfer switch.
5. "Static switch lock-out" switch to inhibit automatic retransfer of load to inverter.
6. Battery charge timer.
7. "Indicator test" switch.
8. Static switch preferred input circuit breaker
9. Static switch output circuit breaker
10. Static switch bypass circuit breaker.
11. Controls for maintenance bypass switch.

F. Indicators:

1. "Inverter synchronized to utility."
2. "Load connected to utility."
3. "Static transfer switch inhibited."
4. "High/low DC voltage."
5. "Overtemperature."
6. "Inverter output overload."

G. Meters: Use 1 percent accuracy meters to indicate the following:

1. Rectifier/charger DC voltage and current.
2. Utility, inverter output, and load AC voltage.
3. Load AC current.
4. Inverter output and utility frequency.
5. UPS output watts.

H. Wall-mounted Alarm Panel: Surface Flush mounted annunciator panel with the following monitoring and alarm functions:

1. "Utility power available."
2. "Utility bypass power available."
3. "Inverter output available."
4. "Inverter synchronized to utility."

5. "Load connected to inverter output."
6. "Load connected to utility bypass power (alarm)."
7. "Static transfer switch inhibited (alarm)."
8. "High/low DC voltage (alarm)."
9. "Overtemperature (alarm)."
10. "Inverter output overload (alarm)."
11. Audible alarm (sounds when any of above alarm conditions occur).
12. Alarm/indicator "silence/test" switch.

I. Fabrication:

1. Electroplate brackets and securing hardware with corrosion resistant material. Secure bolts, studs and nuts with lock washers.
2. Identify internal wiring at each end of conductor. Furnish cabinet grounding lug.
3. Conversion Equipment Enclosure: NEMA 250, Type 1 enclosure allowing access from front for servicing adjustments and connections. Access through hinged door equipped with tumbler lock and latch handle. Equip cabinet for fork truck lifting.
4. Equip air inlet with permanent type filters and pressurize cabinet or use gaskets around door and panel openings to prevent entry of dirt.
5. Cabinet finish: Primed and painted inside and outside with suitable semi-gloss enamel.

2.2 BATTERY

- A. Storage Battery: Lead calcium heavy duty industrial battery, designed for auxiliary power service. Furnish battery with impact resistant plastic case. Furnish cells with explosion proof vents, clear containers, and ample space for plate growth without stressing container and cover.
- B. Ampere-Hour Rating: Sized in accordance with IEEE 1184.
- C. Battery Racks: Maximum of three tier, entirely steel construction, with plastic insulating rails at points of contact with battery case. Paint racks with acid resistant paint.

2.3 SOURCE QUALITY CONTROL

- A. Furnish shop inspection and testing of components and completed UPS assembly.
- B. Make completed UPS available for inspection at manufacturer's factory prior to packaging for shipment. Notify Architect/Engineer at least seven days before inspection is allowed.
- C. Allow witnessing of factory inspections and tests at manufacturer's test facility. Notify Owner at least seven days before inspections and tests are scheduled.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify HVAC Systems are operational to maintain specified environmental conditions.

3.2 EXISTING WORK

- A. Disconnect and remove abandoned uninterruptible power supplies and accessories.

- B. Clean and repair existing uninterruptible power supplies and accessories to remain or to be reinstalled.

3.3 FIELD QUALITY CONTROL

- A. Section 26 00 00 – Basic Electrical Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.22.
- D. Verify specification performance criteria.
- E. Measure battery discharge and recharge times.
- F. Simulate fault in each system component and utility power.
- G. Operate unit at 77 degrees F for eight hours.
- H. Perform other tests as recommended by manufacturer.

3.4 MANUFACTURER'S FIELD SERVICES

- A. Section 26 00 00 – Basic Electrical Requirements: Manufacturer's field services.
- B. Prepare and start up UPS.

3.5 ADJUSTING

- A. Section 26 00 00 – Basic Electrical Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Adjust output voltage to within 1 percent of nominal.
- C. Adjust output frequency to within 0.6 percent of nominal.

3.6 DEMONSTRATION AND TRAINING

- A. Furnish 8 hours of instruction for two persons, to be conducted at project site with manufacturer's representative.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 26 00 00 – Basic Electrical Requirements: Protecting installed construction.

END OF SECTION 263353

SECTION 263553 - TRANSIENT VOLTAGE SURGE SUPPRESSOR

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Transient Voltage Surge Suppressors.
- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
 - 2. Section 26 00 00 – Basic Electrical Requirements.
 - 3. Section 26 24 13 - Switchboards: Transient voltage surge suppressors integrated in switchboards.
 - 4. Section 26 24 16 - Panelboards: Transient voltage surge suppressors integrated in panelboards.

1.2 REFERENCES

- A. Institute of Electrical and Electronics Engineers (IEEE):
 - 1. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.
 - 2. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
 - 3. IEEE C62.45 - Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.
- B. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA LS 1 - Low Voltage Surge Protection Devices.
- C. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code, Article 285.
 - 2. NFPA 780 - Standard for the Installation of Lightning Protection Systems.
- D. Underwriters Laboratories Inc. (UL):
 - 1. UL 1283 - Electromagnetic Interference Filters.
 - 2. UL 1449 - Transient Voltage Surge Suppressors.

1.3 SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.
- B. Product Data: Submit capacity, dimensions, weights, details, and wiring configuration.
- C. UL 1449 Second Edition Listing, Standard for Safety, Transient Voltage Surge Suppressors, documentation.
- D. UL 1283 Listing, Electromagnetic Interference Filters, documentation.
- E. IEEE C62.41, Category C3 (20kV-1.2/50, 10kA-8/20 μ s waveform) clamping voltage test results.

1.4 CLOSEOUT SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for closeout submittals.
- B. Project Record Documents: Record actual locations of transient voltage surge suppressors.
- C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, installation instructions, and maintenance and repair data.

1.5 QUALITY ASSURANCE

- A. List individual units under UL 1449 and UL 1283.
- B. Perform Work in accordance with state and local codes.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products under provisions of Section 26 00 00 – Basic Electrical Requirements.
- B. Accept equipment on site in factory packaging. Inspect for damage.
- C. Protect equipment from damage by providing temporary covers until construction is complete in adjacent space.

1.8 WARRANTY

- A. Section 26 00 00 – Basic Electrical Requirements: Requirements for warranties.

PART 2 - PRODUCTS

2.1 TRANSIENT VOLTAGE SURGE SUPPRESSOR (TVSS)

- A. Manufacturers:
 - 1. Cutler-Hammer, Inc.
 - 2. General Electric Company.
 - 3. Square D Company.
 - 4. Siemens Energy & Automation, Inc., TPS Series.
 - 5. Equivalent as acceptable to Engineer.
- B. Manufacturer of SPD shall be the same as manufacturer of distribution equipment in which devices are installed and shipped.
- C. TVSS shall be installed by and shipped from electrical distribution equipment manufacturer's factory.

- D. Product Description: Surge protective devices for protection of AC electrical circuits.
- E. Each module shall be fused with a surge rated fuse.
- F. Unit Operating Voltage: As indicated on Drawings.
- G. TVSS shall have a UL approved means of disconnect.
- H. TVSS shall have copper bus for surge current path. Small round wiring connections shall not be used in the path for surge current diversion.
- I. Construction:
 - 1. Balanced Suppression Platform: Equally distribute surge current to Metal Oxide Varistor (MOV) components to ensure equal stressing and maximum performance. Furnish surge suppression platform with equal impedance paths to each matched MOV.
 - 2. Internal Connections: Hardwired with connections using low impedance conductors and compression fittings.
 - 3. Safety and Diagnostic Monitoring: Equipped with standard overcurrent protection:
 - a. Continuous monitoring of fusing system.
 - b. Monitor individual MOV's (including neutral to ground). Capable of identifying open circuit failures not monitored by conventional fusing systems.
 - c. Monitor for overheating in each mode due to thermal runaway.
 - d. Furnish green and red solid-state indicator light on each phase. Absence of green light and presence of red light indicates which phases have been damaged. Fault detection activates flashing trouble light and alarm. An alarm on/off switch shall be provided to silence the alarm. Units not capable of detecting open circuit damage, thermal conditions, and over current will not be accepted.
 - 4. Labeling: Permanently affix UL 1449 suppression voltage ratings to unit.
- J. Rating:
 - 1. Electrical Noise Filter: Furnish each unit with high performance EMI/RFI noise rejection filter. Electric line noise attenuation no less than 50 dB at 100 kHz using MIL-STD-220A insertion loss test method.
- K. Accessories:
 - 1. Local audible alarm.
 - 2. Form C dry contacts one normally open (NO) and one normally closed (NC) for remote status monitoring.
- L. SPD shall be listed in accordance with UL 1449 Second Edition and UL 1283, Electromagnetic Interference Filters.
- M. SPD shall be listed in accordance with UL 1449 Second Edition to include Section 37.3 highest Short Circuit Current Rating (SCCR) of 200 kA.
- N. SPD shall be tested with the Category C3 high exposure waveform (20kV-1.2/50µs, 10kA-8/20µs) per ANSI/IEEE C62.41 - 1991.
- O. Pulse life test: Capable of protecting against and surviving 5000 ANSI/IEEE C62.41 Category C3 transients without failure or degradation of clamping voltage by more than 10 percent:

- P. Service Entrance Type TVSS shall have a minimum surge current rating of 160 kA per phase.
- Q. Distribution type TVSS shall have a minimum surge current rating of 120 kA per phase.
- R. Protection Modes: For Wye configured system, furnish device with directly connected suppression elements between line to line (L-L), line-neutral (L-N), line-ground (L-G), and neutral-ground (N-G). For Delta configured system, furnish device with suppression elements between line to line (L-L) and line to ground (L-G).
- S. Do not exceed the following for maximum UL 1449 suppression voltage ratings:

Modes	208Y/120	480Y/277
WYE - L-N; L-G; N-G	400 V	800 V

- T. TVSS shall be designed to withstand a maximum continuous operating voltage of not less than 115 percent of nominal RMS voltage.

2.2 SOURCE QUALITY CONTROL AND TESTS

- A. [Section 26 00 00 – Basic Electrical Requirements] [Section 01 40 00 - Quality Requirements] [Division 01 – General Requirements]: Field inspecting, testing, adjusting, and balancing.
- B. Test units to specified surge ratings to ensure devices will achieve required life expectancy and reliability. Testing to full ratings also verifies internal construction quality of suppressors. Provide withstand testing for each mode and each phase basis.
- C. Perform actual Let-Through voltage test data in form of oscillograph results for ANSI/IEEE C62.41 Catalog C3 (20 kV, 10 kA), Catalog C1 (6 kV, 3 kA), and Catalog. B3 (6 kv, 500 A at 100 kHz) tested in accordance with ANSI/IEEE C62.45.
- D. Perform spectrum analysis of each unit based on MIL-STD-220A test procedures between 50 kHz and 200 kHz verifying device noise attenuation exceeds 50 dB at 100 kHz.
- E. Perform test verifying suppressors can survive published surge current rating for each mode and each phase basis. Test wave based on ANSI/IEEE C62.41, 8x20 microsecond current wave.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify mounting area is ready for equipment.
- C. Verify circuit rough-ins are at correct location.

3.2 INSTALLATION

- A. Mount internally to new power distribution equipment or on existing distribution equipment as noted on drawings.

- B. Install in accordance with IEEE 1100.
- C. Install using direct bus bar connection.
- D. Install indicator lights and trouble alarms in face of power distribution equipment.
- E. Install with maximum conductor length of 14 inches. Install suppressor with internal fusing.

END OF SECTION 263553

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SECTION 264100 - FACILITY LIGHTNING PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Air Terminals.
 - 2. Interconnecting Conductors.
 - 3. Grounding and Bonding for Lightning Protection.
- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.

1.2 REFERENCES

- A. Lightning Protection Institute (LPI):
 - 1. LPI 175 - Standard of Installation.
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 780 - Standard for the Installation of Lightning Protection Systems.
- C. Underwriters Laboratories Inc. (UL):
 - 1. UL 96 - Lightning Protection Components.
 - 2. UL 96A - Installation Requirements for Lightning Protection Systems.

1.3 SYSTEM DESCRIPTION

- A. Description: Conductor system protecting entire building and having UL Master Label LPI Certification.

1.4 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Shop Drawings: Indicate layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details.
- C. Product Data: Submit catalog sheets showing dimensions and materials of each component and include indication of listing in accordance with UL 96.
- D. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.
- E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
- F. Certificate of Compliance: Submit certificate from authority having jurisdiction indicating approval of lightning protection systems.

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with NFPA 780.
- B. Perform Work in accordance with UL 96A and furnish Master Label.
- C. Perform Work in accordance with LPI-175 and furnish LPI Certification.
- D. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in lightning protection equipment with minimum five years documented experience.
- B. Installer: Authorized installer of manufacturer with minimum five years [documented] experience.
- C. Inspection Agency: Company or individual specializing in lightning protection inspecting with minimum five years documented experience.

1.8 PRE-INSTALLATION MEETINGS

- A. Division 01 – General Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 COORDINATION

- A. Division 01 – General Requirements: Coordination and project conditions.
- B. Coordinate Work with roofing and exterior and interior finish installations.

PART 2 - PRODUCTS

2.1 COMPONENTS

- A. Manufacturers:
 - 1. Equivalent as acceptable to Engineer.

- B. Product Listing: UL 96.
- C. Air Terminals:
 - 1. Material: Copper Aluminum.
 - 2. Configuration: Tubular Solid.
 - 3. Use adhesive base for single-ply roof installations.
 - 4. Air Terminal for Chimney: Lead-coated copper.
 - 5. Decorations: Ball. Direction vane. Compass set.
 - 6. Grounding Rods: Solid copper. Stainless steel.
 - 7. Ground Plate: Copper.
 - 8. Conductors:
 - a. Material: Copper Aluminum.
 - b. Configuration: Cable. Strip. Solid rod.
- D. Connectors and Splicers: Bronze. Aluminum.

PART 3 - EXECUTION

3.1 EXISTING WORK

- A. Remove exposed abandoned air terminals, interconnecting cable, and grounding electrodes, and other lightning protection components. Cut cable flush with walls, floors, and roof; patch surfaces.
- B. Maintain access to existing grounding and bonding connections, and other installations remaining active and requiring access. Modify installation or install access panel.
- C. Extend existing lightning protection installations using materials and methods compatible with existing installations and as specified.
- D. Clean and repair existing remaining or reinstalled lightning protection components.

3.2 INSTALLATION

- A. Install in accordance with NFPA 780, UL 96A, and LPI-175.
- B. Connect conductors using mechanical connectors. exothermic welding process. Protect adjacent construction elements and finishes from damage.
- C. Conceal interior conductors within building finishes. Conceal exterior conductors where practical.
- D. Bond exterior metal bodies on building to lightning protection system

3.3 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements: Testing and inspection services. Division 01 – General Requirements: Testing, adjusting, and balancing.
- B. Perform inspection and testing in accordance with UL 96A.

END OF SECTION 264100

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior Luminaires.
 - 2. Interior Lamps.
 - 3. Ballasts.
 - 4. Fluorescent Emergency Ballasts.
 - 5. Exit Signs.
 - 6. Emergency Battery Units.
 - 7. Accessories.

- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
 - 2. Section 26 00 00 – Basic Electrical Requirements.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI C82.1 - Electric Lamp Ballast-Line Frequency Fluorescent Lamp Ballast.
 - 2. ANSI C82.4 - Ballasts-for High-Intensity-Discharge Lamps (Multiple-Supply Type).

1.3 SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.

- B. Shop Drawings:
 - 1. Include outline drawings, catalog cut sheets, lamp and ballast data, support points, weights, accessory information, and performance data for each luminaire type.
 - 2. For all luminaries with paint color or finish options, include single color original of manufacturers color or finish choices for Architects review.

- C. Product Data: Submit dimensions, ratings, and performance data.

- D. Record Drawings: For installations utilizing remotely mounted low voltage transformers, Electrical Contractor shall provide set of record drawings indicating location of installed transformers to facilitate future maintenance.

- E. Samples: Submit two color chips 3 x 3 inch in size illustrating luminaire finish color where indicated in luminaire schedule.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

PART 2 - PRODUCTS

2.1 GENERAL – INTERIOR LIGHTING

- A. Furnish all labor, materials, tools, equipment, and services for all interior lighting, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of all other trades.
- C. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for sound, secure and complete installation.

2.2 INTERIOR LUMINAIRES

- A. Subject to compliance with requirements, fixtures that may be incorporated into work include products specified in lighting fixture schedule on Drawings, and equals listed in accompanying notes.
- B. Basic catalog number only is indicated in lighting fixture schedule. Electrical Contractor shall furnish complete lighting fixtures in quantities, and row lengths as shown on Drawings, including plaster frames, ends, or caps, couplings, connectors, suspension assemblies, mounting brackets and all auxiliary accessories as required.
- C. Reference schedule for description of fixture nomenclature and associated ceiling type and suspension system.
- D. Housing:
 - 1. Shall be free from burrs, sharp corners and edges.
 - 2. Shall be steel, unless noted otherwise, formed and supported to prevent warping and sagging.
 - 3. Provide spring loaded latches for all troffers.
- E. Mounting Accessories:
 - 1. Recessed fixtures:
 - a. Provide trim type and accessories required for installation in ceiling types specified shown on reflected ceiling plan.
 - b. Fixtures mounted in sloped ceilings shall be provided with sloped ceiling adapters and appropriate trim rings and other accessories as required.
 - 2. Surface mounted fixtures: Provide ceiling spacers as required for fixtures not labeled as suitable for direct mounting to a low density ceiling.
 - 3. Suspended fixtures:
 - a. Provide swivel canopy to accommodate any sloped ceilings shown on plans.
 - b. Provide pendant or cable length required to suspend luminaries at indicated height.
 - c. Swivel hangers in mechanical equipment areas shall be shock absorbing type.
- F. Finishes:
 - 1. Painted finishes shall be polyester powder painted enamel finish, and painted after fabrication unless noted otherwise.
 - 2. Polished, brushed or other metal finishes shall be finished with clear coat to inhibit finish deterioration and corrosion.

3. Finish types and colors shall be verified with Architect/Engineer prior to ordering.

G. Louvers, Reflectors, Lenses:

1. Louvers and reflectors shall be semi-specular, low iridescent, clear alzak, unless noted otherwise.
2. Parabolic louver depth shall have minimum actual dimension of 3 inches, unless noted otherwise.
3. Acrylic lenses shall be pattern 12 prismatic, overall 0.125 inch minimum thickness.

H. Provide IC rated light fixtures for light fixtures that will be in contact with insulation.

2.3 FLUORESCENT BALLASTS

A. Manufacturers:

1. Advance Transformer.
2. Universal.
3. Osram/Sylvania.

B. Product Description: Electronic ballast, Program Start, suitable for lamps specified, with universal input voltage that will accept any line voltage between 120-277 volts, unless noted as 480 volts on drawings.

C. Fluorescent ballasts shall be electronic type, unless noted otherwise, and shall meet the following standards:

1. UL Listed (Class P) Sound Rating A and CSA certified.
2. Comply with EMI and RFI limits set by FCC (CFR 47 part 18) or NEMA and not interfere with normal electrical equipment.
3. Meet applicable standards designated by ANSI.
4. Be potted or conformal coated in metallic case and not contain PCB's.
5. Provide normal rated lamp life as stated by lamp manufacturers with rated life at 3 hour burn time for each start.

D. Nominal power factor of 0.95 or higher.

E. Total harmonic distortion of less than 10 percent at 120 or 277 volts.

F. Ballast factor 0.85 or better.

G. Frequency of operation shall be 20 khz – 50 khz and units shall operate without visible flicker.

H. Operating temperature shall not exceed 65 degrees C at any point on case at 40 degree C ambient.

I. Ballasts shall carry minimum three (3) year warranty covering replacement parts and labor for life of warranty.

J. Ballasts shall be marked with manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each lamp type and UL Listing.

K. Ballasts shall withstand line transients as defined in IEEE 587, Category A.

- L. Fluorescent ballasts, other than electronic type, shall only be used where specifically noted on Drawings, shall be of High Power Type, CBM and ETL Certified, Best Energy Saving Type and Sound Rated where available.

2.4 HIGH INTENSITY DISCHARGE (HID) BALLASTS

- A. Built in, automatically resetting thermal protector which disconnects ballast from power line in event of overheating.
- B. Provide F-Can ballast to minimize sound level. F-Can ballast are encased in fluorescent ballast type cans and potted with asphalt or polyester insulating material to minimize noise.
- C. Temperature Rating:
 - 1. For fixtures installed within conditioned spaces rating shall be 104 degrees F.
 - 2. For fixtures installed within non-conditioned spaces rating shall be 131 degrees F.
- D. HID ballasts shall be provided with three (3) year warranty.
- E. HID ballasts Class A noise rating up through 175 watts and Class B for 250 and 400 watts.

2.5 LAMPS

- A. General – Lamps:
 - 1. Lamps shall be provided new.
 - 2. Approved manufacturers;
 - a. Fluorescent:
 - 1) Philips.
 - 2) Osram/Sylvania.
 - 3) General Electric.
 - b. HID:
 - 1) Venture.
 - 2) Philips.
 - 3) Osram/Sylvania.
 - 4) General Electric.
 - c. Incandescent:
 - 1) Philips.
 - 2) Osram/Sylvania.
 - 3) General Electric.
- B. Fluorescent:
 - 1. Color temperature: 3,500K unless noted otherwise.
 - 2. Minimum Color Rendering Index (CRI): 85 unless noted otherwise.
 - 3. Lamp life: Minimum 20,000 hours average based on three hours per start when used on rapid start circuits.
 - 4. Lamps shall be 32 watt, T8, minimum 2,900 lumens initial, rapid start, unless noted otherwise.
 - 5. Lamps shall meet EPA TCLP standards for disposal as non-hazardous waste.
- C. HID:
 - 1. Metal halide lamps shall be pulse start type.

2.6 FLUORESCENT EMERGENCY BALLASTS

- A. Manufacturers:
 - 1. Bodine.
 - 2. Iota.
- B. Fluorescent emergency ballasts shall be compatible with electronic, standard, energy saving, and dimming AC ballasts.
- C. Fluorescent emergency ballasts shall be UL Listed for factory or field installation inside, on top of, or remote from fixture.
- D. Fluorescent emergency ballasts shall operate the following lamps:
 - 1. T8 lamps: Two (2) F32T8 lamps at 1,350 lumens for minimum of 90 minutes.
- E. Fluorescent emergency ballasts shall have minimum five (5) year warranty.
- F. Provide ballast with test switch in fixture or with remote test switch flush mounted in ceiling or on wall at location acceptable to Engineer/Architect.

2.7 EXIT SIGNS

- A. Exit signage shall have 6-inch high lettering meeting code and standard requirements of federal, state, and local jurisdictions where project is located.
- B. Provide directional arrows as indicated and required by authorities having jurisdiction.
- C. Provide mounting accessories as required to back, end, pendant, or top mount in accordance with project requirements.
- D. Provide with internal, pre-wired Nicad battery backup where noted in light fixture schedule.
- E. Exit signage shall be modular design, facilitating replacement of individual parts.
- F. Exit signage shall be illuminated by LED's, unless noted otherwise in light fixture schedule.
- G. Provide exit signs that have internal battery backup with integral test switch.

2.8 INTEGRAL LIGHT FIXTURE GENERATOR TRANSFER DEVICE (GTD)

- A. Where indicated on the Lighting Fixture Schedule, provide light fixtures with an integral GTD that utilizes relay switching to automatically transfer the fixture's circuit from a normal source (switched or un-switched) to an un-switched emergency circuit when the normal power circuit is lost. Devices shall be installed by the fixture manufacturer at the manufacturer's fixture assembly location.
- B. Specifications for the GTD are:
 - 1. UL 924 Listed Emergency Lighting Transfer Switching Component.
 - 2. Dual voltage input, either 120 or 277 volts.
 - 3. Designed to be used on a one GTD for one fixture basis. Inputs fused to carry a maximum load of three amps.
 - 4. Rated for temperatures between -4 degrees F and 149 degrees F.

5. Approximate size of 8 inches x 1.18 inch x 1.18 inch. Approximately weight of 0.5 pounds.
6. Suitable for indoor or damp locations.
7. Acceptable for use with either fluorescent or LED lamps.
8. Inputs will typically include a switched circuit (normal or emergency), an unswitched normal circuit, and an un-switched emergency circuit.

C. Acceptable Manufacturers: Philips-Bodine.

PART 3 - EXECUTION

3.1 EXISTING WORK

- A. Disconnect and remove abandoned luminaires, lamps, and accessories.
- B. Extend existing interior luminaire installations using materials and methods as specified.
- C. Clean and repair existing interior luminaires to remain or to be reinstalled.

3.2 INSTALLATION

- A. Install suspended luminaires using pendants supported from swivel hangers. Install pendant length required to suspend luminaire at indicated height.
- B. Support luminaires larger than 2 x 4 foot size independent of ceiling framing.
- C. Locate recessed ceiling luminaires as indicated on Drawings. Coordinate all discrepancies between lighting and reflected ceiling plans with architect.
- D. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- E. Install recessed luminaires to permit removal from below.
- F. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- G. Install earthquake clips to secure recessed grid-supported luminaires in place.
- H. Install wall-mounted luminaires at height as indicated on Drawings.
- I. Install accessories furnished with each luminaire.
- J. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- K. Install specified lamps in each luminaire.
- L. Electrical Contractor shall check Structural Drawings, architectural reflected ceiling plans, General Construction Drawings and Mechanical Drawings to verify construction and type of surface on or in which lighting fixtures are installed, for ceiling construction proper type of suspended ceiling and space above same and possible conflicts with equipment of other trades.

1. Determine specific ceiling construction including ceiling materials and ceiling suspension system in each area where suspended ceiling is to be provided.
2. Verify suspended ceiling type with ceiling contractor prior to releasing lighting fixtures for delivery.
3. Furnish fixture of type scheduled complete with accessories necessary to make installation accordance with manufacturer's recommendations including plaster frames, couplings and connectors, suspension assemblies mounting brackets and other auxiliary equipment.

M. Bond fixtures and metal accessories to branch circuit equipment grounding conductor.

N. Fixture Connections:

1. Surface and wall recessed fixtures shall be connected directly to junction box or solid conduit.
2. Ceiling recessed fixtures shall be connected to flexible metal conduit, originating at solidly supported J-Box.
3. Flexible metal conduit shall be minimum 3/8 inch diameter. Conduit length shall allow movement of fixture for maintenance purposes.
4. Minimum wire size shall be #12 AWG.

O. Provide box-outs and other accessories around recessed fixtures as required to maintain fire ratings for spacing required from insulation in ceiling space. Final installation shall meet regulatory requirements and manufacturer's recommendations.

P. Contractor shall verify exit signs are provided and visible along all exit paths shown on Architectural Life Safety Plan.

3.3 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection.
- B. Inspect for proper connection and operation.

3.4 ADJUSTING

- A. Aim and adjust luminaires as indicated on Drawings and adjust as directed by designated Owner personnel.

3.5 CLEANING

- A. Remove dirt and debris from enclosures.
- B. Clean photometric control surfaces as recommended by manufacturer.
- C. Clean finishes and touch up damage.

3.6 PROTECTION OF FINISHED WORK

- A. Division 01 – General Requirements: Protecting finished work.
- B. Relamp luminaires having failed or noticeable dim lamps at Substantial Completion.

END OF SECTION 265100

SECTION 265600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exterior Luminaries.
 - 2. Poles.
 - 3. Accessories.
- B. Related Sections
 - 1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
 - 2. Section 26 00 00 – Basic Electrical Requirements.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Exterior Luminaire:
 - 1. Basis of Measurement: Each.
 - 2. Basis of Payment: Includes concrete base, luminaire pole, and luminaire with lamps and accessories. connection to power source.

1.3 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI C82.1 - Electric Lamp Ballast-Line Frequency Fluorescent Lamp Ballast.
 - 2. ANSI C82.4 - Ballasts-for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).
 - 3. ANSI O5.1 - Wood Poles, Specifications and Dimensions.

1.4 SUBMITTALS

- A. Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.
- B. Shop Drawings: Indicate dimensions and components for each luminaire not standard Product of manufacturer.
- C. Product Data: Submit dimensions, ratings, and performance data.
- D. Samples: Submit two color chips 3 x 3 inch in size illustrating luminaire finish color where indicated in luminaire schedule.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

1.6 MOCK-UP

- A. Section 26 00 00 – Basic Electrical Requirements: Mock-up requirements.

- B. Construct mock-up of to measure luminaire performance. Include 4 luminaries.
- C. Locate where indicated on Drawings.
- D. Incorporate accepted mockup as part of Work.
- E. Remove mockup when directed by Engineer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products under provisions of Section 26 00 00 – Basic Electrical Requirements.
- B. Store and handle solid wood poles in accordance with ANSI O5.1.

1.8 COORDINATION

- A. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

1.9 MAINTENANCE MATERIALS

- A. Section 26 00 00 – Basic Electrical Requirements: Spare parts and maintenance products.
- B. Furnish two of each lamp installed.
- C. Furnish two gallons of touch-up paint for each different painted finish and color.
- D. Furnish two ballasts of each lamp type installed.

PART 2 - PRODUCTS

2.1 LUMINARIES

- A. Product Description: Complete exterior luminaire assemblies, with features, options, and accessories as scheduled.
- B. Substitutions: Equivalent as acceptable to Engineer.
 - 1. Refer to Lighting Fixture Schedule on construction documents.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify foundations are ready to receive fixtures.

3.2 EXISTING WORK

- A. Disconnect and remove abandoned exterior luminaries.

- B. Extend existing exterior luminaire installations using materials and methods [compatible with existing installations, or] as specified.
- C. Clean and repair existing exterior luminaries to remain or to be reinstalled.

3.3 INSTALLATION

- A. Install concrete bases for lighting poles at locations as indicated on Drawings, in accordance with Section 03 31 00 – Structural Concrete.
- B. Install poles plumb. Install shims double nuts to adjust plumb. Grout around each base.
- C. Install lamps in each luminaire.
- D. Bond and ground luminaries, metal accessories and metal poles in accordance with Section 26 05 26 – Grounding and Bonding. Install supplementary grounding electrode at each pole.

3.4 FIELD QUALITY CONTROL

- A. Section 26 00 00 – Basic Electrical Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Operate each luminaire after installation and connection. Inspect for improper connections and operation.
- C. Measure illumination levels to verify conformance with performance requirements.
- D. Take measurements during night sky, without moon or with heavy overcast clouds effectively obscuring moon.

3.5 ADJUSTING

- A. Section 26 00 00 – Basic Electrical Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Aim and adjust luminaries to provide illumination levels and distribution as indicated on Drawings.

3.6 CLEANING

- A. Section 26 00 00 – Basic Electrical Requirements: Final cleaning.
- B. Clean photometric control surfaces as recommended by manufacturer.
- C. Clean finishes and touch up damage.

3.7 PROTECTION OF FINISHED WORK

- A. Section 26 00 00 – Basic Electrical Requirements: Protecting finished work.
- B. Relamp luminaries having failed lamps at Substantial Completion.

END OF SECTION 265600

SECTION 27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Minimum requirements for equipment and cable installations in communications equipment rooms (Telecommunications Closets).
2. Included in this section are minimum composition requirements and installation methods for following:
 - a. Grounding Electrode System
 - b. Busbars
 - c. Bonding accessories

B. Related Sections:

1. Applicable provisions of Division 01- General Requirements shall govern all work under this Section.
2. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
3. Section 27 05 28 – Pathways for Communications Systems.
4. Section 27 05 29 – Hangers and Supports for Communications Systems.
5. Section 27 10 00 – Structured Cabling.

1.2 REFERENCES

A. Building Industry Consulting Service International, Inc. (BICSI):

1. BICSI TDM Manual - Telecommunications Distribution Methods Manual.

B. National Fire Protection Association (NFPA):

1. NFPA 70 - National Electrical Code.

C. Telecommunication Industry Association/Electronic Industries Alliance (TIA/EIA):

1. ANSI/TIA 568 - Commercial Building Telecommunications Cabling Standard.
2. TIA 569 - Commercial Building Standard for Telecommunications Pathways and Spaces.
3. ANSI/TIA 606 - Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
4. ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
5. TIA/EIA 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications.

1.3 SUBMITTALS

A. Division 01 – General Requirements: Requirements for submittals.

B. Provide product data for the following:

1. Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Procedures for closeout submittals.
- B. Project Record Documents: Record actual locations of components and grounding electrodes.

1.5 QUALITY ASSURANCE

- A. All cable and equipment shall be installed in neat and workmanlike manner. All methods of construction that are not specifically described or indicated in contract documents shall be subject to control and approval of Owner or Owner Representative. Equipment and materials shall be of quality and manufacture indicated. Equipment specified is based upon acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of equipment specified and subject to approval.
- B. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five (5) years’ documented experience.
- B. Installer: Company specializing in performing work of this section with minimum five (5) years’ experience approved by manufacturer.

PART 2 - PRODUCTS

2.1 GROUNDING ELECTRODE SYSTEM

- A. When required Grounding Electrode System shall meet the following.
 - 1. Active grounding system constantly replenishing moisture into the soil
 - 2. Provide low resistance to ground
 - 3. Provide season to season stability
 - 4. Be maintenance-free for 30 years
 - 5. Contain no hazardous materials or chemicals
- B. Manufacturers
 - 1. Equivalent as acceptable to Engineer.

2.2 WALL-MOUNT BUSBARS

- A. Telecommunications Main Grounding Busbar (TMGB)
 - 1. Telecommunications Main Grounding Busbar (TMGB) shall be constructed of .25 inch (6.4 mm) thick solid copper bar.
 - 2. Busbar shall be 4 inches (100 mm) high and 20 inches (510 mm) long and shall have 30 attachment points (two rows of 15 each) for two-hole grounding lugs.
 - 3. Hole pattern for attaching grounding lugs shall meet requirements of ANSI-J-STD – 607-A and shall accept 27 lugs with 5/8-inch hole centers and 3 lugs with 1-inch hole centers.

4. Busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating 4-inch standoff from wall.
5. Busbar shall be UL Listed as grounding and bonding equipment.

B. Telecommunications Grounding Busbar (TGB)

1. Telecommunications Grounding Busbar (TGB) shall be constructed of .25-inch-thick solid copper bar.
2. Busbar shall be 2 inches high and 12 inches long and shall have 9 attachment points (one row) for two-hole grounding lugs.
3. Hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 6 lugs with 5/8-inch hole centers and 3 lugs with 1-inch hole centers.
4. Busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating 4-inch standoff from the wall.
5. Busbar shall be UL Listed as grounding and bonding equipment.

2.3 BONDING ACCESSORIES

A. Compression Lugs

1. Compression lugs shall be manufactured from electroplated tinned copper.
2. Compression lugs shall have two holes spaced on 5/8 inch or 1-inch centers, as stated below, to allow secure two bolt connections to busbars.
3. Compression lugs shall be sized to fit specific size conductor, sizes #6 to 4/0, as stated below.
4. Compression lugs shall be UL Listed as wire connectors.

B. Antioxidant Joint Compound

1. Oxide inhibiting joint compound for copper-to-copper, aluminum-to-aluminum or aluminum-to-copper connections.

C. C-Type, Compression Taps

1. Compression taps shall be manufactured from copper alloy.
2. Compression taps shall be C-shaped connectors that wrap around two conductors forming irreversible splice around conductors; installation requires hydraulic crimping tool.
3. Compression taps shall be sized to fit specific size conductors, sizes #2 AWG to 4/0, as stated below.
4. Compression taps shall be UL Listed.

D. Pedestal Clamp with Grounding Connector

1. Pedestal clamp shall be made from electroplated tinned copper or bronze. Installation hardware will be stainless steel.
2. Pedestal clamps shall be sized to fit specific size conductor, size #6 and/or 2/0, as stated below.
3. Pedestal clamp installation hardware shall be sized to attach to round and/or square raised access floor pedestals that are 1-1/8 inch to 1-3/4 inch in diameter, as stated below.
4. Pedestal clamp shall provide straight (in-line) or cross (intersection) support for up to two conductors.
5. Pedestal clamp shall be UL Listed as grounding and bonding equipment.

E. Pipe Clamp with Grounding Connector

1. Pipe clamp shall be made from electroplated tinned bronze. Installation hardware will be stainless steel.

2. Pipe clamp shall be sized to fit up to two conductors ranging in size from #6 to 250 MCM; conductors must be same size.
 3. Pipe clamp installation hardware shall be sized to attach to pipes, sizes 1 inch to 6 inch (.75 inch to 6.63 inch in diameter), as stated below.
 4. Pipe clamp shall be UL Listed as grounding and bonding equipment.
- F. Equipment Ground Jumper Kit
1. Kit includes one 24-inch L insulated ground jumper with a straight two-hole compression lug on one end and an L-shaped two-hole compression lug on the other end, two plated installation screws, an abrasive pad and .5 ounce tube of antioxidant joint compound.
 2. Ground conductor is an insulated green/yellow stripe #6 AWG wire
 3. Lugs are made from electroplated tinned copper and have two mounting holes spaces .5 inch to .625 inch apart that accept 1/4-inch screws.
 4. Jumper will be made with UL Listed components.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Outdoor Grounding and Bonding Connections
1. All outdoor grounding and bonding (earthing) connections shall be accomplished using exothermic welding.
- B. Wall-Mount Busbars
1. Attach busbars to wall with appropriate hardware according to manufacturer's installation instructions.
 2. Conductor connections to the TMGB or TGB shall be made with two-hole bolt-on compression lugs sized to fit busbar and conductors.
 3. Each lug shall be attached with stainless steel hardware after preparing bond according to manufacturer recommendations and treating bonding surface on busbar with antioxidant to help prevent corrosion at bond.
 4. Wall-mount busbar shall be bonded to ground as part of overall Telecommunications Bonding and Grounding System.
- C. Rack-Mount Busbars and Ground Bars
1. When rack or cabinet supports active equipment or any type of shielded cable or cable termination device requiring ground connection, add rack-mount horizontal or vertical busbar or ground bar to rack or cabinet. Rack-mount busbar or ground bar provides multiple bonding points on rack for rack and rack-mount equipment.
 2. Attach rack-mount busbars and ground bars to racks or cabinets according to manufacturer's installation instructions.
 3. Bond rack-mount busbar or ground bar to room's TMGB or TGB with appropriately sized hardware and conductor.
- D. Rack Grounding
1. Every rack and cabinet shall be bonded to TMGB or TGB.
 2. Minimum bonding connection to racks and cabinets shall be made with two-hole compression lug sized to fit conductor and rack and installed according to manufacturer recommendations.
 3. Remove paint between rack/cabinet and compression lug, clean surface and use antioxidant between rack and terminal block to help prevent corrosion at bond.

E. Pedestal Clamp

1. At minimum, bond every sixth raised access floor pedestal with minimum #6 AWG conductor to TMGB or TGB using pedestal clamp sized to fit pedestal and conductor and installed according to manufacturer's recommendations.
2. If pedestal clamps are used to construct signal reference grid, bond signal reference grid to TMGB or TGB and bond each rack and/or cabinet to signal reference grid using compression tap or similar non-reversible bonding component sized to fit both conductors.
3. Remove paint between pedestal and pedestal clamp, clean surface and use antioxidant between pedestal and clamp to help prevent corrosion at bond.
4. Remove insulation from conductors where wires attach to pedestal clamp.

F. Pipe Clamp

1. Bond metal pipes located inside data center computer room with minimum #6 AWG conductor to TMGB or TGB using pipe clamp sized to fit pipe and conductor and installed according to manufacturer's recommendations.
2. Remove paint between pipe and pipe clamp, clean surface and use antioxidant between pipe and clamp to help prevent corrosion at bond.
3. Remove insulation from conductors where wires attach to pipe clamp.

G. Equipment Ground Jumper Kit

1. Bond equipment to vertical rack-mount busbar or groundbar using ground jumper according to manufacturer's recommendations.
2. Clean the surface and use antioxidant between compression lugs on jumper and rack-mount busbar or groundbar to help prevent corrosion at bond.

3.2 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Visually inspect from each bus bar to main grounding electrode service location.
- C. Test in accordance with BICSI TDM Manual, TIA/EIA 607, and NFPA 70.
- D. When improper grounding is found, check entire project and correct. Perform retest.

END OF SECTION 270526

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SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope of Work

1. Install empty raceway system, including underfloor and overhead distribution system, fish wire, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cable troughs, service poles, miscellaneous and positioning material to constitute complete system, as indicated for distribution of Telecommunications wiring which includes cables for Data, Voice, Video, Audio, Security and future signal requirements.
2. Location at which all new telecommunications wiring will terminate is called Telecom Outlet (TO). There are several styles of outlets:
 - a. New construction
 - b. Existing construction typical
 - c. Existing construction variations
 - d. Telephone (Voice) only
 - e. Data only
3. Furnish and install split channel raceway and outlet boxes as specified in Drawings and as specified herein.
4. Furnish and install conduit stubs in walls and floors for cable routes.

B. Related Sections:

1. Applicable provisions of Division 01- General Requirements shall govern all work under this Section.
2. Section 26 05 26 – Grounding and Bonding for Electrical Systems.

1.2 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI C80.1 Rigid Steel Conduit - Zinc Coated.
2. ANSI C80.4 Fittings for Rigid Metal Conduit.

B. ASTM International (ASTM):

1. ASTM A123 - Specifications for Zinc (Hot Galvanized) Coatings on Iron and Steel.
2. ASTM – A276-06 Standard Specification for Stainless Steel Bars and Shapes.
3. ASTM A510 - Specifications for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
4. ASTM A580/A580M-06 Standard Specification for Stainless Steel Wire.
5. ASTM A653 - Specifications for Steel Sheet, Zinc-Coated (Galvanized) by Hot Dip Process.
6. ASTM B633 - Specifications for Electrodepositing Coatings of Zinc on Iron and Steel, Sections SC2 and SC3.
7. ASTM E814 – Standard Test Method for Fire Tests of Penetration Firestop Systems.

C. Building Industry Consulting Services International (BICSI):

1. BICSI Electronic Safety and Security Reference Manual (ESSDRM), current edition.
2. BICSI Information Transport Systems Installation Methods Manual (ITSIM), current edition.
3. BICSI Network Design Reference Manual (NDRM), current edition.

4. BICSI Telecommunications Distribution Methods Manual (TDMM), current edition.
 5. BICSI Wireless Design Reference Manual (WDRM), current edition.
- D. National Fire Protection Association (NFPA):
1. ASI/NFPA 70/250 - National Electric Code – Ground and Bonding.
 2. ANSI/NFPA 70/318 – National Electric Code – Cable Trays.
 3. CANSI/NFPA 70/645 – National Electric Code – Information Technology Equipment.
 4. ANSI/NFPA 70/770 – National Electric Code – Optical Fiber Cables and Raceways.
 5. NFPA 70B, “Recommended Practice for Electrical Equipment Maintenance” pertaining to cable tray systems.
- E. National Electrical Manufacturers Association (NEMA):
1. NEMA VE 2-2006 Cable Tray Installation Guidelines.
 2. NEMA VE-1/CSA C22.2 No 126 1-02 Metal Cable Tray Systems.
- F. Telecommunication Industry Association/Electronic Industries Alliance (TIA/EIA):
1. ANSI/TIA - 568-B Commercial Building Telecommunications Cabling Standard.
 2. ANSI/TIA - 569-A Commercial Building Standard for Telecommunications Pathways and Spaces.
 3. ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
- G. Underwriters’ Laboratories (UL):
1. UL and cUL E209183.
 2. UL 1479 – Standard for Fire Tests of Penetration Firestops.

1.3 QUALITY ASSURANCE

- A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in contract documents shall be subject to control and approval of Owner or Owner Representative. Equipment and materials shall be of quality and manufacture indicated. Equipment specified is based upon acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of equipment specified and subject to approval.
- B. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.
- C. Assure that "as installed" system is correctly and completely documented including engineering drawings, manuals, and operational procedures in such a manner as to support maintenance and future expansion of the system.
- D. Material and work specified herein shall comply with applicable requirements of current revision of the following:
1. ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

1.4 SUBMITTALS

- A. Division 01 – General Requirements: Requirements for submittals.

- B. Product Data: For features, ratings, and performance of each component specified.
- C. Submit manufacturer's instructions for storage, handling, protection, examination, preparation, operation, and installation of products. Include application conditions or limitations of use stipulated by any product testing agency. Submit for the following:
 - 1. Wall Boxes
 - 2. Raceway
 - 3. Conduit
 - 4. Conduit Bushings
- D. Shop Drawings
 - 1. Component List: List manufacturer, part number, and quantity of each component.
 - 2. Include dimensioned plan and elevation views of equipment rooms, labeling each individual component. Show raceway assemblies, method of field assembly, workspace requirements, and access for cable connections.

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Procedures for closeout submittals.
- B. Project Record Documents: Record actual locations of components and grounding electrodes.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site in manufacturer's original un-opened containers and packaging, with labels clearly indication manufacturer and material.
- B. Store materials in dry area indoors, protected from damage and in accordance with manufacturer's instructions.
- C. Protect materials and finishes during handling and installation to prevent damage.

PART 2 - PRODUCTS

2.1 Telecom Outlets (TO)

- A. Manufacturers
 - 1. Equivalent as acceptable to Engineer.
- B. New construction TO consist of one (1) 4-11/16 inch square by 2-1/8 inch deep flush mounted box. Each outlet box shall have EMT conduit stubbed above drop ceiling or extended into hallway cabletray. Conduits size is as follows:
 - 1. For Outlets with 3 or less cables, use 1 inch EMT conduit
 - 2. For Outlets with 3-6 cables, use 1.25 inch EMT conduit
 - 3. For all other sizes, calculate fill ratio at 40 percent for proper sized conduit
- C. Existing surface-mounted construction TO typically consists of surface-mounted raceway including base, cover, end fitting, entrance end fitting, and (2) 1 inch EMT conduits stubbed out top of entrance end fitting to above ceiling or out to nearest hallway distribution system. Size of raceway is site dependent based on number of conductors to be installed.

- D. Intent of installation of TOs which consist of raceway is as follows:
1. Where ceilings are accessible, raceway and entrance end fitting shall extend above ceiling and conduits installed above ceiling in room to nearest hallway distribution system.
 2. Where ceilings are partially accessible, or if Drawings and/or Specifications indicate installation of access panels, raceway shall extend above ceiling and conduits installed above ceiling in room to nearest hallway distribution system.
 3. Where ceilings are inaccessible or no ceilings exist, raceway shall extend up as close to ceiling as practical to allow installation of conduits as high as possible to nearest hallway distribution system.

2.2 HORIZONTAL DISTRIBUTION SYSTEMS

- A. Conduit System (Renovations only, where conduit exists)
1. Provide conduits secured to wall above corridor ceilings as shown on Drawings or as specified herein for installation of telecommunications cables.
 2. Corridor conduits shall be 4 inch EMT, furnished in 10 foot lengths wherever possible, with no sharp edges, reamed as necessary, evenly supported at two locations per 10 foot section spacing. Conduits shall be sized and quantified to account for handling cables in all TO conduits at 40 percent fill back to TR and/or ER rooms. Verify size prior to installation. Bushings and/or connectors on ends of EMT are required.
 3. All conduits shall be installed stacked and attached to walls unless conditions exist which prohibit this type of installation. When this condition exists, mount conduits side-by-side supported with 3/8 inch rod attached to building structure utilizing unistrut channel to form trapeze. Double nut top and bottom at unistrut. Utilize conduit clamp to secure conduits to unistrut.
 4. Provide measured pull line in each conduit rated at 1200 lbs. minimum. Increments must be in 12 inch steps.
 5. Grounding of conduits is not required per NEC #250-33, Exception No. 2. shall be painted except conduit above suspended ceilings or in mechanical, electrical or telecommunication rooms. Color to match that of surface installed upon or as directed by Owner's Representative. Coordinate with other trades prior to painting.
 6. Provide restorable fire stops inside and around conduits as recommended by UL1479 or ASTM E814 for all conduits penetrating fire-rated construction. Fire rated construction to be verified with AHJ. See Section 27 05 32 – Firestopping for Telecommunications Systems for more information.
- B. Corridor Cable Tray System
1. Complete wall mounted or suspended aluminum cable tray system and necessary accessories shall be provided as shown on plans. Install entire cable tray system in accordance with manufacturer's minimum installation practices and all local governing codes.
 2. Coordinate installation of cable tray with other trades to allow a minimum of 12 inches above, 12 inches in front, and 12 inches below of clearance from piping, conduits, ductwork, etc. Allowance must be provided for access to tray with reasonable room to work. Obstructions to tray must be minimized and cannot block more than 6 feet of tray at any point in run.
 3. Submittal drawings, in form of 8 1/2 x 11 inch catalog cut sheets, shall be provided for the following items: cable tray, fittings, accessories and load data.
 4. Cable tray shall not be loaded beyond 60 percent of manufacturer's recommended load capacity.
 5. Install wall mounted cable tray on both sides of hallway as shown on drawings and where applicable.

6. Where new cable tray distribution system encounters a wall, install sufficient 4 inch EMT sleeves through wall so cabling does not exceed 20 percent fill.
 7. Where cable tray is exposed below ceiling, install appropriate solid bottom inserts to conceal cables.
 8. Install cable tray dropouts where large quantities of cables exit distribution system.
 9. Cable tray must be sized to facilitate sufficient growth capacity for migration cable plant to coexist in same tray as existing cable plant, wherever possible.
 10. Manufacturer of cable tray in corridors and telecom rooms shall be B-Line, Cablofil or Panduit.
- C. Telecommunication Room Ladder Rack (Universal Cable Runway)
1. Ladder rack shall be manufactured from 3/8 inch wide by 1-1/2 inches high tubular steel with .065 inch wall thickness.
 2. Ladder rack (side stringers) will be 9 feet-11½ inches long. Cross members will be welded in between stringers on 12 inch intervals/centers beginning 5-3/4 inch from one end so that there are 10 cross members per ladder rack. There will be 10-1/2 inch of open space in between each cross member.
 3. Ladder rack will be delivered individually boxed, and available in width(s) specified below.
 4. Ladder rack will be UL Classified for suitability as equipment grounding conductor only (installer must remove paint or use ground straps at splices and intersections).
 5. Finish shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below.
- D. Horizontal 90 degree Turns (Cable Runway E-Bend)
1. Horizontal 90 degree turns shall be manufactured from 3/8 inch wide by 1-1/2 inch high tubular steel with .065 inch wall thickness.
 2. Stringers (sides) will be formed in 90 degree arc. Cross members will be welded in between stringers on approximate 23 degree increments so that there are 5 cross members per turn. Welded assembly will have 15 inch inside radius and will create smooth horizontal 90 degree turn.
 3. Horizontal 90 degree turns will be available in width(s) specified below.
 4. Finish shall be epoxy-polyester hybrid powder coat (paint) in color(s) specified below.
- E. Vertical-To-Horizontal 90 degree Turns (Cable Runway Outside Radius Bend)
1. Vertical-to-horizontal 90 degree turns shall be manufactured from 3/8 inch wide by 1-1/2 inch high tubular steel with .065 inch wall thickness.
 2. Stringers (sides) will be formed in 90 degree arc with 12-1/2 inch outside radius. Cross members will be welded in between stringers on approximate 23 degree increments so that there are 3 cross members per turn. Welded assembly will create smooth 90 degree vertical-to-horizontal turn.
 3. Vertical-to-horizontal 90 degree turns will be available in width(s) specified below.
 4. Finish shall be epoxy-polyester hybrid powder coat (paint) in color(s) specified below.
- F. Horizontal-To-Vertical 90 degree Turns (Cable Runway Inside Radius Bend)
1. Horizontal-to-vertical 90 degree turns shall be manufactured from 3/8 inch wide by 1-1/2 inch high tubular steel with .065 inch wall thickness.
 2. Stringers (sides) will be formed in 90 degree arc with 12-1/2 inch outside radius. Cross members will be welded in between stringers on approximate 23 degree increments so that there are 3 cross members per turn. Welded assembly will create smooth 90 degree horizontal-to-vertical turn.
 3. Horizontal-to-vertical 90 degree turns will be available in width(s) specified below.
 4. Finish shall be epoxy-polyester hybrid powder coat (paint) in color(s) specified below.

G. Ladder Rack Splices

1. Splice kits will provide method of mechanically connecting ladder rack sections and turns together end-to-end or side-to-end to form continuous pathway for cables.
2. Grounding kits will provide method of bonding ladder rack sections and turns together that is independent of pathway splices. Grounding kit should be constructed of UL Listed components. Preferred solution is #6 AWG green insulated stranded copper conductor connected on both ends to ladder rack using two-hole compression lugs and stainless steel hardware.
3. Insulator bar kit will provide means of electrically isolating individual ladder rack sections through end-to-end splice separated with non-conductive material. Preferred solution is 3/8 inch wide by 1-1/2 inch high by 5-1/2 inch long insulator bar made of Delrin® (by DuPont, Delrin is registered trademark of E.I. du Pont de Nemours and Company).
4. Splices (splice plates) will be manufactured from steel. Splice, grounding and insulator bar kits will include installation hardware.
5. Finish (of splice plates and hardware) shall be zinc plate in the color(s) specified below. Colors are applied as chem. film over zinc plate.

H. Ladder Rack Supports

1. Supports will be sized to match width of ladder rack that is supported. Some supports will work with multiple or all widths of ladder rack.
2. Each support will include means of mechanically securing ladder rack to support.
3. Supports will be manufactured from steel or aluminum.
4. Finish shall be epoxy-polyester hybrid powder coat (paint) in color(s) specified below or zinc plate with gold chem. finish specified gold. Included hardware shall be zinc plated with gold chem. finish.

I. All open pathway/trays shall be installed minimum of six (6) inches away from any light fixture or other source of EMI (Electromagnetic Interference).

J. All pathways shall be grounded per NEC Article 250.

K. Provide external grounding strap at expansion joints, sleeves and crossover and at other locations where pathway/tray continuity is interrupted.

L. Support all pathways from building construction. Do not support pathways from ductwork, piping, or equipment hangers.

M. Install cable tray level and straight unless noted on construction drawings.

N. Ladder Tray Raceway and Accessories Color – [BLACK] [CLEAR] [ZINK].

2.3 STATION CONDUITS

A. Station conduit is defined as conduit that originates at TO and rises within walls or is exposed from raceway and extends up into drop ceiling or over to hallway distribution system.

B. Provide station conduits from TOs to above drop ceiling or extend over to hallway distribution systems consisting of 1 inch EMT minimum or appropriate size as shown on Drawings or as specified herein for installation of telecommunications cables.

- C. Provide insulating press fit bushing on all telecommunications conduits including interconnecting nipples and stub to distribution system. To prevent conflicts with other cables or conduits to cable tray, conduit shall be stubbed not less than 6 inches above or below conduit/cable tray center line. Where space permits, every effort shall be made to bend station conduits down such that flow of installed cables promotes minimum length back to TR and least amount of bends in cables. Bushings must be rated to be used in environmental air handling space (Plenum).
- D. Provide measured pull line in 12 inch increments in each empty conduit to hallway distribution system.
- E. Indelibly mark station conduit at hallway distribution end with Room # that conduit serves.
- F. Use of 90 degree electrical pulling elbows is prohibited.
- G. Do not include more than two 90 degree bends between pulling points when installing station conduit runs. If path of station conduits requires more than 180 degrees of total bends, installation of appropriate sized junction box is required. See section 2.4 for junction box requirements.
- H. Place appropriate sized junction box in each individual station conduit run that exceeds 100 feet in length.
- I. Use of third bend in conduit is only acceptable if:
 - 1. Total conduit run is reduced by 15 percent.
 - 2. Conduit size is increased to next trade size.
 - 3. One of bends is located within 12 inches of cable feed end.

2.4 JUNCTION BOX REQUIREMENTS FOR STATION CONDUITS

- A. If station conduit route exceeds 180 degree of total bends limitation, appropriate sized junction box is required within straight section of conduit run.
- B. Each station conduit run requires separate junction box. Sharing of junction box by multiple conduits is prohibited.
- C. Junction box shall not be used in place of bend. All junction boxes in station conduit paths shall be installed within straight section of conduit run.

2.5 SERVICE ENTRANCE CONDUITS

- A. Minimum of (2) 4 inch IMC conduits shall be installed from nearest utility tunnel on outside of building as shown on Drawings. Terminate entrance conduits entering ER rooms from below grade to extend 4 inches above finished floor. Location of entrance conduits shall be within 12 inches of room corners.
- B. Terminate entrance conduits entering ER rooms from above ceiling height to extend 4 inches below finished ceiling or 12 inches above cable tray.
- C. Terminate entrance conduits entering an ER rooms from below ceiling height to extend 4 inches into room.

- D. Entrance conduits shall be continuous into building and to ER. Securely fasten all entrance conduits to building to withstand any cable placing operation. Do not include more than two 90 degree bends between pulling points when installing entrance conduits.
- E. On exterior wall penetrations, seal both sides of wall around outside of conduit with hydraulic cement to prevent water from entering building. Seal inside of conduit on both sides with conduit plugs, water plugs, or duct sealer to prevent water, vapors, or gases from entering building.

2.6 PATHWAY REQUIREMENTS FOR ENTRANCE CONDUITS

- A. If entrance conduits exceeds 180 degree of total bends limitation, appropriate sized junction box, manhole, or hand hole is required.
- B. As-built drawings of entrance conduit path required to be submitted to Owner's Representative before covered with soil.

2.7 RISER CONDUITS

- A. Riser conduits shall only be used when noted on Construction Documents for special applications only. Riser conduits are not required as general rule for riser system. However, when required:
 - 1. Minimum of (2) 4 inch conduits shall be installed between ER room and each TR room as shown on Drawings.
 - 2. Conduits entering ER and TR rooms shall be reamed or bushed and terminated not more than 4 inches from entrance wall and within 12 inches of room corners.
 - 3. Conduits entering ER and TR rooms from below floor shall be terminated not more than 4 inches above finished floor.
 - 4. Conduits for riser cables shall be continuous and separate from all other conduit or enclosed raceway systems. Do not include more than two 90 degree bends between pulling points when installing riser conduits. Where junction boxes are required, locate in accessible areas, such as above suspended ceilings in hallways.
 - 5. Conduits shall not be less than 4 inch trade size and be equipped with measured pull line at 12 inch increments rated at minimum 1200 pound test.
 - 6. Provide restorable fire stops inside and around conduits as recommended by UL1479 or ASTM E814 for all conduits penetrating fire-rated construction. Fire-rated construction to be verified with AHJ. See Section 27 05 32 – Firestopping for Telecommunications Systems for more information.
 - 7. Provide insulating press fit bushing on all telecommunications riser conduits. Bushings must be rated to be used in environmental air handling space (Plenum).
 - 8. Manufacturer of insulating bushing on all telecommunication conduits shall be Arlington or equal.
 - 9. Riser conduits shall not be used for distribution of horizontal cables.

2.8 FIRESTOPPING

- A. In all buildings, floor/ceiling assemblies, stairs, and elevator penetrations must be sealed with 2-hour fire stop assembly at a minimum, unless otherwise noted.
- B. Contact Owner's Representative to identify walls which are fire-rated construction. Walls must be sealed with 2-hour fire stop assembly at minimum.

- C. Communication pathways requiring fire stopping shall utilize removable/re-usable fire stopping putties for ease of moves, adds and changes.
- D. All fire stopping penetrations shall conform to the recommended practices listed in UL1479 or ASTM.
- E. See Section 27 05 32 - Firestopping for Telecommunications Systems.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Intention of telecommunications conduits is to provide route between ER and TR rooms, routes from TRs throughout building floors to hallways, and routes from hallway distribution systems into rooms to individual TOs for telecommunications cabling.
- B. Installation of new pathways shall not interfere with existing pathways in such a way that installation of new cables within the existing pathway is made more difficult.

3.2 EXAMINATION

- A. Examine areas to receive cable management system. Notify Owner's Representative of conditions that would adversely affect installation or subsequent utilization of system.
- B. Do not proceed with installation until unsatisfactory conditions are corrected.

3.3 INSTALLATION

- A. Install in accordance with recognized industry practices, to ensure that equipment complies with requirements of NEC, and applicable portions of NFPA 70B and NECA "Standards of Installation" pertaining to general electrical installation practice.
- B. Coordinate installation with other trades.
- C. Field verification is required before installation.
- D. Install cable management system at locations indicated on Drawings and in accordance with manufacturer's instructions.

3.4 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Test in accordance with BICSI TDM Manual.

END OF SECTION 270528

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SECTION 270529 - HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDES

- A. Work covered under this section consists of furnishing of all necessary labor, supervision, materials, equipment, and services to completely execute system of non-continuous cable supports as described in this specification.
- B. Related Sections:
 - 1. Applicable provisions of Division 01- General Requirements shall govern all work under this Section.
 - 2. Section 03 31 00 - Structural Concrete: Product requirements for concrete for placement by this section.
 - 3. Section 26 05 29 - Hangers and Supports for Electrical Systems.
 - 4. Section 27 05 32 – Firestopping for Telecommunications System.
 - 5. Section 28 05 27 - Hangers and Supports for Electronic Safety and Security.

1.2 SCOPE OF WORK

- A. This Section includes minimum requirements for support structures for Communications Systems for project as outlined in Bid Document.
 - 1. Non-continuous cable supports (2.3A)
 - 2. Adjustable non-continuous cable support sling (2.3B)
 - 3. Multi-tiered non-continuous cable support assemblies (2.3C)
 - 4. Non-continuous cable support assemblies from tee bar (2.3D)
 - 5. Non-continuous cable support assemblies from drop wire/ceiling (2.3E)
 - 6. Non-continuous cable support assemblies from beam, flange (2.3F)
 - 7. Non-continuous cable support assemblies from C & Z Purlin (2.3G)
 - 8. Non-continuous cable support assemblies from wall, concrete, or joist (2.3H)
 - 9. Non-continuous cable support assemblies from threaded rod (2.3I)
 - 10. Raised floor non-continuous cable support assemblies (2.3J)
 - 11. Cantilever-Mounted Option for non-continuous cable supports (2.3K)
 - 12. Installation accessories for non-continuous cable supports (2.3L)

1.3 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM A109 - Standard Specification for Steel, Strip, Carbon, Cold-Rolled.
 - 2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 3. ASTM A167 - Standard Specification for Stainless and heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - 4. ASTM A480 - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
 - 5. ASTM A568 - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy Hot-Rolled and Cold-Rolled
 - 6. ASTM A653 G60 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip process

7. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
8. ASTM A682 - Standard Specification for Steel, Strip, High-Carbon, Cold-Rolled, Spring Quality
9. ASTM A879 - Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface
10. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
11. ASTM B117 - Standard Method of Salt Spray (Fog) Testing
12. ASTM B633 - Standard Specification for Electro-deposited Coatings of Zinc on Iron and Steel
13. ASTM B695-90 - Standard Specification for coatings of Zinc Mechanically Deposited on Iron and Steel
14. ASTM D610 - Standard test Method for Evaluating Degree of Rusting on Painted Steel Surfaces

B. National Fire Protection Association (NFPA):

1. NFPA 70 - National Electrical Code.

C. Telecommunication Industry Association/Electronic Industries Alliance (TIA/EIA):

1. ANSI/ TIA-568 Commercial Building Telecommunications Cabling Standard, current revision level.
2. ANSI/ TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces, current revision level.

D. Underwriters Laboratories Inc. (UL):

1. UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces.

1.4 SUBMITTALS

A. Division 01 – General Requirements: Requirements for submittals.

B. Submit product data on non-continuous cable support devices, including attachment methods. Product data to include, but not limited to materials, finishes, approvals, load ratings, and dimensional information.

C. Firestopping Schedule:

1. Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

D. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.
2. Firestopping: Submit preparation and installation instructions.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Non-continuous cable supports and cable support assemblies shall be listed by Underwriters Laboratories for Canadian and US standards (cULus).

- B. Non-continuous cable supports shall have manufacturers name and part number stamped on part for identification.
- C. Manufacturer: Company specializing in manufacturing products specified in this section with minimum of five years documented experience in industry, and certified ISO 9000.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five (5) years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum years documented experience approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 – General Requirements: Environmental conditions affecting products on site.
- B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.
- C. Maintain this minimum temperature before, during, and for minimum three (3) days after installation of firestopping materials.
- D. Provide ventilation in areas to receive solvent cured materials.

1.9 COORDINATION

- A. Coordinate installation of hangers, supports and cables with other trades.

PART 2 - PRODUCTS

2.1 NON-CONTINUOUS CABLE SUPPORT SYSTEMS

- A. Manufacturers
 1. ERICO CADDY
 2. COOPER B-LINE
 3. Equivalent as acceptable to Engineer.
- B. Non-continuous cable supports shall provide bearing surface of sufficient width to comply with required bend radii of high-performance cables; cULus Listed.

- C. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.
- D. Non-continuous cable supports sized 1-5/16 inch and larger shall have cable retainer strap to provide containment of cables within hanger. Cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.
- E. Non-continuous cable supports shall have electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments.
- F. Stainless Steel non-continuous cable supports are intended for indoor and outdoor use in non-corrosive environments or where only mildly corrosive conditions apply.
- G. Multi-Tiered Non-Continuous Cable Support Assemblies
 - 1. Multi-tiered non-continuous cable support assemblies shall be used where separate cabling compartments are required. Assemblies may be factory assembled or assembled from pre-packaged kits. Assemblies shall consist of steel angled hanger bracket holding up to six non-continuous cable supports, rated for indoor use in non-corrosive environments; cULus Listed.
 - 2. If required, multi-tier support bracket may be assembled to manufacturer recommended specialty fasteners including beam clamps, flange clips, C and Z purlin clips.

2.2 Non-Continuous Cable Support Assemblies From Tee Bar

- A. Tee bar support bracket with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.
- B. Non-Continuous Cable Support Assemblies From Drop Wire/Ceiling
 - 1. Fastener to wire/rod with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.
- C. Non-Continuous Cable Support Assemblies From Beam, Flange
 - 1. Fastener to beam or flange with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.
- D. Non-Continuous Cable Support Assemblies From C & Z Purlin
 - 1. Fastener to C or Z purlin with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments, cULus Listed.
- E. Non-Continuous Cable Support Assemblies From Wall, Concrete, or Joist
 - 1. Fastener to wall, concrete, or joist with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments, cULus Listed.
- F. Non-Continuous Cable Support Assemblies From Threaded Rod
 - 1. Fastener to threaded rod with one non-continuous cable support, factory or jobsite assembled, rated for indoor use in non-corrosive environments, cULus Listed.
 - 2. Multi-tiered support bracket shall have static load limit of 300 lbs.
 - 3. U-hooks and Double J-hook shall attach directly to threaded rod using standard nuts.
- G. Raised Floor Non-Continuous Cable Support Assemblies
 - 1. Fastener to raised (access) floor pedestal with one non-continuous cable support, factory or jobsite assembled, rated for indoor use in non-corrosive environments; cULus Listed.

H. Cantilever-Mounted Cable Supports

1. U-hook shall be able to be assembled to wide variety of wall mount brackets.
2. Spacing of individual U-hooks as needed, max of 4 feet to 5 feet apart.
3. U-hooks may have optional attachment of cable roller for ease in pulling cables.

I. Installation Accessories for Non-Continuous Cable Supports

1. Cable Pulley
 - a. Non-continuous cable supports may be used as installation tool when removable pulley assembly is included. Pulley shall be made of plastic and be without sharp edges. Pin and bail assembly must be able to be secured to J-Hook during cable installation. Pulley must remain secured while cables are being pulled.
 - b. Pin and roller assembly must be removed after cables are installed.
2. Cable Protector
 - a. Protective steel tube shall fit over threaded rod and be at least 4 inches in length.
 - b. Tube shall prevent damage to cables placed in or pulled through CAT-CMTM U-hooks. Tube shall not inhibit pulling of cables.

2.3 FINISHES

A. ASTM B633 Standard Specification for Electro-deposited Coatings of Zinc on Iron and Steel

1. ASTM B 695 Standard Specification for coatings of Zinc Mechanically Deposited on Iron and Steel
2. ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
3. ASTM A924/A924M Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by Hot-Dip Process

B. Non-continuous cable supports used where only mildly corrosive conditions apply shall be stainless steel, AISI type 304.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation and configuration shall conform to requirements of current revision levels of ANSI/EIA/TIA Standards 568 & 569, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer's installation instructions.
- B. Do not exceed load ratings specified by manufacturer.
- C. Adjustable non-continuous support sling shall have static load limit of 100 lbs.
- D. Follow manufacturer's recommendations for allowable fill capacity for each size non-continuous cable support.
- E. Locate pathways per Telecommunications Drawings.

3.2 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements: Requirements for testing, adjusting, and balancing.

3.3 PROTECTION OF FINISHED WORK

- A. Division 01 – General Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

END OF SECTION 270529

SECTION 270532 - FIRESTOPPING FOR TELECOMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 07 Specification Sections, apply to this Section.
- B. Cable fill calculations must be included to show maximum cable fill ratio for each Firestopping System and cable type.

1.2 SUMMARY

- A. Section Includes
 - 1. This Section describes requirements for furnishing and installing firestopping for fire-rated construction. This includes all openings in fire-rated floors, walls and other rated elements of construction, both blank (empty) and those accommodating items such as cables, conduits, pipes, ducts, etc.
 - a. Fireblocking for Concrete Floor or Wall Sleeved Cables.
 - b. Fireblocking for Gypsum Wall Sleeved Cables.
 - c. Fireblocking for Concrete Block Wall Sleeved Cables.
- B. Related Sections:
 - 1. Applicable provisions of Division 01- General Requirements shall govern all work under this Section.
 - 2. Section 27 05 26 – Grounding and Bonding for Communication Systems.
 - 3. Section 27 05 29 – Hangers and Supports for Communication Systems.

1.3 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM E119 - Fire Tests of Building Construction and Materials.
 - 2. ASTM E814 - Fire Tests of Through-Penetration Fire Stops.
- B. BOCA – Basic/National Building Code
- C. ICBO – Uniform Building Code
- D. National Fire Protection Association (NFPA):
 - 1. ANSI/NFPA 70 – National Electrical Code (NEC).
 - 2. NFPA 101 - Life Safety Code.
- E. SSBCCI – Standard Building Code.
- F. Telecommunications Industry Association (TIA):
 - 1. TIA 569 – Commercial Building Standard for Telecommunications Pathways & Spaces.
- G. Underwriters Laboratories Inc. (UL):
 - 1. UL Fire Resistance Directory – Penetration Firestops System (XHE2) and Fill, Void or Cavity Materials.

2. UL 1479 - Fire Tests of Through-Penetration Firestops

1.4 SUBMITTALS

- A. Division 01 – General Requirements: Requirements for submittals.
- B. Submit manufacturer’s product literature and installation procedures for each type of Firestop material to be installed. Literature shall indicate product characteristics, typical uses, performance and limitation criteria and test data. Submit cured samples of firestop materials.
- C. Shop drawings: Show typical installation details for methods of installation. Indicate which firestop materials will be used where and when applications requirements to meet Specific jobsite conditions.
- D. Product Data: Shall be clearly marked to indicate all technical information which specifies full compliance with requirements of this section and Contract Documents, including the following:
 - 1. Copy of UL illustration of each proposed system indicating manufacturer’s approved modifications.
 - 2. Each condition requiring penetration seals in proposed UL systems materials, anchorage, methods of installation and actual adjacent construction.
- E. Applicator’s Qualification Statement: Shall include list of projects indicating required experience.

1.5 QUALITY ASSURANCE

- A. Firestopping systems (materials and design) shall conform to both Flame (F) ratings and Time (T) ratings as required by local building code and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire tests in configuration that is representative of field conditions.
- B. Work of this section shall be performed by company which specializes installing UL Classified penetration seals required for this Project, with minimum of five years of documented successful experience and shall be performed by skilled Workmen thoroughly experience in necessary crafts.
- C. Deliver material in manufacturer’s original, unopened containers or packages with manufacturer’s name, product identification, lot number, UL label, and mixing and installation instructions as applicable.
- D. Store materials in original, unopened containers or packages, and under conditions recommended by manufacturer.
- E. All firestop materials shall be installed prior to expiration of shelf life.

1.6 COORDINATION

- A. Coordinate layout and installation of Firestopping System with other trades.
- B. Revise locations and elevations from those indicated as required to suit field conditions and as approved by Architect.

- C. Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products will not be installed. Store devices and accessories in original cartons and in clean dry space; protect from weather and construction traffic. Wet materials will be unpacked and dried before storage.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers
 - 1. Equivalent as acceptable to Engineer.
- B. Materials and products required for work of this section shall not contain asbestos or polychlorinated biphenyls (PCB).
- C. Manufacturer and Firestopping System must be approved by local AHJ before purchase or installation.

2.2 GENERAL

- A. Provide and install firestopping materials to meet applicable codes and installation requirements for each firestopping application. Products using caulking, putties, wrap strips, mortars, composite boards and/or mechanical devices shall be used as appropriate for specific condition.

2.3 CAULKING

- A. When caulking is used, provide and install flexible caulking materials. Cured firestop materials 1/8 thick shall be able around 1 inch mandrell without breaking.

2.4 FIRESTOP

- A. Do not use any firestop products which re-emulsify, leach active intumescent ingredients or dissolve when placed in water after curing. Product must withstand passage of cold smoke, either as inherent property of system or by use of separate product included as part of UL system or device, and designed to perform this function.

2.5 PENETRATION SEALS

- A. Penetration seals (firestopping material) shall be asbestos-free and capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of ASTM E814 and UL 1479.
- B. Materials shall meet and be acceptable for use by all three model building codes, Basic/National Building Code, Building Code and Standard Building Code, per National Evaluation Service, Inc. report # NER-243.
- C. Materials shall meet requirements of NFPA 101 and NFPA 70.
- D. Materials shall be suitable for firestopping of penetrations made by steel, glass, plastic and insulated pipe, conduit, bus duct, noninsulated pipe and ductwork.
- E. On insulated pipe, fire-rating classification must not require removal of insulation.

- F. Rating of penetration seals shall not be less than rating of time-rated floor or wall assembly.
- G. Systems shown below are examples and other equal systems may be approved or required by AHJ.
- H. 2-Hour Rated Concrete Floor
 - 1. Penetrants: Multiple pipes.
 - 2. UL System: No. 93.
- I. 2-hour Rated Concrete Floor
 - 1. Penetrants: Maximum 30 inch dia. Metal pipe/conduit.
 - 2. UL System: No.319
- J. 1-2 –Hour Rated Gypsum Board Wall
 - 1. Penetrant: Metal pipe/conduit.
 - 2. UL System: No. 147
- K. 2-Hour Rated Gypsum Board Wall
 - 1. Penetrant: Metal pipe/conduit.
 - 2. UL System: No. 147
- L. 3-Hour Rated Concrete Wall
 - 1. Penetrant: Metal duct, maximum 2 foot square and maximum dimension of 30 inches.
 - 2. UL System: No. 105

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and condition where Firestops are to be installed and notify Architect of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected by contractor in manner acceptable to Architect.

3.2 CONDITIONS REQUIRING FIRESTOPPING

- A. Provide firestopping for conditions specified whether or not firestopping is indicated, and if indicated, whether such material is designed as insulation, safing, or otherwise.
- B. At any point where fire rated wall is penetrated with cable or conduit.
- C. Penetrations
 - 1. Penetrations include conduit, cable wire, pipe, duct or other elements which pass through one or both outer surfaces of fire rated floor, wall or partition.
 - 2. These requirements for penetrations shall apply whether or not sleeves have been provided, and whether or not penetrations are to be equipped with escutcheons or other trim. If penetrations are sleeved firestop any annular space between sleeve and wall opening.
- D. Provide firestopping to fill miscellaneous voids and openings in fire-rated construction as specified herein.

3.3 INSTALLATION

- A. Installation of Firestops shall be performed by applicator/installer qualified and trained by manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
- B. Apply Firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations.
- C. Coordinate with plumbing, mechanical, electrical and other trades to assure that all pipe, conduit, cable, and other items which penetrate fire-rated construction have been permanently installed prior to installation of Firestop.
- D. Field Quality Control
 - 1. Prepare and install firestopping systems in accordance with manufacturer's printed instructions and recommendations.
 - 2. Follow safety procedures recommended in Material Safety Data Sheets.
 - 3. Finish surfaces of firestopping which is to remain exposed in completed work to uniform and level condition.
 - 4. All areas of work must be accessible until inspection by applicable Code Authorities.
 - 5. Correct unacceptable firestops and provide additional inspection to verify compliance with this specification at no additional cost.
- E. Calculate maximum cable fill ratio for each FireStopping System and cable type. Do not exceed maximum fill ratio.
- F. Prepare and install firestopping systems in accordance with manufacturer's printed instructions and recommendations.

3.4 WARRANTY

- A. Comply with General Conditions, and include but not be limited to:
 - 1. Repairs and replacement of penetration seals which fail in joint adhesion, cohesion, abrasion, resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability, or appear to deteriorate in any other manner not clearly specified in submitted manufacturer's data as inherent quality of material for exposure indicated.

3.5 CLEANING

- A. Remove spilled and excess materials adjacent to firestopping without damaging adjacent surfaces.
- B. Leave finished work in neat, clean condition with no evidence of spillovers or damage to adjacent surfaces.

END OF SECTION 270532

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SECTION 270533 - CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Outlets.
 - 2. Conduits.

- B. Related Sections:
 - 1. Applicable provisions of Division 01- General Requirements shall govern all work under this Section.
 - 2. Section 27 05 26 - Grounding and Bonding for Communications Systems.
 - 3. Section 27 05 29 - Hangers and Supports for Communications Systems.
 - 4. Section 27 05 36 - Cable Trays for Communications Systems.
 - 5. Section 27 05 53 - Identification for Communications Systems.

1.2 REFERENCES

- A. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.

- B. Telecommunication Industry Association/Electronic Industries Alliance (TIA/EIA):
 - 1. ANSI/ TIA-568 Commercial Building Telecommunications Cabling Standard, current revision level.
 - 2. ANSI/ TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces, current revision level.

- C. Underwriters Laboratories Inc. (UL):
 - 1. UL 651 – Standard for Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.
 - 2. UL 797 – Standard for Electrical Metallic Tubing - Steel.

1.3 OUTLETS

- A. Each data outlet in wall or floor shall be served by one (1) 1 inch conduit and double-gang deep device box with single-gang mud ring.

- B. Wall mounted telephones shall be served by one 0.75 inch conduit and single-gang deep device box with single-gang mud ring. Outlet box shall be mounted at center height of 48 inch above finished floor, unless otherwise specified on drawing, and shall have clearance of 12 inch of wall surface on all sides.

- C. All outlet conduits shall be stubbed into accessible ceiling space.

- D. All outlet conduits shall have burrs and any other abrasive elements removed and insulating bushing shall be installed on both ends.

- E. No section of conduit shall be longer than 100 feet between pull points.

- F. No more than 180 degrees of conduit bends shall be permitted between pull points.

- G. Minimum inside radius for any bend of outlet conduit shall be six times inside diameter of that conduit.

1.4 CONDUITS

- A. Electric metallic tubing: Comply with UL 797. Tubing shall have hot dipped galvanized exterior, enamel-coated interior.
- B. Flexible conduit shall not be used in lieu of conduit bends and offsets.
- C. PVC conduit: Comply with UL 651, listed for use with 90 degrees C conductors operating at 90 degrees C.

1.5 STANDARDS COMPLIANCE

- A. General standards: Comply with current revision of TIA 569 as amended.

1.6 SUBMITTALS

- A. Division 01 – General Requirements: Requirements for submittals.
- B. Provide product data for the following:
 - 1. Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1.7 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Requirements for submittals.
- B. Project Record Documents:
 - 1. Record actual routing of conduits larger than two (2) Inch.
 - 2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Product storage and handling requirements.
- B. Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products will not be installed. Store materials in original cartons and in clean dry space; protect from weather and construction traffic. Wet materials will be unpacked and dried before storage.

1.9 COORDINATION

- A. Division 01 – General Requirements: Coordination and project conditions.
- B. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.
- C. Coordinate installation of labels with other trades.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Equivalent as acceptable to Engineer.

2.2 APPROVED PRODUCTS

- A. Dry location device boxes: Manufacturer shall meet specified requirements.
- B. Wet location boxes: Manufacturer shall meet specified requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Coordination and project conditions.
- B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 INSTALLATION

- A. Installation and configuration shall conform to requirements of current revision levels of ANSI/EIA/TIA Standards 568 & 569, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer's installation instructions.
- B. Install conduits using techniques, practices, and methods that are consistent with Category 6 or higher requirements and that supports Category 6 or higher performance of completed and linked signal paths, end to end.
- C. Follow manufacturer's recommendations for allowable fill capacity for each size non-continuous cable support.

3.3 ADJUSTING

- A. Division 01 – General Requirements: Testing, adjusting, and balancing.
- B. Adjust flush-mounting outlets to make front flush with finished wall material.
- C. Install knockout closures in unused openings in boxes.

3.4 CLEANING

- A. Division 01 – General Requirements: Final cleaning.
- B. Clean interior of boxes to remove dust, debris, and other material.
- C. Clean exposed surfaces and restore finish.

END OF SECTION 270533

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SECTION 280528.29 - HANGERS AND SUPPORTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Conduit supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Firestopping relating to electronic safety and security work.
7. Firestopping accessories.
8. Equipment bases and supports.

B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
2. Section 07 84 00 - Firestopping: Product requirements for firestopping for placement by this section.
3. Section 26 05 29 - Hangers and Supports for Electrical Systems.
4. Section 27 05 29 - Hangers and Supports for Communications Systems.

1.2 REFERENCES

A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved by Factory Mutual Research for Property Conservation.

C. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

D. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

E. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

1.3 DEFINITIONS

- A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

- A. Firestopping Materials: Comply with requirements of Section 07 84 00.
- B. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

- A. Firestopping Materials: Comply with requirements of Section 07 84 00.
- B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.
- C. Product Data:
 - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
 - 2. Firestopping: Submit data on product characteristics, performance and limitation criteria.
- D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
- E. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.
- F. Manufacturer's Installation Instructions:
 - 1. Hangers and Supports: Submit special procedures and assembly of components.
 - 2. Firestopping: Submit preparation and installation instructions.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- H. Firestopping Engineering Judgments: For conditions not covered by UL or WH listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

- A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10-inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - 1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.

2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - a. Floor Penetrations Within Wall Cavities: T-Rating is not required.
- B. Through Penetration Firestopping of Non-Fire Rated Floor [and Roof] Assemblies: Materials to resist free passage of flame and products of combustion.
 1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
 2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.
- C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.
- D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10-inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.
- E. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- F. Perform Work in accordance with State Municipality of standard.
- G. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum years documented experience approved by manufacturer.

1.9 PRE-INSTALLATION MEETINGS

- A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

- B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.
- C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.
- D. Provide ventilation in areas to receive solvent cured materials.

PART 2 - PRODUCTS

2.1 CONDUIT SUPPORTS

- A. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.
- B. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.
- C. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.
- D. Conduit clamps - general purpose: One-hole malleable iron for surface mounted conduits.
- E. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self-locking.

2.2 FORMED STEEL CHANNEL

- A. Product Description: Galvanized 12 gage) thick steel. With holes 1-1/2 inches on center.

2.3 SPRING STEEL CLIPS

- A. Product Description: Mounting hole and screw closure.

2.4 SLEEVES

- A. Furnish materials in accordance with State Municipality standards.
- B. Sleeves for Through Non-fire Rated Floors: 18 gage thick galvanized steel.
- C. Sleeves for Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- D. Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.
- E. [Stuffing] [Fire-stopping] Insulation: Glass fiber type, non-combustible.

2.5 MECHANICAL SLEEVE SEALS

- A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and

pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6 FIRESTOPPING

- A. Firestopping Materials: Comply with requirements of Section 07 84 00.
- B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
 - 1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
 - 2. Foam Firestopping Compounds: Single Multiple component foam compound.
 - 3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
 - 4. Fiber Stuffing and Sealant Firestopping: Composite of mineral ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
 - 5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
 - 6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
 - 7. Firestop Pillows: Formed mineral fiber pillows.
- C. Color: Dark gray Black.

2.7 FIRESTOPPING ACCESSORIES

- A. Installation Accessories: Comply with requirements of Section 07 84 00.
- B. Dam Material: Permanent:
 - 1. Mineral fiberboard.
 - 2. Mineral fiber matting.
 - 3. Sheet metal.
 - 4. Plywood or particle board.
 - 5. Alumina silicate fire board.
- C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
- D. General:
 - 1. Furnish UL listed products or products tested by independent testing laboratory.
 - 2. Select products with rating not less than rating of wall or floor being penetrated.
- E. Non-Rated Surfaces:
 - 1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
 - 2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify openings are ready to receive sleeves.
- C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
- B. Remove incompatible materials affecting bond.
- C. Install backing damming materials to arrest liquid material leakage.
- D. Obtain permission from Engineer/Architect before using powder-actuated anchors.
- E. Do not drill or cut structural members.
- F. Obtain permission from Engineer/Architect before drilling or cutting structural members.

3.3 INSTALLATION - HANGERS AND SUPPORTS

- A. Anchors and Fasteners:
 - 1. Concrete Structural Elements: Provide precast inserts.
 - 2. Steel Structural Elements: Provide [beam clamps] [, spring steel clips] [, steel ramset fasteners] [, and] [welded fasteners].
 - 3. Concrete Surfaces: Provide [self-drilling anchors] [and] [expansion anchors].
 - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide [toggle bolts] [and] [hollow wall fasteners].
 - 5. Solid Masonry Walls: Provide [expansion anchors] [and] [preset inserts].
 - 6. Sheet Metal: Provide sheet metal screws.
 - 7. Wood Elements: Provide wood screws.
- B. Inserts:
 - 1. Install inserts for placement in concrete forms.
 - 2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut [above] [flush with top of] [recessed into and grouted flush with] slab.
- C. Install conduit and raceway support and spacing in accordance with NEC.
- D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

- E. Install multiple conduit runs on common hangers.
- F. Supports:
 - 1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
 - 2. Install surface mounted cabinets and panelboards with minimum of four anchors.
 - 3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.
 - 4. Support vertical conduit at every [other] floor.

3.4 INSTALLATION - FIRESTOPPING

- A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.
- B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.
- C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.
- D. Compress fibered material to maximum 40 percent of its uncompressed size.
- E. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.
- F. Place intumescent coating in sufficient coats to achieve rating required.
- G. Remove dam material after firestopping material has cured. Dam material to remain.
- H. Fire Rated Surface:
 - 1. Seal opening at [floor,] [wall,] [partition,] [ceiling,] [and] [roof] as follows:
 - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
 - b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.
 - c. Pack void with backing material.
 - d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
 - 2. Where [cable tray,] [bus,] [cable bus,] [conduit,] [wireway,] [trough,] [and] penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.
- I. Non-Rated Surfaces:
 - 1. Seal opening through non-fire rated [wall,] [partition] [floor,] [ceiling,] [and] [roof opening] as follows:
 - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
 - b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.
 - c. Install type of firestopping material recommended by manufacturer.

2. Install [escutcheons] [floor plates] [or] [ceiling plates] where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.
4. Interior partitions: Seal pipe penetrations at computer rooms, telecommunication rooms, and data rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer to Section 03 30 00.
- B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct supports of steel members formed steel channel. Brace and fasten with flanges bolted to structure.

3.6 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with adjustable interlocking rubber links.
- B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.
- C. Set sleeves in position in forms. Provide reinforcing around sleeves.
- D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- E. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
- F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with stuffing fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- G. Install chrome plated steel plastic stainless steel escutcheons at finished surfaces.

3.7 FIELD QUALITY CONTROL

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.8 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean adjacent surfaces of firestopping materials.

3.9 PROTECTION OF FINISHED WORK

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

END OF SECTION 280528.29

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SECTION 28 05 28 - CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.
- B. Related Sections:
 - 1. Section 26 05 03 - Equipment Wiring Connections.
 - 2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
 - 3. Section 26 05 34 - Floor Boxes for Electrical Systems.
 - 4. Section 26 05 36 - Cable Trays for Electrical Systems.
 - 5. Section 26 05 39 - Underfloor Raceways for Electrical Systems.
 - 6. Section 26 27 16 - Electrical Cabinets and Enclosures.
 - 7. Section 26 27 26 - Wiring Devices.
 - 8. Section 27 05 33 - Conduits and Backboxes for Communications Systems.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Raceway:
 - 1. Basis of Measurement: By linear foot.
 - 2. Basis of Payment: Includes materials, delivery, handling, and installing.
- B. Boxes:
 - 1. Basis of Measurement: By cubic foot.
 - 2. Basis of Payment: Includes materials, delivery, handling, and installing.

1.3 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
 - 2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
 - 3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).
- B. National Electrical Manufacturers Association:
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
 - 3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - 6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
 - 7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.4 SYSTEM DESCRIPTION

- A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.
- B. Underground More than 5 feet outside Foundation Wall: Provide rigid steel conduit, intermediate metal conduit, plastic coated conduit, thick wall nonmetallic conduit and thin-wall nonmetallic conduit. Provide cast metal boxes or nonmetallic handhole.
- C. Underground Within 5 feet from Foundation Wall: Provide rigid steel conduit, intermediate metal conduit, plastic coated conduit, thick wall nonmetallic conduit and thin-wall nonmetallic conduit. Provide cast metal or nonmetallic boxes.
- D. In or Under Slab on Grade: Provide rigid steel conduit, intermediate metal conduit, plastic coated conduit, thick wall nonmetallic conduit and thin-wall nonmetallic conduit. Provide cast or nonmetallic metal boxes.
- E. Outdoor Locations, Above Grade: Provide rigid steel and aluminum conduit, intermediate metal conduit and electrical metallic tubing. Provide cast metal or nonmetallic outlet, pull, and junction boxes.
- F. In Slab Above Grade: Provide rigid steel conduit, intermediate metal conduit, electrical metallic tubing and thickwall nonmetallic conduit. Provide cast sheet metal nonmetallic boxes.
- G. Wet and Damp Locations: Provide rigid steel and aluminum conduit, intermediate metal conduit, electrical metallic tubing, thickwall nonmetallic conduit and, nonmetallic tubing. Provide cast metal or nonmetallic outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.
- H. Concealed Dry Locations: Provide rigid steel and aluminum conduit, intermediate metal conduit, electrical metallic tubing, thickwall nonmetallic conduit and nonmetallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
- I. Exposed Dry Locations: Provide rigid steel and aluminum conduit, intermediate metal conduit, electrical metallic tubing and thickwall nonmetallic conduit. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

1.5 DESIGN REQUIREMENTS

- A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

1.6 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit for the following:
 - 1. Flexible metal conduit.

2. Liquidtight flexible metal conduit.
3. Nonmetallic conduit.
4. Flexible nonmetallic conduit.
5. Nonmetallic tubing.
6. Raceway fittings.
7. Conduit bodies.
8. Surface raceway.
9. Wireway.
10. Pull and junction boxes.
11. Handholes.

- C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.7 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents:
1. Record actual routing of conduits larger than 2 inch.
 2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- C. Protect PVC conduit from sunlight.

1.9 COORDINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate installation of outlet boxes for equipment connected under Section 26 05 03.
- C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2 - PRODUCTS

2.1 METAL CONDUIT

- A. Rigid Steel Conduit: ANSI C80.1.
- B. Rigid Aluminum Conduit: ANSI C80.5.
- C. Intermediate Metal Conduit (IMC): Rigid steel.

- D. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit. furnish aluminum fittings with steel conduit. all steel fittings.

2.2 PVC COATED METAL CONDUIT

- A. Product Description: NEMA RN 1; rigid steel conduit with external PVC coating, 20/40 mil thick.
- B. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.3 FLEXIBLE METAL CONDUIT

- A. Product Description: Interlocked steel aluminum construction.
- B. Fittings: NEMA FB 1.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Product Description: Interlocked steel aluminum construction with PVC jacket.
- B. Fittings: NEMA FB 1.

2.5 ELECTRICAL METALLIC TUBING (EMT)

- A. Product Description: ANSI C80.3; galvanized tubing.
- B. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron, compression set screw indenter type.

2.6 NONMETALLIC CONDUIT

- A. Product Description: NEMA TC 2; Schedule 40/80 PVC.
- B. Fittings and Conduit Bodies: NEMA TC 3.

2.7 NONMETALLIC TUBING

- A. Product Description: NEMA TC 2.
- B. Fittings and Conduit Bodies: NEMA TC 3.

2.8 SURFACE METAL RACEWAY

- A. Product Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.
- B. Finish: Gray Buff enamel. Stainless steel.
- C. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories; match finish on raceway.

2.9 SURFACE NONMETAL RACEWAY

- A. Product Description: Plastic Fiberglass channel with fitted cover, suitable for use as surface raceway.
- B. Finish: Gray.
- C. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories, finish to match raceway.

2.10 WIREWAY

- A. Product Description: General purpose Oiltight and dust-tight Raintight type wireway.
- B. Knockouts: Manufacturer's standard None Bottom only.
- C. Size: 4 x 4 inch 6 x 6 inch 8 x 8 inch 12 x 12 inch; length as indicated on Drawings.
- D. Cover: Hinged Screw cover with full gaskets.
- E. Connector: Slip-in Flanged.
- F. Fittings: Lay-in type with removable top, bottom, and side; captive screws drip shield.
- G. Finish: Rust inhibiting primer coating with gray enamel finish.

2.11 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.
 - 2. Concrete Ceiling Boxes: Concrete type.
- B. Nonmetallic Outlet Boxes: NEMA OS 2.
- C. Cast Boxes: NEMA FB 1, Type FD, aluminum cast ferrous alloy. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.
- D. Wall Plates for Finished Areas: As specified in Section 26 27 26.
- E. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.12 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Hinged Enclosures: As specified in Section 26 27 16.
- C. Surface Mounted Cast Metal Box: NEMA 250, Type 4 4X 6; flat-flanged, surface mounted junction box:
 - 1. Material: Galvanized cast iron Cast aluminum.
 - 2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

- D. In-Ground Cast Metal Box: NEMA 250, Type 6, outside inside flanged, recessed cover box for flush mounting:
 - 1. Material: Galvanized cast iron Cast aluminum.
 - 2. Cover: Smooth Nonskid cover with neoprene gasket and stainless steel cover screws.
 - 3. Cover Legend: "ELECTRIC".

- E. Fiberglass Concrete composite Handholes: Die-molded, glass-fiber concrete composite hand holes:
 - 1. Cable Entrance: Pre-cut 6 inch x 6 inch cable entrance at center bottom of each side.
 - 2. Cover: Glass-fiber concrete composite, weatherproof cover with nonskid finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 EXISTING WORK

- A. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces.
- B. Remove concealed abandoned raceway to its source.
- C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.
- D. Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.
- E. Extend existing raceway and box installations using materials and methods compatible with existing electrical installations, or as specified.
- F. Clean and repair existing raceway and boxes to remain or to be reinstalled.

3.3 INSTALLATION

- A. Install Work in accordance with State Municipality of Highways Public Work's standards.
- B. Ground and bond raceway and boxes in accordance with Section 26 05 26.
- C. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.
- D. Identify raceway and boxes in accordance with Section 26 05 53.
- E. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.4 INSTALLATION - RACEWAY

- A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.
- B. Arrange raceway supports to prevent misalignment during wiring installation.
- C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29; provide space on each for 25 percent additional raceways.
- E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports
- F. Do not attach raceway to ceiling support wires or other piping systems.
- G. Construct wireway supports from steel channel specified in Section 26 05 29.
- H. Route exposed raceway parallel and perpendicular to walls.
- I. Route raceway installed above accessible ceilings parallel and perpendicular to walls.
- J. Route conduit in and under slab from point-to-point.
- K. Maximum Size Conduit in Slab Above Grade: 3/4 1/2 inch. Do not cross conduits in slab larger than 1/2 inch.
- L. Maintain clearance between raceway and piping for maintenance purposes.
- M. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.
- N. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- O. Bring conduit to shoulder of fittings; fasten securely.
- P. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.
- Q. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- R. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install hydraulic one-shot bender to fabricate factory elbows for bends in metal conduit larger than 2 inch size.
- S. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

- T. Install fittings to accommodate expansion and deflection where raceway crosses seismic , control and expansion joints.
- U. Install suitable pull string or cord in each empty raceway except sleeves and nipples.
- V. Install suitable caps to protect installed conduit against entrance of dirt and moisture.
- W. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.
- X. Close ends and unused openings in wireway.

3.5 INSTALLATION - BOXES

- A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings. specified in section for outlet device.
- B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.
- C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.
- D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.
- H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- I. Install stamped steel bridges to fasten flush mounting outlet box between studs.
- J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- K. Install adjustable steel channel fasteners for hung ceiling outlet box.
- L. Do not fasten boxes to ceiling support wires or other piping systems.
- M. Support boxes independently of conduit.
- N. Install gang box where more than one device is mounted together. Do not use sectional box.
- O. Install gang box with plaster ring for single device outlets.

3.6 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with Section 07 84 00 26 05 29.
- B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified in Section.
- C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings reflected ceiling plan.
- D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.7 ADJUSTING

- A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust flush-mounting outlets to make front flush with finished wall material.
- C. Install knockout closures in unused openings in boxes.

3.8 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.
- B. Clean interior of boxes to remove dust, debris, and other material.
- C. Clean exposed surfaces and restore finish.

END OF SECTION 280528

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SECTION 283100 - FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes fire alarm control panels, manual fire alarm stations, automatic smoke and heat detectors, fire alarm signaling appliances, and auxiliary fire alarm equipment and power and signal wire and cable.
- B. Related Sections:
 - 1. Section 08 71 00 - Door Hardware: Door closers, electric locks, electric releases.
 - 2. Section 21 12 00 - Fire-Suppression Standpipes: Flow detection and alarm devices.
 - 3. Section 21 13 13 - Wet-Pipe Sprinkler Systems: Flow detection and alarm devices.
 - 4. Section 21 13 16 - Dry-Pipe Sprinkler Systems: Flow detection and alarm devices.
 - 5. Section 21 13 26 - Deluge Fire-Suppression Sprinkler Systems: Flow detection and alarm devices.
 - 6. Section 23 33 00 - Air Duct Accessories: Smoke dampers.
 - 7. Section 25 50 00 - Integrated Automation Facility Controls.
 - 8. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
 - 9. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 10. Section 28 05 53 - Identification for Electronic Safety and Security.

1.2 REFERENCES

- A. National Fire Protection Association:
 - 1. NFPA 72 - National Fire Alarm Code.
 - 2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

1.3 SYSTEM DESCRIPTION

- A. Fire Alarm System: NFPA 72, manual and automatic local fire alarm system with connections to municipal system. with connections to central station.
- B. Alarm Sequence of Operation: Actuation of initiating device causes the following system operations:
 - 1. Local fire alarm signaling devices sound and display with march time signal.
 - 2. Non-coded Zone-coded signal transmits to municipal connection. remote station equipment. central station.
 - 3. Location of alarm zone indicates on fire alarm control panel and on remote annunciator panel.
 - 4. Signal transmits by zone to building smoke removal system.
 - 5. Signal transmits to building elevator control panel, initiating return to main floor or alternate floor and lockout for fire service.
 - 6. Signal transmits to building mechanical controls, shutting down fans and operating dampers.
 - 7. Signal transmits by zone to release door hold-open devices.
 - 8. Signal releases magnetic door hold opens.
 - 9. Signal releases electric door locks.

- C. Drill Sequence of Operation: Manual drill function causes alarm mode sequence of operation.
- D. Trouble Sequence of Operation: System or circuit trouble causes the following system operations:
 - 1. Visual and audible trouble alarm indicates by zone at fire alarm control panel.
 - 2. Visual and audible trouble alarm indicates at remote annunciator panel.
 - 3. Trouble signal transmits to municipal connection. remote station. central station.
- E. Zoning: As indicated on Drawings.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate system wiring diagram showing each device and wiring connection; indicate annunciator layout, and design calculations.
- C. Product Data: Submit catalog data showing electrical characteristics and connection requirements.
- D. Test Reports: Indicate procedures and results for specified field testing and inspection.
- E. Manufacturer's Field Reports: Indicate activities on site, adverse findings, and recommendations.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of fire alarm equipment.
- C. Operation and Maintenance Data: Submit manufacturer's standard operating and maintenance instructions.

1.6 QUALITY ASSURANCE

- A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.
- B. Perform Work in accordance with State Municipality of Highways Public Work's standard.
- C. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of project.
- B. Installer: Certified fire alarm installer with service facilities within 100 miles of Project.
- C. Design fire alarm under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location. in State of

1.8 MAINTENANCE SERVICE

- A. Section 01 70 00 - Execution and Closeout Requirements: Maintenance service.
- B. Furnish service and maintenance of fire alarm equipment for one year from Date of Substantial Completion.

1.9 MAINTENANCE MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish ten manual station break-glass rods.
- C. Furnish six keys of each type.

1.10 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish three of each type of automatic smoke detector without base.

PART 2 - PRODUCTS

2.1 CONTROL PANEL

- A. Product Description: Modular fire alarm control panel with flush surface wall-mounted enclosure.
- B. Power supply: Adequate to serve control panel modules, remote detectors, remote annunciators, smoke dampers, relays, and alarm signaling devices. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours followed by alarm mode for 5 minutes.
- C. System Supervision: Component or power supply failure places system in trouble mode.
- D. Initiating Device Circuits: Supervised zone module with alarm and trouble indication; occurrence of single ground or open condition places circuit in trouble mode but does not disable circuit from initiating alarm.
- E. Indicating Appliance Circuits: Supervised march time signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode but does not disable circuit from signaling alarm.
- F. Municipal Trip Circuit: Output connections for future use. connection to local energy shunt trip parallel telephone circuit municipal master fire alarm box. remote station transmitter. Include municipal trip DISCONNECT switch.
- G. Remote Station Signal Transmitter: Electrically supervised digital alarm communicator transmitter, capable of transmitting alarm and trouble signals over telephone lines to central station receiver.

- H. Auxiliary Relays: Sufficient SPDT auxiliary relay contacts for each detection zone to provide accessory functions specified.

2.2 MANUAL FIRE ALARM STATIONS

- A. Product Description: Manual single-action double-action station with break-glass rod.
- B. Mounting: Semi-Flush Surface.
- C. Type: Coded Non-coded.
- D. Backbox: Manufacturer's standard.

2.3 SPOT HEAT DETECTOR

- A. Product Description: Fixed temperature, Combination rate-of-rise and fixed temperature, spot heat detector.
- B. Temperature Rating: 135 degrees F.
- C. Rate-of-Rise: 15 degrees F.

2.4 CEILING SMOKE DETECTOR

- A. Product Description: NFPA 72, ionization type photoelectric type ceiling smoke detector with the following features:
 - 1. Adjustable sensitivity.
 - 2. Plug-in base.
 - 3. Auxiliary relay contact.
 - 4. Integral thermal element rated 135 degrees F.
 - 5. Visual indication of detector actuation.
 - 6. Comply with UL 268.
- B. Mounting: 4-inch outlet box.
- C. Furnish two-wire detector with common four-wire detector with separate power supply and signal circuits.

2.5 DUCT-MOUNTED SMOKE DETECTOR

- A. Product Description: NFPA 72, ionization type photoelectric type with the following features:
 - 1. Auxiliary SPDT relay contact.
 - 2. Key-operated normal-reset-test switch.
 - 3. Duct sampling tubes extending width of duct.
 - 4. Visual indication of detector actuation.
 - 5. Duct-mounted housing.
 - 6. Comply with UL 268A.
- B. Furnish two-wire detector with common four-wire detector with separate power supply and signal circuits.

2.6 FLAME DETECTOR

- A. Product Description: NFPA 72, ultraviolet infrared radiation type flame detector.

2.7 ALARM BELLS

- A. Product Description: NFPA 72, vibrating, single-stroke, electric bell with the following features:
 1. Operating mechanism behind dome.
 2. Integral strobe lamp and flasher with red lettered "FIRE" on white lens.
 3. Size: 8 10 inch.
 4. Sound Rating: 81 dB at 10 feet.

2.8 ALARM LIGHTS

- A. Product Description: NFPA 72, strobe lamp and flasher with red lettered "FIRE" on white lens.

2.9 ALARM HORN

- A. Product Description: NFPA 72, surface flush projector type fire alarm horn with the following features:
 1. Sound Rating: 87 dB at 10 feet.
 2. Integral strobe lamp and flasher with red lettered "FIRE" on white lens.
- B. Product Description: Exterior mounted siren horn with the following features:
 1. Sound Rating: 120 dB at 10 feet.

2.10 REMOTE ANNUNCIATOR

- A. Product Description: Supervised remote. Remote annunciator including audible and visual indication of fire alarm by zone, and audible and visual indication of system trouble.
- B. Mounting: Factory mounted in flush surface wall-mounted enclosure.

2.11 DOOR RELEASE

- A. Product Description: Magnetic door holder with integral diodes to reduce buzzing.
- B. Coil voltage: 24 VDC.

2.12 WIRE AND CABLE

- A. Product Description: Non-power limited fire-protective signaling cable, copper conductor, 150-volt insulation rated 60 degrees C. Power limited fire-protective signaling cable, copper conductor, 300 volts insulation rated 105 degrees C.
- B. Cable Located Exposed in Plenums: Power limited fire-protective signaling cable classified for fire and smoke characteristics, copper conductor, 300 volts insulation rated 105 degrees C, suitable for use in air handling ducts, hollow spaces used as ducts, and plenums.
- C. Fire alarm circuit conductors have insulation color or code as follows:
 1. Power Branch Circuit Conductors: Black, red, white.
 2. Initiating Device Circuit: Black, red.

3. Detector Power Supply: Violet, brown.
4. Signal Device Circuit: Blue (positive), white (negative).
5. Door Release: Gray, gray.
6. Municipal Trip Circuit: Orange, orange.
7. Municipal Fire Alarm Loop: Black, white.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify products and systems receiving devices are ready for installation.

3.2 EXISTING WORK

- A. Remove exposed abandoned fire alarm wiring, including abandoned wiring above accessible ceiling finishes. Cut cable flush with walls and floors, and patch surfaces.
- B. Disconnect and remove abandoned fire alarm equipment.
- C. Maintain access to existing fire alarm equipment and other installations remaining active and requiring access. Modify installation or provide access panel.
- D. Extend existing fire alarm installations using materials and methods compatible with existing installations, or as specified.
- E. Clean and repair existing fire alarm equipment to remain or to be reinstalled.

3.3 INSTALLATION

- A. Install manual station with operating handle 4 feet 6 inches above floor.
- B. Install audible and visual signal devices 7 feet 6 inches above floor.
- C. Install 16 14 AWG minimum size conductors for fire alarm detection and signal circuit conductors in conduit. cable.
- D. Mount end-of-line device in control panel. box with last device or separate box adjacent to last device in circuit.
- E. Mount outlet box for electric door holder to withstand 80 pounds pulling force.
- F. Connect conduit and wire to door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control panels, and duct smoke detectors.
- G. Automatic Detector Installation: Conform to NFPA 72.
- H. Install engraved plastic nameplates in accordance with Section 28 05 53.
- I. Ground and bond fire alarm equipment and circuits in accordance with Section 26 05 26.

3.4 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Test in accordance with NFPA 72 and local fire department requirements.

3.5 MANUFACTURER'S FIELD SERVICES

- A. Section 01 40 00 - Quality Requirements: Manufacturer's field services.
- B. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

3.6 DEMONSTRATION AND TRAINING

- A. Furnish 8 hours of instruction each for two persons, to be conducted at project site with manufacturer's representative.

END OF SECTION 283100

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SECTION 310200 - GENERAL REQUIREMENTS FOR SITEWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section governs only technical specifications related to site work construction.
- B. Section Includes:
 - 1. Definitions.
 - 2. Field Engineering.
 - 3. Pre-installation Meeting.
 - 4. Demonstration and Training Meeting.
 - 5. Submittal Procedures.
 - 6. Traffic Control Plan.
 - 7. Quality Control Requirements.
 - 8. Erosion and Sediment Control.
 - 9. Proposed Products List.
 - 10. Product Requirements.
 - 11. Project Closeout Procedures.
- C. Related Divisions:
 - 1. Division 02 – Existing Conditions.
 - 2. Division 31 – Earthwork.
 - 3. Division 32 – Exterior Improvements.
 - 4. Division 33 – Utilities.

1.2 DEFINITIONS

- A. Field Engineering: Contractor's establishment of elevations, lines, and levels as indicated on Drawings, utilizing recognized engineering survey practices.
- B. Pre-installation Meeting: Meeting to discuss a product or material, typically complex in nature, and review manufacturer's precautions, restrictions, and installation procedures.
- C. Demonstration and Training Meeting: Contractor and/or manufacturer representative administered demonstration and training sessions for Owner for each portion of equipment and products that are required to have training in proper operation and maintenance.
- D. Submittal Procedures: Specified requirements regarding procedures related to submission of product data, Shop Drawings, manufacturer's certificates, and substitutions.
- E. Traffic Control Plan: Plan developed consistent with Manual on Uniform Traffic Control Devices (MUTCD).
- F. Quality Control: Inspection, analysis, and other relevant actions taken to provide control over what is being done, manufactured, or fabricated, so that a desirable level of quality is achieved and maintained during duration of the Work.

- G. Erosion and Sediment Control: Enforcement of state law and city or county ordinance for erosion and sediment control including installation, maintenance, and regular Contractor inspection and repair.
- H. Proposed Product List: Prepared listing of all materials and products intended to be used for site work related to sewer and water utilities, aggregates, and soils, and pavement mix designs.
- I. Product Requirements: Product information regarding manufacturer's data, preparation, fabrication, conveying and erection of Work including material, machinery, components, equipment, fixtures, and systems incorporated in Work.
- J. Project Closeout Procedures: Process that provides acceptance of project by Owner and Engineer/Architect including verification and documentation of required project records, and retention of other essential project documentation.

1.3 FIELD ENGINEERING

- A. Employ Land Surveyor registered in State of Florida and acceptable to Owner, Engineer/Architect and Construction Manager.
- B. Contractor shall locate and protect survey control and reference points. Promptly notify Owner, Engineer/Architect and Construction Manager of discrepancies discovered.
- C. Control datum for survey is that established by Owner provided survey.
- D. Verify setbacks and easements; confirm drawing dimensions and elevations.
- E. Provide required field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.
- F. Submit copy of site drawing and certificate signed by registered Land Surveyor certifying elevations and locations of the Work are in conformance with Contract Documents.
- G. Maintain complete and accurate log of control and survey work as Work progresses.
- H. On completion of foundation walls and major site improvements, prepare certified survey illustrating dimensions, locations, angles, and elevations of building construction and site utilities work.
- I. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- J. Promptly report to Owner, Engineer/Architect and Construction Manager loss or destruction of reference point or relocation required because of changes in grades or other reasons.
- K. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Owner, Engineer/Architect and Construction Manager.
- L. A Registered Land Surveyor shall replace damaged property corners at Contractor's expense.

1.4 PREINSTALLATION MEETING

- A. When required in individual specification sections, convene preinstallation meeting at Project site prior to commencing work of specific section.
- B. Require attendance of parties directly affecting, or affected by, Work of specific section.
- C. Notify Owner, Engineer/Architect and Construction Manager four (4) days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of installation, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two (2) days after meeting to participants, with two (2) copies to Owner, Engineer/Architect and Construction Manager and those affected by decisions made.

1.5 DEMONSTRATION AND TRAINING MEETING

- A. Contractor shall schedule and administer demonstration and training sessions for Owner for each portion of equipment and products that are required to have training in proper operation and maintenance.
- B. Contractor shall schedule representatives of equipment manufacturer to attend demonstration and training sessions to provide additional information as necessary.

1.6 SUBMITTAL PROCEDURES

- A. Contractor shall provide Engineer/Architect electronic PDF copies of specific submittal information regarding products and materials of this specification section with extended permission of Architect.
- B. Submit Shop Drawings and product data in electronic PDF copies covering identified equipment and materials that will become a permanent part of Work to Engineer/Architect for review.
- C. Electronically submit material information, product data, and shop drawings in PDF format directly to [redacted]@graef-usa.com]. For questions related to submittals review and miscellaneous questions, contact [[redacted] at (414) 266-_____]] [(608) 242-_____] [(920) 592-_____].
- D. Shop Drawings and product data shall include drawings, descriptive information, and sufficient detail to show kind, size, arrangement, and operation of component materials and devices needed for installation and coordination with other materials and equipment.
- E. All submittals, regardless of origin, shall be stamped with approval of Contractor and identified with name of the Project, Contractor's name, and references to applicable specification sections and Drawings.
- F. Each submittal shall indicate intended use of item in Work. When manufacturer data sheets are submitted, clearly identify applicable items and cross out inapplicable data.

- G. Manufacturer's data sheets shall be current and include issue number and date.
- H. Contractor's stamp of approval is a representation to Engineer/Architect that Contractor accepts full responsibility for determining and verifying all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, and that Contractor reviewed and coordinated each submittal with requirements of the Work.
- I. Contractor shall accept full responsibility for completeness of each submission. When an item consists of components from several sources, Contractor shall submit a complete initial submittal including all components.
- J. Identify deviations from Specifications and Drawings on each submittal and tabulate in Contractor's letter of transmittal. Such submittals shall indicate details of proposed changes, including modifications to other facilities that may result from deviation, and required piping and wiring diagrams.
- K. Submit electronic PDF copies of each drawing and necessary data to Engineer/Architect. Engineer/Architect will return two marked copies to Contractor. Electronic copies will not be acceptable.
- L. Engineer/Architect will not accept submittals from anyone but Contractor or Architect.
- M. Submittals shall be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades.
- N. Review of Shop Drawings and Product Data:
 - 1. Engineer/Architect's review of Shop Drawings and product data will cover only general conformity to Drawings and Specifications, external connections, and dimensions that affect layout. Engineer/Architect's review does not indicate a thorough review of all dimensions, quantities, and details of material, equipment, device, or item shown.
 - 2. Engineer/Architect's review shall not relieve Contractor of Contractor's responsibility for errors, omissions, or deviations in drawings and data, or of sole responsibility for compliance with the Work.
 - 3. Engineer/Architect's submittal review period shall be a maximum of seven (7) days from date of submittal or resubmittal.
 - 4. When Shop Drawings and data are returned marked "NOT ACCEPTABLE" or "RETURNED FOR CORRECTION", Contractor shall make corrections as noted by Engineer/Architect and resubmit six (6) corrected copies. Electronic copies will not be acceptable.
 - 5. When Shop Drawings and product data are returned marked "EXCEPTIONS NOTED" or "APPROVED AS SUBMITTED", no additional copies need be submitted unless requested by Engineer/Architect at time of review.
- O. Re-submittal of Shop Drawings and Product Data:
 - 1. Contractor shall accept full responsibility for completeness of each re-submittal.
 - 2. Contractor shall verify that resubmittal provides all corrected data and additional information previously requested by Engineer/Architect.
 - 3. When corrected files are re-submitted, Contractor shall indicate in writing revisions made.
 - 4. Requirements specified for initial submittals also apply to re-submittals.
 - 5. Re-submittals shall bear number of first submittal followed by a letter (A, B, etc.) to indicate sequence of re-submittal.

6. Make re-submittals within seven (7) days of date of letter returning material to be modified or corrected.

P. Substitutes and “Or-Equal” Items:

1. Whenever a material or article is specified or described by using a single name of a proprietary product or a single name of a particular manufacturer or vendor, specified item mentioned shall be understood as establishing type, function, and quality desired.
2. Whenever two or more names of proprietary products or particular manufacturers or vendors are used, it shall be understood that products of one named supplier shall be furnished with no options or substitutions allowed.
3. Products, materials, or equipment not specified by proprietary name and submitted as a proposed substitute shall be reviewed and approved or rejected by Owner, Engineer/Architect or Construction Manager.

N.T.S. – Discuss next paragraphs with your client prior to including this language into this section. When Contractor proposes a product, material, or equipment as a substitute that is not listed as an approved manufacturer under Part 2 – Products within individual technical specification sections, we (GRAEF) are allowed to charge a fee for each substitution request received from Contractor.

4. [Cost of proposed substitution review is subject to financial reimbursement from Contractor to [Engineer] [Engineer/Architect] for time taken for review and verification in the amount of [\$200.00] [\$_____] dollars for each hour of review and verification.]
5. [Contractor shall be liable for all costs incurred by [Engineer] [Engineer/Architect] related to each substitution review, including proposed substitutions which are rejected.]

1.7 TRAFFIC CONTROL PLAN

- A. Submit a traffic control plan for construction in public right-of-way in accordance with the “Manual on Uniform Traffic Control Devices.”
- B. Data to be included on a traffic control plan will vary depending upon complexity of project, volume of traffic affected, and roadway geometrics where construction is being performed.
- C. Traffic control plan must clearly depict exact sequence of construction operation(s), construction to be performed, and traveled way that will be utilized by all movements of traffic during each phase of construction.
- D. Multiple phases of construction will require a separate traffic control plan for each different construction phase or operation.

1.8 QUALITY CONTROL REQUIREMENTS

- A. Construction Notification:
 1. Contractor shall be responsible for locating existing underground installations in advance of excavating or trenching by contacting local utility identification agency.
- B. Licenses, Permits, and Certificates:
 1. All licenses, permits, and certificates, required for, and in connection with site and utility work shall be secured by Contractor at their sole cost and expense.
 2. Contractor will be required to pay any permit fees required for utility work.

3. Contractor shall comply with all requirements and recommendations of authority or authorities issuing license, permit, or certificate.
- C. Easements and Rights-of-Way:
1. Contractor will confine construction operations to areas designated on Drawings or identified by Engineer/Architect, Owner's Representative or Construction Manager.
 2. Contractor shall use care in placement of construction tools, equipment, excavated materials, pipe materials, and supplies so as to minimize damage to property and minimize interference with the public.
- D. Protection of Property:
1. Contractor shall protect from damage or injury all property including survey monuments, property markers, and benchmarks. Items damaged shall be replaced or repaired at Contractor's expense.
 2. Locate existing utilities and utility services in advance of excavation and protect against damage. Changes in grade and alignment may be made to Work to avoid conflicts with existing structures if approved by Owner, Engineer/Architect and/or Construction Manager.
- E. Reference Standards:
1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean latest edition of appropriate standard, specification, manual, code, law, or regulation in effect on date of first advertisement for the Work, unless specifically stated otherwise in Contract Documents.
 2. Should there be a conflict in Reference Standards, Contractor shall request clarification from Owner, Engineer/Architect and Construction Manager before proceeding.
- F. Compaction and Gradation Testing:
1. Contractor shall provide and pay for compaction and gradation testing by an Owner, Engineer/Architect and Construction Manager approved independent testing laboratory.
 - a. Make two (2) initial gradation tests for each type of bedding and backfill material, and make one additional gradation test for each additional 500 tons of each material.
 - b. Moisture-density (Proctor) tests and relative density tests on materials, and in-place field density tests, shall be made at intervals determined by Owner, Engineer/Architect or Construction Manager.
 - c. Perform compaction testing in accordance with procedures specified in Section 31 23 17 – Site Excavation, Backfill, and Compaction.
- G. Traffic Control - General:
1. Protect streets, roads, highways, and other public thoroughfares that are to be temporarily closed or restricted for traffic flow by effective barricades equipped with operational warning signals.
 2. Locate barricades at nearest intersecting public highway or street on each side of blocked section.
 3. Cover open trenches and other excavations with steel plates and have suitable barricades, signs, and lights to provide adequate protection to the public. Provide obstructions such as material piles and equipment with similar warning signs and lights.
- H. Maintenance of Traffic:
1. Maintain effected traffic areas throughout duration of construction, in accordance with local, state, or federal requirements which govern Work area.

2. Contractor is responsible for maintaining traffic.
3. Contractor shall conduct work to minimize interference with traffic, vehicular or pedestrian.
4. Contractor shall obtain and pay for any permit required by local authority for areas where traffic will be obstructed.
5. Contractor shall provide and maintain suitable and safe bridges, detours, or other temporary measures for accommodating public and private travel.
6. Contractor shall provide at least 24 hours' notice to owners of private drives before performing Work which would obstruct safe passage by drive owner.
7. Illuminate barricades and obstructions with warning lights from sunset to sunrise.
8. Store material storage and perform Work on or alongside public streets and highways to minimize obstruction and inconvenience to public.

I. Traffic Control Devices:

1. Contractor shall provide barricades, cones, construction warning signs, flagmen, and incidental devices to protect personnel and equipment on the Work site.

1.9 EROSION AND SEDIMENT CONTROL

- A. Comply with requirements specified in Section 31 25 13 – Erosion and Sediment Controls and as indicated on Drawings.

1.10 PROPOSED PRODUCTS LIST

- A. Within seven (7) days after date of Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.11 PRODUCT REQUIREMENTS

- A. Products include material, equipment, and systems.
- B. Comply with specifications and referenced standards as minimum requirements.
- C. Components required to be supplied in quantity within a Specification section shall be same, and shall be interchangeable.
- D. Do not use materials and equipment removed from existing structure, except as specifically required or allowed by Contract Documents.
- E. Products Specified by Reference Standards or by Description Only: Furnish any product meeting those standards.
- F. Products Specified by Naming Two (2) or More Manufacturers: Furnish products of one named manufacturer meeting specifications; no options or substitutions allowed.
- G. Products Specified by Naming One (1) or More Manufacturers or with a Provision for Substitutions: Submit a request for substitution of a proposed equal.

1.12 PROJECT CLOSEOUT PROCEDURES

- A. Project Records Documents:
1. Contractor shall maintain, on site, one (1) set of the following record documents:
 - a. Drawings.
 - b. Specifications.
 - c. Approved Shop Drawings.
 - d. Product data.
 - e. Samples.
 2. Contractor shall store Record Documents separate from documents used for construction.
 3. Contractor shall record actual revisions to the Work and maintain information concurrent with construction progress.
 4. Contractor shall legibly mark each item to record actual construction including:
 - a. Measured horizontal and vertical locations of new utilities and existing underground utilities and appurtenances referenced to permanent surface improvements.
 - b. Field changes of dimensions and Drawing details.
 - c. Details not on original Drawings.
 5. Submit Record Documents to Owner, Engineer/Architect and Construction Manager at Final Inspection, including:
 - a. Project Drawings.
 - b. Survey notes.
 - c. Approved submittals.
 - d. Operation and Maintenance Manuals.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 310200

SECTION 310513 - SOILS FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Subsoil materials.
 - 2. Topsoil materials.

- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
 - 2. Section 02 41 13 - Site Demolition.
 - 3. Section 31 05 16 - Aggregates for Earthwork.
 - 4. Section 31 10 00 - Site Clearing.
 - 5. Section 31 23 17 – Site Excavation, Backfill, and Compaction.
 - 6. Section 31 25 13 – Erosion and Sediment Control: Erosion and sediment control requirements.

1.2 REFERENCES

- A. State of Florida Department of Transportation (FDOT):
 - 1. Standard Specifications for Road and Bridge Construction, Current Edition with latest supplements.
 - 2. <http://www.dot.state.fl.us/specificationsoffice/implemented/specbooks/2010bk.shtm>

- B. ASTM International (ASTM):
 - 1. ASTM D2487 - Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - 2. ASTM D5268 – Topsoil Used for Landscaping Purposes.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures, Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.

- B. Samples: Submit, in airtight containers, 10 lb. sample of each type of fill to testing laboratory.

- C. Product Data: Submit testing laboratory results for each type of specified soil.

- D. Materials Source: Submit name of source of imported materials.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with Florida Department of Transportation standards.

PART 2 - PRODUCTS

2.1 SUBSOIL MATERIALS

A. Subsoil Type S1:

1. Excavated and re-used material, Imported borrow, Select or local borrow, Structural.
2. Graded.
3. Free of lumps larger than three (2) inches, rocks larger than two (1) inches, and debris.
4. Contractor shall provide 10 lb sample of existing site material to laboratory for soil classification analysis conforming to ASTM D2487.

B. Subsoil Type S2:

1. Imported borrow, Select or local borrow, Structural.
2. Graded.
3. Free of lumps larger than [three (3) inches, rocks larger than [two (2) inches, and debris.
4. Imported subsoil and borrow shall be similar in composition when compared to existing site subsoil.
5. Contractor shall provide 10 lb sample of proposed imported borrow material to laboratory for soil classification analysis conforming to ASTM D2487.

2.2 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements, Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework: Testing and analysis of soil material.
- B. When tests indicate materials do not meet specified requirements, change material and retest.
- C. Furnish materials of each type from same source throughout the Work.

PART 3 - EXECUTION (Not Used)

END OF SECTION 310513

SECTION 310516 - AGGREGATES FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aggregate materials and designations for building, structure, aggregate base course.
2. Aggregate materials and designations for backfill.
3. Materials and designations for drainage aggregate.
4. Aggregate materials and designations for grading purposes.

B. Related Sections:

1. Applicable provisions of Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
2. Section 02 41 13 – Site Demolition.
3. Section 31 05 13 – Soils for Earthwork.
4. Section 31 23 17 – Site Excavation, Backfill, and Compaction.
5. Section 31 25 13 – Erosion and Sediment Control: Erosion control requirements.

1.2 REFERENCES

A. State of Florida Department of Transportation (FDOT):

1. Standard Specifications for Road and Bridge Construction, Current Edition with latest supplements.
<http://www.dot.state.fl.us/specificationsoffice/implemented/specbooks/2010bk.shtm>

B. State of Florida Department of Transportation

1. Standard Specifications for Road and Bridge Construction, Current Edition with latest supplements. (FDOT)

C. ASTM International (ASTM):

1. ASTM C33 – Standard Specification for Concrete Aggregates.
2. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

1.3 SUBMITTALS

- A. [Section 01 33 00 – Submittal Procedures, Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.
- B. Product Data: Submit gradation information for each type of aggregate specified. Gradation results shall be taken within the past three (3) months from contract date.
- C. Samples: Submit, in airtight containers, 10 lb sample of each type of fill to testing laboratory.
- D. Materials Source: Submit name of source of imported materials.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with Florida Department of Transportation standards.

PART 2 - PRODUCTS

2.1 AGGREGATE MATERIALS

Florida Aggregates:

The following are State of Florida DOT gradation designations; refer to project Geotechnical Report for in depth project information and recommendations, if available.

*Size No. 24 – Coarse Aggregate for Granular Fill

*Size No. 467 – Dense-Graded Aggregate for Building, Pavement and Structure Base

*Size No 68– Open-Graded Aggregate for Drainage Fill under Buildings, Pavements and Structures

Designation	Size No. 24	Size No. 467	Size No. 68
3-inch	100	----	----
2-1/2-inch	90-100	----	----
2-inch	----	100	----
1-1/2-inch	25-60	95-100	----
1-inch	----	----	----
3/4-inch	0-10	35-70	90-100
1/2--inch	0-5	----	----
3/8-inch	----	10-30	30-65
No. 4	----	0-5	5-25
No. 8	----	----	0-10
No. 16	----	----	0-5

- A. Aggregate Type A1 (Gravel): Crushed Gravel; free of organic matter and debris; graded in accordance with:
 - 1. FDOT Size No. 68.
- B. Aggregate Type A2 (Gravel): Crushed Gravel; free of organic matter and debris; graded in accordance with:
 - 1. FDOT Size No. 467.
- C. Aggregate Type A3 (Recycled): Crushed Concrete; free of from wood, steel, roots, bark or other extraneous material; graded in accordance with:
 - 1. FDOT Size No. 467.
- D. Aggregate Type A4 (Recycled): Crushed Asphaltic Concrete; free of from wood, steel, roots, bark or other extraneous material; graded in accordance with:
 - 1. FDOT Size No. 467.
- E. Aggregate Type A5 (Stone): Crushed Stone; free of clay, shale, organic matter; graded in accordance with:
 - 1. FDOT Size No. 68.
- F. Aggregate Type A6 (3/8-Inch Stone Chips): Crushed stone; free of clay, shale, organic matter; graded in accordance with the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
1/2-inch	100
3/8-inch	85 - 100
No. 4	10 - 30
No. 8	0 - 10
No. 16	0 - 5

- G. Aggregate Type A7 (3/4-Inch Stone Chips): Crushed stone; free of clay, shale, organic matter; graded in accordance with the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
1-inch	100
3/4-inch	90 - 100
3/8-inch	20 - 55
No. 4	0 - 10
No. 8	0 - 5

- H. Aggregate Type A8 (Pea Gravel): Fractured, washed, free of clay, shale, organic matter; graded in accordance with the following limits:

1. Minimum Size: 1/4-inch.
2. Maximum Size: 3/8-inch.

- I. Aggregate Type A9 (Granular Fill): Natural gravel/stone; free of clay, shale, organic matter; graded in accordance with:

1. FDOT Size No. 24.

- J. Aggregate Type A10 (Bank Run Sand/Gravel): Natural river or bank sand; free of silt, clay, loam, friable or soluble materials, and organic matter; graded in accordance with following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
2-inch	95 - 100
No. 4	35 - 60
Finer Than No. 200	5 - 15

- K. Aggregate Type A11 (Drainage Aggregate): Crushed stone; free of clay, shale, organic matter; graded in accordance with the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
1-inch	100 - 75
3/4-inch	50 - 75
No. 4	0 - 60
No. 40	0 - 50
No. 200	0 - 5

- L. Aggregate Type A12 (Bedding Sand): Unwashed bank-run sand or rejected concrete sand; approximately six (6) percent fine clay or loam particles but free of silt and clay or loam lumps consisting of durable particles ranging in size from fine to coarse in uniform combinations; maximum moisture content shall be 10 percent, graded within following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
1-inch	100
No. 16	45 - 80
No. 200	2 - 10

- M. Aggregate Type A13 (Sand Fill): Natural river or bank sand; free of silt, clay, or loam, friable or soluble materials, or organic matter; consisting of durable particles ranging in size from fine to coarse in uniform combinations; maximum moisture content shall be 10 percent, graded within following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/8-inch	100
No. 4	95 - 100
No. 8	75 - 90
No. 16	55 - 75
No. 30	30 - 50
No. 50	10 - 25
No. 100	2 - 10
No. 200	0

- N. Aggregate Type A14 (Stone): Crushed Stone; free of clay, shale, organic matter; graded in accordance with ASTM C33, Size No. 2.

2.2 SOURCE QUALITY CONTROL

- A. Section 01 40 00 – Quality Requirements, Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework: Testing and analysis of aggregates.
- B. When tests indicate materials do not meet specified requirements, change material or material source and retest.
- C. Furnish materials of each type from same source throughout the Work.

PART 3 - EXECUTION (Not Used)

END OF SECTION 310516

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Removal of grass and vegetation.
2. Removal of trees, shrubs, and other plant life.
3. Herbicide application.
4. Removal of site debris.
5. Clearing activities near existing permanent utilities and structures.
6. Protection of project entrances and exits.

B. Related Sections:

1. Applicable provisions of Section 31 02 00 - General Requirements for Sitework shall govern Work under this Section.
2. Section 02 41 13 - Site Demolition: Removal of site demolition material.
3. Section 02 41 16 - Structure Demolition: Removal of structure demolition material.
4. Section 31 13 00 - Tree Removal and Grubbing: Removal of trees and saplings including stumps and roots.
5. Section 31 22 13 - Rough Grading: Removal of topsoil and subsoil.
6. Section 31 23 16 - Utility Trench Excavation, Backfill, and Compaction: Backfill and compaction of cleared areas.
7. Section 31 23 17 - Site Excavation, Backfill, and Compaction: Backfill and compaction of cleared areas.
8. Section 31 23 18 - Rock Removal: Removal of rocks and boulders.
9. Section 31 25 13 - Erosion and Sediment Controls.
10. Section 32 01 00 - Site Restoration: Restoration of site affected by construction activities.
11. Section 32 96 00 - Shrub and Tree Transplanting: Shrub and tree relocation.

1.2 REFERENCES

A. State of Florida Department of Environmental Protection (FDEP):

1. The Florida Development Manual: A Guide to Sound Land and Water Management, Chapter 6, Stormwater and Erosion and Sediment Control Best Management Practices for Developing Areas.
<http://www.dep.state.fl.us/>

B. State of Florida Department of Transportation (FDOT):

1. Standard Specifications for Road and Bridge Construction, Current Edition with latest supplements.
<http://www.dot.state.fl.us/specificationoffice/Implemented/SpecBooks/default.shtm>

C. U.S. Environmental Protection Agency (USEPA):

1. Developing Your Stormwater Pollution Prevention Plan, A Guide for Construction Sites.
<http://cfpub.epa.gov/npdes/stormwater/swppp.cfm>

1.3 DEFINITIONS

- A. Tree - Woody perennial plant, single main stem with trunk, diameter of six (6) inches or greater. Multiple-stem trees with forks up to four (4) feet from ground elevation shall be considered a cluster of trees. Trees that fork above four (4) feet shall be considered a single tree.
- B. Sapling - Woody perennial plant with single stem with trunk less than six (6) inches in diameter.
- C. Root Zone - Area around a tree extending as far from tree base as longest horizontal branches.
- D. Surface Water - Soil water that flows through ditch lines, creeks, and streams by gravity.
- E. Grubbing - To clear project site by removing roots and stumps.
- F. Clearing - Cutting down of bushes and trees and the digging and removal of their roots and stumps.
- G. Clearing Limits - Area designated on Drawings scheduled for clearing operations within project site or right-of-way.
- H. Herbicide - Post emergence type, used to kill entire plant or vegetation, including root system.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures Division 01 – General Requirements Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.
- B. Submit product data for herbicide, including manufacturer's instructions, usage, and hazardous materials sheets.

1.5 REGULATORY REQUIREMENTS

- A. Contractor shall comply with local, state, and federal regulations applicable to Work of this Section.
- B. Contractor shall comply with and be solely responsible for compliance with U.S. Department of Labor OSHA Part 1926 Safety and Health Regulations for Construction for this Work.
- C. Contractor performing Work of this Section shall be solely responsible for identifying, furnishing, installing and maintaining equipment and materials required by State and Federal regulations to establish safe working conditions during Work of this Section.
- D. Conform to applicable code for environmental requirements, disposal of debris, burning debris on site and use of herbicides.
- E. Coordinate clearing Work with utility companies.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Herbicide:

1. Pre-emergence Herbicide: Liquid or wettable powder form; type which controls plants emerging from seed, but has no harmful effect on established plants when applied at recommended rates; resist leaching, and remain effective throughout one growing season.
2. Post-Emergence Herbicide: Water soluble and deactivate upon contact with soil, leaving no harmful residue; vegetation control herbicide when applied to leaves and stems of plants, is absorbed and translocated to all parts of plant including roots and underground stem; capable of killing entire plant.

PART 3 - EXECUTION

3.1 NOTIFICATION

- A. Contractor, prior to any excavation work, shall notify (1) a designated locating service; (2) utilities, governmental agencies, entities, known to, or which can reasonably be assumed to, have above or below ground pipe, conduit cables, structures, or similar items within limits of project; to locate and mark location of such items.
- B. In accordance with Florida Statutes Chapter 556, "Underground Facility Damage Prevention and Safety Act," every "Person" as defined in 556.102(9) shall be solely responsible to provide advance notice to "Sunshine State One-Call of Florida, Inc." (800-638-4097) not more than five nor less than two (2) working days prior to commencement of any Excavation or Demolition, as defined in the statute, required to perform work contained in this Project, and further said "Person" shall comply with all other requirements of this Statute relative to Excavator's Work. [Florida Statute Chapter 556 - Underground Facility Damage Prevention and Safety Act](#)

3.2 PREPARATION

- A. Verify erosion control is in place prior to start of Work.
- B. Verify that existing plant life designated to remain is tagged or identified and protected.
- C. Identify a temporary waste area and/or salvage area for placing removed materials.

3.3 PROTECTION

- A. Maintain and repair damaged erosion control items throughout Work.
- B. Protect utilities that remain, from damage.
- C. Do not divert or relocate surface water without prior written approval from Engineer/Architect, Owner's Representative and/or Construction Manage].
- D. Protect trees, plant growth, and features designated to remain as final landscaping.
- E. Protect benchmarks, survey control points, and existing structures from damage or displacement.

- F. Keep entrances and exits, and adjacent roadways affected, free of debris from clearing operations.

3.4 CLEARING

- A. Clear area required for access to site and execution of Work.
- B. Remove trees and shrubs within marked areas. Remove stumps, root zone.
- C. Remove surface rock larger than two (2) inches.
- D. Clear undergrowth and deadwood, without disturbing subsoil.
- E. Apply herbicide to remaining stumps to inhibit growth.

3.5 REMOVAL

- A. Remove debris, rock, and extracted plant life from site.
- B. Notify Engineer/Architect, Owner's Representative and/or Construction Manager if underground storage tanks and piping is uncovered during Work.
- C. Cease work in immediate area of tanks until direction is given to proceed.

END OF SECTION 311000

SECTION 312317 - SITE EXCAVATION, BACKFILL, AND COMPACTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Verification of subsurface conditions and utilities prior to excavation.
2. Saw cutting of pavements prior to excavation.
3. Excavation for building, structure foundation.
4. Excavation for slabs-on-grade, grade-beam slab.
5. Excavation of trenches for sanitary sewer collection system.
6. Excavation of trenches for storm sewer collection system.
7. Excavation of trenches for water distribution system.
8. Building, Structure backfilling to subgrade elevations.
9. Backfill under slabs-on-grade, grade beam slab.
10. Backfill requirements for utility trenches.
11. Backfill for over-excavation corrections.
12. Consolidation and compaction.

B. Related Sections:

1. Applicable provisions of Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
2. Section 31 05 16 – Aggregates for Earthwork: Aggregate backfill materials.
3. Section 31 25 13 – Erosion and Sediment Controls.
4. Section 33 10 13 – Water Main Installation: Installation of public water main system.
5. Section 33 11 00 – Site Water System: Installation of site water lines for private use.
6. Section 33 11 19 – Fire Suppression Water Distribution Piping: Installation of fire service main for private use.
7. Section 33 12 13 – Water Service Laterals: Installation of water service laterals.
8. Section 33 40 13 – Storm Sewer Installation: Installation of public storm sewer system.
9. Section 33 41 00 – Site Storm Sewer System: Installation of storm sewer system.
10. Section 33 42 13 – Pipe Culverts: Installation of pipe culverts.

1.2 REFERENCES

A. State of Florida Department of Transportation (FDOT):

1. Standard Specifications for Road and Bridge Construction, Current Edition with latest supplements.

[State of Florida DOT Standard Specifications](#)

B. State of Florida Department of Transportation, Standard Specifications for [Highway and Structure Construction] [Road and Bridge Construction, Current Edition with latest supplements. (FDOT)

C. ASTM International (ASTM):

1. ASTM C518 - Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
2. ASTM C578 – Specification for Rigid, Cellular Polystyrene Thermal Insulation.

3. ASTM D698 - Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort 12,400 ft.-lbf/ft³.
4. ASTM D1557 - Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort 56,000 ft.-lbf/ft³.
5. ASTM D1621 - Test Method for Compressive Properties of Rigid Cellular Plastics.
6. ASTM D2842 - Test Method for Water Absorption of Rigid Cellular Plastics.
7. ASTM D2487 - Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
8. ASTM D6072 - Practice for Obtaining Samples of Geosynthetic Clay Liners.
9. ASTM D6938 – Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures, Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.
- B. Samples: Submit 10 lb. sample of each type of specified fill to testing laboratory, in airtight containers.
- C. Provide certified analysis of material(s) to Engineer/Architect, Geotechnical Engineer, Owner's Representative, Construction Manager prior to any use on Work.

1.4 REGULATORY REQUIREMENTS

- A. Contractor shall comply with all local, state, and federal regulations applicable to Work of this Section.
- B. Contractor shall comply with and be solely responsible for compliance with U.S. Department of Labor OSHA Part 1926 Safety and Health Regulations for Construction for this Work.
- C. Contractor performing Work of this Section shall be solely responsible for identifying, furnishing, installing and maintaining equipment and materials required by state and federal regulations to establish safe working conditions during Work of this Section.

PART 2 - PRODUCTS

2.1 BEDDING AND BACKFILL MATERIALS

- A. Water Main Bedding: Type A12, as defined in Section 31 05 16 – Aggregates for Earthwork.
- B. Sewer Bedding (18 Inches in Diameter and Less): Type A6, as defined in Section 31 05 16 – Aggregates for Earthwork.

- C. Sewer Bedding (Greater than 18 Inches in Diameter): Type A7, as defined in Section 31 05 16 – Aggregates for Earthwork.
- D. Crushed Gravel Backfill: Type A1 as defined in Section 31 05 16 – Aggregates for Earthwork.
- E. Crushed Stone Backfill: Type A5 as defined in Section 31 05 16 – Aggregates for Earthwork.
- F. Site Excavated Material (Spoil) Backfill: Type S1 as defined in Section 31 05 13 – Soils for Earthwork.
- G. Imported Subsoil Material Backfill: Type S2 as defined in Section 31 05 13 – Soils for Earthwork.

2.2 AGGREGATE SLURRY BACKFILL

- A. Place materials in a clean cement mixer truck and thoroughly mixed in following quantities:

1,350 lbs.	sand
775 lbs.	1-1/4 Inch stone
1,150 lbs.	3/4 Inch stone
25 gals.	(+0 to -0.5) water/cu.yd.
- B. Lean concrete backfill shall conform to above with addition of a minimum of one bag of cement per cubic yard.

2.3 PIPE INSULATION

- A. Extruded polystyrene board to ASTM C578, Type V, rigid, closed cell type, with integral high density skin.
 - 1. Thermal Resistance: Typical 5 year aged value of R-5 per 1 inch of thickness per ASTM C518.
 - 2. Board Size: 24 x 96 x 2-inch thick. Square edges.
 - 3. Compressive Strength: Minimum 100 psi per ASTM D1621.
 - 4. Water Absorption: 0.7 percent by volume maximum per ASTM D2842.
 - 5. Insulation shall be:
 - a. Dow Chemical Company STYROFOAM™ Highload 100; [Dow Chemical Styrofoam Highload 100 Insulation](#).
 - b. Or Approved Equal.

PART 3 - EXECUTION

3.1 NOTIFICATION

- A. Contractor, prior to any excavation work, shall notify (1) a designated locating service; (2) all utilities, governmental agencies, entities, known to, or which can reasonably be assumed to have above or below ground pipe, conduit cables, structures, or similar items within limits of project; to locate and mark location of such items.
- B. In accordance with Florida Statutes Chapter 556, "Underground Facility Damage Prevention and Safety Act," every "Person" as defined in 556.102(9) shall be solely responsible to provide advance notice to "Sunshine State One-Call of Florida, Inc." (800-638-4097) not more than five

nor less than two (2) working days prior to commencement of any Excavation or Demolition, as defined in the statute, required to perform work contained in this Project, and further said "Person" shall comply with all other requirements of this Statute relative to Excavator's Work. [Florida Statute Chapter 556 - Underground Facility Damage Prevention and Safety Act](#)

3.2 SITE VERIFICATION

- A. Verify that survey benchmark and intended elevations for Work are as indicated.

3.3 FIELD MEASUREMENTS

- A. Verify that survey benchmark and intended elevations for the Work are as shown on Drawings.
- B. Primary line and grade will be furnished by Owner and will be established by Owner, Engineer/Architect and Contractor.
- C. Contractor shall employ a Registered Land Surveyor, registered in the State of Florida to perform all survey work related to primary line and grade for project utilities.
- D. Contractor shall check accuracy of line and grade stakes by means of visual and taping checks and shall be responsible for protection and preservation of such stakes established by Registered Land Surveyor.
- E. Contractor shall bear sole responsibility for correct transfer of all construction lines and grades from primary line and grade points and for correct alignment and grade of finished structure, based upon primary line and grade established by Registered Land Surveyor.
- F. Except for those lot corners and survey monuments that fall within trench excavation, Contractor shall be solely responsible for protection and/or replacement of all survey corners that exist throughout work area.
- G. Corners will be located and marked by Owner or Engineer/Architect, upon request by Contractor, prior to commencing its work.
- H. A Registered Land Surveyor shall replace damaged corners at Contractor's expense.

3.4 SAWING AND BREAKING PAVEMENT

- A. Saw concrete pavement, slabs, or bases to full-depth, slab, or base prior to removal.
- B. Saw cut asphalt surface course and asphalt binder course full depth before removal.
- C. Cut pavements evenly along edges of excavation prior to their removal in such a way as to avoid excessive removal or ragged, uneven edges.
- D. A drop weight or other type of machinery for breaking pavement when approved by Engineer/Architect, Owner's Representative or Construction Manager may be used when such usage does not become a nuisance or a source of damage to underground or adjacent structures.
- E. Prior to employing a drop weight, Contractor shall verify that there are no nearby underground structures that would be injured by its use.

- F. Contractor shall be solely responsible for any damage caused thereby.
- G. Engineer/Architect, Owner's Representative and Construction Manager reserves right to order discontinuance of use of such drop weight at any time.

3.5 PREPARATION FOR EXCAVATION

- A. Identify required lines, levels, contours, and datum.
- B. Stake and flag locations of known utilities.
- C. Notify utility company to remove and/or relocate utilities that interfere with Work.
- D. Protect above and below grade utilities indicated to remain.
- E. Protect plant life, lawns and other features remaining as portion of final landscaping.
- F. Protect benchmarks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- G. Cut out soft areas of subgrade not capable of in situ compaction. Backfill with Type A2, as specified in Section 31 05 16 – Aggregates for Earthwork, fill and compact to density equal to or greater than requirements for subsequent backfill material.

3.6 FIELD QUALITY CONTROL FOR EXCAVATION

- A. Field inspection will be performed under provisions of Section 01 40 00 – Quality Requirements, Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework.
- B. Provide for visual inspection of bearing surfaces.

3.7 [BUILDING] [STRUCTURE] EXCAVATION

- A. Underpin adjacent structures that may be damaged by excavation work, including utilities and pipe chases.
- B. Excavate subsoil required to accommodate building foundation, slabs-on-grade and site structures and construction operations.
- C. Machine slope banks to angle of repose or less, until shored.
- D. Excavation cut not to interfere with normal 45 degree bearing splay of foundation.
- E. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- F. Hand trim excavation. Remove loose matter.
- G. Remove lumped subsoil, boulders, and rock.
- H. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

- I. Correct unauthorized excavation at no extra cost to Owner.
- J. Correct areas over-excavated in error.
- K. Stockpile excavated material in area designated on site and remove excess material not being reused, from site. Remove excavated material from site.

3.8 EXPOSING EXISTING SANITARY SEWER, STORM SEWER AND WATER MAIN

- A. Before excavation of trench is begun, Contractor shall uncover stub end of existing utility to which new utility is to be connected. This will permit adjustments in line and grade and verify connection required.
- B. Securely plug existing terminations in manholes to which new utilities are to be connected to prevent entry of construction water and debris into active system.
- C. Contractor shall be responsible to verify that plug(s) are in place at end of each workday.
- D. Contractor shall remove any water or debris from terminal manhole as required but not less than once a week.

3.9 TRENCH EXCAVATION

- A. Excavate subsoil required for installation of utility.
- B. Excavate trenches at top of pipe to a maximum width based on dimension of outside diameter of pipe plus 24 inches to enable installation of pipe and to allow inspection.
- C. Width at top of pipe may be increased with prior approval of Engineer/Architect, Owner's Representative or Construction Manager to allow for stringers and sheathing when required.
- D. Provide pipe laid in open-cut trench with six (6) inch minimum clearance between outside face of pipe barrel and face of sheathing or sidewall of trench.
- E. Maximum width of trench at ground surface shall not exceed width of trench at top of pipe by more than two (2) feet without prior request to Engineer/Architect, Owner's Representative or Construction Manager, unless it is specifically allowed on Drawings.
- F. Place excavated material stored along trench excavation a minimum distance back from edge of trench. Determine distance by angle of repose of trench material to prevent surcharging of trench wall material leading to potential shearing of trench wall and collapse of trench.
- G. Store excavated material to be used for trench backfilling so that it will not interfere with:
 - 1. Public travel.
 - 2. Adjacent property owners or tenants.
 - 3. Other Contractors.
- H. Contractor shall immediately remove and dispose of excavated material which is not to be used as trench backfill, unless directed otherwise by Contract Documents.
- I. Engineer/Architect, Owner's Representative and Construction Manager reserves right to order up to 10 percent of surplus excavated material to be delivered to Owner's streets, alleys, public

properties, or locations designated by Engineer/Architect, Owner's Representative or Construction Manager.

- J. Cost of delivering and leveling such surplus material to any point within a driving distance of two miles from site of work shall be include in unit prices bid for work.
- K. After delivery to designated location, material shall be leveled off at direction of Engineer/Architect, Owner's Representative or Construction Manager.
- L. Contractor shall maintain all finished excavations free of water or sewage during Work.
- M. Hand trim excavation. Remove loose matter.
- N. Remove lumped subsoil, boulders, and rock up to 1/3 cubic yard, measured by volume.
- O. Correct unauthorized excavation and over-excavated areas at no cost to Owner.
- P. Excavate no more trench in advance of completed pipe laying operations than can be completed and backfilled by end of workday.
- Q. Do not obstruct more than one street crossing by same trench at any one time.

3.10 TRENCH BEDDING

- A. Keep trench bottom free of water prior to placement of bedding and laying of pipe.
- B. Place and shape bedding material to pipe, to a minimum depth of three inches under bell and four inches under spigot and compact to 95 percent modified Proctor density.
- C. Support pipe during placement and compaction of bedding material.
- D. Bring bedding and cover material over top of pipe to a minimum compacted depth of 12 inches, compact to specified density.
- E. Where sand is used for cover material, compact sand with portable plate compactor to a depth of twelve inches in two lifts of six (6) inches each for initial cover over pipe.

3.11 PIPE INSULATION

- A. Insulate water pipes with less than six (6) foot of cover with a minimum four (4) inch thick sheet of extruded polystyrene insulation.
- B. Sanitary sewers or storm sewers containing building condensate or clearwater shall have a minimum four (4) inch thick sheet of extruded polystyrene insulation when cover is less than:
 - 1. 60 inches in paved areas.
 - 2. 42 inches in non-paved areas.
- C. Extend insulation a minimum of two (2) feet each side of pipe centerline.
- D. Sheet insulation shall be minimum two (2) feet each side of pipe centerline and in addition shall have four (4) inches of insulation board placed vertically at end of horizontal board to bottom of excavated trench.

3.12 PROTECTION

- A. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

3.13 EXAMINATION PRIOR TO BACKFILLING

- A. Verify fill material to be reused are acceptable.
- B. Verify foundation perimeter drainage installation has been inspected.

3.14 BACKFILLING

- A. Backfill with materials and to contours and elevations shown on Drawings. Generally, compact subgrade to density requirements for subsequent backfill materials.
- B. Place specified backfill in loose lift layers. Use compaction equipment that will achieve desired compaction requirements.
- C. Systematically backfill to allow for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- D. Where sidewall material is loose or unstable, place geotextile cloth material over sidewall prior to backfilling.
- E. Employ a placement method that does not disturb or damage pipe in trench.
- F. Maintain optimum moisture content of backfill materials to attain required compaction density.
- G. Backfill simultaneously on each side of unsupported non-basement foundation walls.
- H. Slope grade away from building minimum two (2) inches in 10 feet, unless noted otherwise.
- I. Make grade changes gradual. Blend slope into level areas.
- J. Leave fill material stockpile areas completely free of excess fill materials.
- K. Remove surplus backfill materials from site.

3.15 MECHANICAL COMPACTION

- A. Mechanically compact backfill by means of a tamping roller, sheepsfoot roller, pneumatic tire roller, vibrating roller, or other mechanical tampers. Impact, free-fall, or "stomping" type compaction equipment shall not be allowed.
- B. Flooding or jetting of backfill for compaction purposes shall not be allowed.
- C. Contractor shall furnish written notification to Engineer/Architect, Owner's Representative or Construction Manager prior to start of work as to size and type of mechanical compaction equipment to be used.

- D. Place material for mechanically compacted backfill in lifts, which, prior to compaction, shall not exceed thickness specified below for type of compaction equipment used:
 - 1. Vibratory equipment including vibratory plate, vibratory smooth-wheel rollers, and vibratory pneumatic-tired rollers: maximum lift thickness two (2) feet.
 - 2. Rolling equipment, including sheepsfoot (both vibratory and non-vibratory), grid, smooth-wheel (non-vibratory), pneumatic-tired (non-vibratory), and segmented wheels: maximum lift thickness one (1) foot.
 - 3. Hand-directed mechanical tampers: maximum lift thickness of six (6) inches.

3.16 TOLERANCES FOR BACKFILL

- A. Top Surface of Backfill: Plus or minus 1 inch from required elevations.

3.17 COMPACTION REQUIREMENTS

- A. Granular Material shall be compacted to 95 percent of modified Proctor density.
- B. Excavated Material to be used for backfill shall be compacted to a density equal to adjacent undisturbed trench wall or as specified.

3.18 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 40 00 – Quality Requirements, Division 01 – General Requirements, Section 31 02 00 - General Requirements for Sitework.
- B. Testing and analysis of fill material will be performed in accordance with ASTM D698, D1557 and Section 01 40 00 – Quality Requirements, Division 01 - General Requirements, Section 31 02 00 - General Requirements for Sitework.
- C. Compaction and moisture testing will be performed in accordance with ASTM D6938 and Section 01 40 00 – Quality Requirements, Division 01 – General Requirements, Section 31 02 00 - General Requirements for Sitework.
- D. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest at no cost to Owner.

3.19 PROTECTION OF FINISHED WORK

- A. Reshape and recompact fills subjected to vehicular traffic.
- B. Contractor shall have available a supply of steel plates with minimum dimensions of four (4) feet by eight (8) feet by one (1) inch.
- C. Use plates to bridge open trenches crossing roadways and secure against possibility of shifting or dropping into excavation.
- D. During winter months, do not leave plates in roadway overnight.

3.20 SCHEDULE OF BACKFILL

- A. Section 31 05 16 – Aggregates for Earthwork defines “A” designated fill materials and Section 31 05 13 – Soils for Earthwork defines “S” designated fill materials.
- B. Fill to Correct Over-Excavation:
 - 1. Aggregate Type A2 fill, flush to required elevation, compacted to 90 percent modified Proctor density.
 - 2. Lean concrete to minimum compressive strength of 1000 psi.
- C. Foundations:
 - 1. Aggregate Type A2 fill. Place materials in continuous loose lifts layers not exceeding seven (7) inch depth, compacted to 95 percent modified Proctor density.
- D. Below Grade Slabs and Basement Slabs:
 - 1. Aggregate Type A5 fill. Place materials in continuous loose lifts layers not exceeding nine (9) inch depth, compacted to 95 percent modified Proctor density.
- E. Interior Slab-On-Grade:
 - 1. Aggregate Type A2 fill. Place materials in continuous loose lifts layers not exceeding seven (7) inch depth, compacted to 95 percent modified Proctor density.
- F. Exterior Slab-On-Grade:
 - 1. Aggregate Type A1, A2 and A3 fill. Place materials in continuous loose lifts layers not exceeding seven (7) depth, compacted to 95 percent modified Proctor density.
- G. Foundation Drainage - Stone Cover:
 - 1. Aggregate Type A5 fill. Place materials in continuous loose lifts layers not exceeding nine (9) inch depth, compacted to 95 percent modified Proctor density.]
- H. Utility Piping - Stone Bedding and Cover:
 - 1. Aggregate Type A6 or A7 fill depending on pipe size. Place materials in continuous loose lifts layers not exceeding nine (9) inch depth, compacted to 95 percent modified Proctor density.
- I. Utility Piping - Sand Bedding and Cover:
 - 1. Aggregate Type A11 fill. Place materials in continuous loose lifts layers not exceeding 12-inch depth, compacted to 95 percent modified Proctor density.
- J. Utility Trench – Backfill in Paved Areas:
 - 1. Aggregate Type A1 or A2 fill. Place materials in continuous loose lifts layers not exceeding 12-inch depth, compacted to 95 percent modified Proctor density.
- K. Utility Trench – Backfill in Non-paved Areas:
 - 1. Subsoil Type S1 or S2 fill, to six (6) inches below finish grade. Place materials in continuous loose lifts layers not exceeding 12-inch depth, compacted to 90 percent modified Proctor density.
- L. Fill Under Roadways or Driveways.
 - 1. Aggregate Slurry Fill placed to 12 inches below finish grade, placed in continuous applications.]

M. Fill Under Grass Area.

1. Subsoil Type S1 or S2 fill, to six (6) inches below finish grade. Place materials in continuous loose lifts layers not exceeding 12-inch depth, compacted to 90 percent modified Proctor density.

N. Frequency of Compaction Tests:

1. General Excavation and Fill: One (1) Test for Every 1000 Cubic Yards.
2. Excavation and Backfill for Trenches (Gravel): One (1) Test for Every 300 Cubic Yards.
3. Excavation and Backfill for Trenches (Spoil): One (1) Test for Every 750 Cubic Yards.
4. Undercut Excavation: One (1) Test for Every 1000 Cubic Yards.

END OF SECTION 312317

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SECTION 312323 - ENGINEERED SOIL FOR SITE WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnishing and placing engineered soil.

B. Related Sections:

1. Applicable provisions of Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
2. Section 31 05 13 – Soils for Earthwork.
3. Section 31 25 13 – Erosion and Sediment Control: Slope protection and erosion control.

1.2 REFERENCES

A. AOAC International (AOAC); [AOAC International Website](#).

1. Official Methods of Analysis.

B. ASTM International (ASTM):

1. ASTM C88 - Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
2. ASTM C131 - Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
3. ASTM D422 – Test Method for Particle-Size Analysis of Soils.
4. ASTM D1557 - Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
5. ASTM D1883 - Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils.

C. ISRIC - World Soil Information (ISRIC); [ISRIC Website](#).

1. Technical Paper 9 – Procedures for Soil Analysis.
2. United States Department of Agriculture –Natural Resources Conservation Service (NCRS);
 - a. Acres of Prime Farmland.
 - b. Soil Texture Calculator.

1.3 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures, Section 31 02 00 – General Requirements for Sitework, Division 01 – General Requirements: Requirements for submittals.

B. At least 30 days prior to ordering materials, Contractor shall submit representative samples, certificates, manufacturer's literature and certified tests for materials specified below to Geotechnical Engineer and Engineer.

C. Do not order materials until Geotechnical Engineer or Engineer reviews and approves required samples, certificates, manufacturer's literature, and test results. Delivered materials shall closely match approved samples.

- D. Approval shall not constitute final acceptance. Geotechnical Engineer and Engineer reserves right to reject, on or after delivery, any material not meeting these specifications.
- E. Submit two (2) 1/2 cubic foot representative samples of clay loam and two (2) two cubic foot representative samples of engineered soil mixes in this section for testing, analysis, and approval.
- F. Submit one (1) set of samples for every 500 cubic yards of material to be delivered. In the event of multiple source fields for clay loam, submit a minimum of one set of samples per source field or stockpile.
- G. Take samples randomly throughout field or stockpile at locations as directed by Geotechnical Engineer or Engineer and package in presence of Geotechnical Engineer or Engineer.
- H. Contractor shall deliver samples to testing laboratories and have test results sent directly to Geotechnical Engineer and Engineer. Label samples including location of source of material, date of sample, and Contractors name.
- I. Testing laboratory shall use one (1) sample for testing purposes. Submit second sample of clay loam and engineered soil to Geotechnical Engineer and Engineer at same time as test analysis as a record of soil color and texture.
- J. Submit locations of source fields for clay loam.
- K. Submit a list of chemicals and herbicides applied to clay loam for last five (5) years and a list of crops grown in clay loam source fields for last three (3) years.
- L. Submit soil test analysis reports for each sample of clay loam and engineered soil from an approved soil-testing laboratory.
- M. Geotechnical Engineer or Engineer shall approve soil testing laboratory. Testing laboratory for particle size and chemical analysis may be a public agricultural extension service agency or agricultural experiment station.
- N. Submit a bulk density of sample and particle size analysis including the following gradient of mineral content:

<u>NCRS Texture Designation</u>	<u>Size in mm.</u>
Gravel	+2 mm
Sand	0.05 - 2 mm
Silt	0.0002-0.05 mm
Clay	minus 0.002 mm

- O. Perform sieve analysis and compare to NCRS Soil Texture System. Perform sieve analysis by a combined hydrometer and wet sieving using sodium hexametaphosphate as a dispersant in compliance with ASTM D422 after destruction of organic matter by hydrogen peroxide.
- P. Submit a chemical analysis, performed in accordance with current AOAC methods, including the following:
 - 1. pH and Buffer pH.

2. Percent organic matter as determined by loss of ignition of oven dried samples. Test samples shall be oven dried to a constant weight at a temperature of 230 degrees F, plus or minus nine (9) degrees.
 3. Analysis for nutrient levels by parts per million including nitrate nitrogen, ammonium nitrogen, phosphorus, potassium, magnesium, manganese, iron, zinc, calcium, and extractable aluminum.
 4. Nutrient test shall include testing laboratory recommendations for supplemental additions to soil as calculated by amount of material to be added per volume of soil for type of plants to be grown in soil.
 5. Analysis for levels of toxic elements and compounds including arsenic, boron, cadmium, chromium, copper, lead mercury, molybdenum, nickel, zinc, and PCB. Test results shall be cited in milligrams per kilogram.
 6. Soluble salt by electrical conductivity of a 1:2 soil/water sample measured in Millimho per cm.
 7. Cation Exchange Capacity (CEC) per ISRIC.
 8. Carbon/Nitrogen Ratio.
- Q. Submit 5-point minimum moisture density curve based on ASTM D1557 test results for each engineered soil sample without removing oversized aggregate.
- R. Submit California Bearing Ratio test results for each engineered soil sample compacted to peak standard density. Soaked CBR, ASTM D1883, shall equal or exceed a value of 50.
- S. Submit measured dry-weight percentage of stone in mixture.
- T. Approved engineered soil samples shall be standard for each lot of 500 cubic yards of material.
- U. Testing and analysis shall be at Contractor's expense.
- V. Maintenance Instructions:
1. Prior to time of final acceptance of the Work, submit maintenance instructions for use, removal and replacement of engineered soil for licensor's use.
 2. Instructions shall be reviewed by Project Engineer as a pre-condition for final acceptance of the Work.
- W. Submit a proposed plan and vertical section layout of engineered soil to Geotechnical Engineer and Engineer for review.
- X. Submit one cubic foot sample per each 500 cubic yards of required material, and for each sample, the following analysis for crushed stone. Geotechnical Engineer or Engineer shall approve soil testing laboratory.
- Y. Provide a particle size analysis including the following gradient of mineral content:

<u>NCRS Texture Designation</u>	<u>Size in mm.</u>
3@	+76 mm
2-1/2@	63-76 mm
2@	50-63 mm
1-1/2@	37-50 mm
1@	25-37 mm

NCRS Texture Designation	Size in mm. Cont.
3/4@	19-25 mm
Fine gravel	2-19 mm
Sand	0.05 -2 mm
Silt	0.002-0.05 mm
Clay	minus 0.002 mm

- Z. Provide manufacturers analysis of the following:
1. Loose and rodded unit weight.
 2. Bulk specific gravity and absorbency.
 3. Stone dimension and surface texture description.
 4. Documentation of acceptance for use as FDOT approved aggregate.

AA. Provide a percent pore space analysis defined as follows:

$$\text{Rodded Unit Weight divided by Bulk Specific Gravity X 100}$$

- BB. Submit one pound sample of each type of fertilizer and three (3) certificates showing composition and analysis. Submit purchase receipt for each fertilizer showing total quantity purchased for project prior to installation.
- CC. Submit Landscape or Pavement Material Contractor's qualifications outlining projects of similar quality, schedule requirements and construction detailing over last five (5) years.
- DD. Qualifications shall include names of all similar projects, year completed, location, description of scope of work including types and quantities of planting mix/pavement material installed and name, address and telephone number of owner or owner's representative.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver or place soils in frozen, wet, or muddy conditions.
- B. Deliver material at or near optimum compaction moisture content.
- C. Do not deliver or place materials in an excessively moist condition beyond two (2) percent above optimum compaction moisture content.
- D. Protect soils and mixes from absorbing excess water and from erosion.
- E. Do not store materials unprotected from large rainfall events. Do not allow excess water to enter site prior to compaction.
- F. If water is introduced into material after grading, allow material to drain or aerate to optimum compaction moisture content.

1.5 EXAMINATION OF CONDITIONS

- A. Contractor shall inspect areas to receive engineered soil before starting work and shall report any defects such as incorrect grading or inadequate compaction to Geotechnical Engineer and Engineer prior to beginning this work.

- B. Contractor shall be responsible for judging full extent of work requirements involved, including, but not limited to, potential need for temporary storage and staging of soils, moving soil stockpiles at site to accommodate scheduling of other work and need to protect installed soils from compaction, erosion and contamination.

1.6 QUALITY ASSURANCE

- A. Qualifications of Landscape or Pavement Material Contractor:
 - 1. The Work of this section shall be performed by a Landscape Contracting firm which has a minimum of five (5) years experience successfully installing planting mix of a similar quality, schedule requirement and construction detailing to this project. Submit proof of this experience in accordance with requirements of Article 1.3 – Submittals.

PART 2 - PRODUCTS

2.1 CLAY LOAM

- A. Clay loam shall be a “loam” based on NCRS soil texture classification system as determined by mechanical analysis (ASTM D422) and it shall be of uniform composition, without admixture of subsoil.
- B. Clay loam shall be free of stones greater than one-half inch, lumps, plants and their roots, debris, and other extraneous matter over one (1) inch in diameter or excess of smaller pieces of same materials as determined by Geotechnical Engineer or Engineer.
- C. Clay loam shall not contain toxic substances harmful to plant growth. Clay loam shall be obtained from naturally well-drained areas, which have never been stripped of top soil before and have a history of satisfactory vegetative growth.
- D. Clay loam shall contain not less than two (2) or more than five (5) percent organic matter as determined by loss on ignition of oven-dried samples. Test samples shall be oven-dried to a constant weight at a temperature of 230 degrees F., plus or minus nine (9) degrees.
- E. Mechanical analysis for a loam/clay loam shall be as follows:

NCRS Textural Class	% of total weight
Gravel	less than 5%
Sand	20 - 45%
Silt	20 - 50%
Clay	20- 40%

- F. Chemical analysis: Meet or be amended to meet the following criteria.
 - 1. pH between 5.5 to 6.5.
 - 2. Percent organic matter 2–5 percent by dry weight.
 - 3. Nutrient levels as required by testing laboratory recommendations for type of plants to be grown in soil.
 - 4. Toxic elements and compounds below U.S. Environmental Protection Agency Standards for Exceptional Quality sludge or local standard; whichever is more stringent.
 - 5. Soluble salt less than 1.0 Millimho per cm.

6. Cation Exchange Capacity (CEC) greater than 10.
7. Carbon/Nitrogen Ratio less than 33:1.

G. Clay loam shall be product of a commercial processing facility specializing in production of stripped natural topsoil. No topsoil shall come from NCRS-classified prime farmland.

2.2 FERTILIZER

- A. Provide commercial fertilizer complying with state and federal fertilizer laws. Deliver fertilizer in original unopened containers bearing manufacturer's certificate of compliance covering analysis, which shall be furnished to Geotechnical Engineer and Engineer.
- B. Fertilizer shall be formulated for mixing into soil and be certified by manufacturer to provide controlled release of nitrogen continuously for a period of no less than nine (9) months and no more than 12 months.
- C. Fertilizer percentages of weight of ingredients and application rates shall be as recommended by soil testing results.

2.3 SULFUR

- A. Sulfur shall be commercial granular, 96 percent pure sulfur, delivered in containers with name of manufacturer, material, and analysis appearing on container.
- B. Sulfur used to lower soil pH above 6.5 shall be ferrous sulfate formulation.

2.4 LIME

- A. Agricultural limestone containing a minimum of 85 percent carbonates.
- B. Minimum gradation: 100 percent passing 10 mesh sieve; 98 percent passing 20 mesh sieve; 55 percent passing 60 mesh sieve; and 40 percent passing 100 mesh sieve.

2.5 CRUSHED STONE

- A. Crushed Stone shall be FDOT certified crushed stone. 90 - 100 percent of stone shall pass 1-1/2-inch sieve, 20-55 percent shall pass 1-inch sieve, and 10 percent shall pass 3/4-inch sieve. A ratio of nominal maximum to nominal minimum particle size of 2 is required.
- B. Acceptable aggregate dimensions will not exceed 2.5:1.0 for any two dimensions chosen.
- C. Minimum 90 percent with one fractured face, minimum 75 percent with two or more fractured faces.
- D. Results of Aggregate Soundness Loss test, ASTM C88, shall not exceed 18 percent.
- E. Losses from LA Abrasion tests, ASTM C131, shall not exceed 40 percent.

2.6 HYDROGEL

- A. Water absorbent synthetic polymer which may be potassium based and/or crosslinked.
 1. Amereq Corporation - Gelscape; <http://www.amereq.com/>; (800) 832-8788.

2. JRM Chemical Inc. – Soilmoist; <http://www.soilmoist.com/>; (800) 962-4010.
3. Aquatrols Corporation – Supersorb; <http://aquatrols.com/?LOCALE=USA>; (800) 257-7797.
4. Or Approved Equal.

2.7 WATER

- A. Contractor shall be responsible to furnish his own supply of water to site at no extra cost. Work injured or damaged due to lack of water, or use of too much water, shall be Contractor's responsibility to correct. Water shall be free from impurities injurious to vegetation.

2.8 ENGINEERED SOIL

- A. A uniformly blended mixture of crushed stone, clay loam and hydrogel, mixed to the following proportion:

Material	Unit Of Weight
Crushed Stone	100 units dry weight
Loam	As determined by mix test (Approx. 20 units)
Hydrogel	0.03 units dry weight
Total moisture	ASTM D1557 optimum moisture

- B. Determine initial mix design for testing by adjusting ratio between crushed stone and clay loam (see Appendices I and II). Adjust final mix dry weight mixing proportion to decrease soil in mixture if CBR test results fail to meet acceptance (CBR # 50).

PART 3 - EXECUTION

3.1 MIX DESIGN

- A. Prepare sample engineered soil mixes to determine ratio of mix components. Submit for approval.
- B. Submit samples and test results of each mix component for approval. Based on samples and analysis of mix components.
- C. Geotechnical Engineer and Engineer and Contractor will jointly determine a mix ratio to be tested for conformance with requirements of specifications.
- D. For engineered soil quantities greater than 500 cubic yards, test mix ratio for each clay loam or crushed stone where testing indicates a significant difference in physical analysis of clay loam or crushed stone as determined by Geotechnical Engineer and Engineer.
- E. Geotechnical Engineer and Engineer may request testing of additional engineered soil mix ratio samples in the event that further refinement of mix is necessary.
- F. Submit to Geotechnical Engineer and Engineer proposed fertility amendment recommendations including amounts and types of fertilizers and pH adjustments for each mix ratio. Include fertility adjustments as part of mixing process.

3.2 SOIL MIXING AND QUALITY CONTROL TESTING

- A. Perform engineered soil mixing at Contractor's yard using appropriate soil measuring, mixing and shredding equipment of sufficient capacity and capability to assure proper quality control and consistent mix ratios.
- B. No mixing of engineered soil at project site shall be permitted. Portable pugging may be used.
- C. Maintain adequate moisture content during mixing process. Soils and mix components shall easily shred and break down without clumping.
- D. Soil clods shall easily break down into a fine crumbly texture. Soils shall not be overly wet or dry.
- E. Contractor shall measure and monitor amount of soil moisture at mixing site periodically during mixing process.
- F. Mixing procedure for front-end loader shall be as follows:
 - 1. On a flat asphalt or concrete paved surface, spread an 8 inch to 12-inch layer of crushed stone.
 - 2. Spread specified amount of dry hydrogel evenly over stone.
 - 3. Spread a proportional amount of clay loam over dry hydrogel and crushed stone according to mix design.
 - 4. Blend entire amount by turning, using a front-end loader or other suitable equipment until a consistent blend is produced.
- G. Add moisture gradually and evenly during blending and turning operation as required to achieve required moisture content.
- H. Delay applications of moisture for 10 minutes prior to successive applications.
- I. Once established, mixing should produce a material within one (1) percent of optimum moisture level for compaction.
- J. A pugging operation mixing procedure may be as follows:
 - 1. Feed a known weight of crushed stone into mixing trough.
 - 2. Add hydrogel slurry into trough and mix slurry and stone into a uniform blend.
 - 3. Meter in soil in proper proportion of clay loam soil while stone-slurry mixture is in motion.
 - 4. Add water to bring mixture to target moisture content after factoring in water from slurry and clay-loam moisture a portable pugging operation.
 - 5. Add soil amendments to alter soil fertility including fertilizers and pH adjustment at time of mixing at rates recommended by soil test.
 - 6. Adjust soil pH to fall within a value of 5.5 and 6.5 two months after mixing if material is stored, unless mixing with a high pH stone. Once pavement is laid, no adjustment should be imposed.
 - 7. Adjust soil component carbon/nitrogen ratio to be less than 33:1 within two (2) months after mixing.
- K. Contractor shall mix sufficient material in advance of time needed at job site to allow adequate time for final quality control testing as required by progress of the Work.

- L. Store engineered soil in piles of approximately 500 cubic yards and number each pile for identification and quality control purposes.
- M. Protect storage piles from rain and erosion by covering with plastic sheeting.
- N. During mixing process, Contractor shall take two (2) one (1) cubic foot quality control samples per 500 cubic yards of production from final engineered soil.
- O. Take samples from random locations in numbered stockpiles as required by this specification. Test each sample for particle size analysis and chemical analysis as described above. Submit results directly to Geotechnical Engineer and Engineer for review and approval.
- P. Quality control sample clay loam/crushed stone ratio's shall be no greater or less than two (2) percent of approved test sample as determined by splitting a known weight of oven dried material on a No. 4 sieve.
- Q. In the event that quality control samples vary significantly from approved engineered soil sample, as determined by Geotechnical Engineer and Engineer, remix and retest any lot of soil that fails to meet correct analysis making adjustments to mixing ratios and procedures to achieve approved consistency.

3.3 UNDERGROUND UTILITIES AND SUBSURFACE CONDITIONS

- A. Notify Geotechnical Engineer and Engineer of any subsurface conditions which will affect Contractor's ability to complete the Work.
- B. Locate and confirm location of underground utility lines and structures prior to starting any excavation.
- C. Repair any underground utilities or foundations damaged by Contractor during progress of this Work. Cost of repairs shall be at Contractor's expense.

3.4 SITE PREPARATION

- A. Do not proceed with installation of engineered soil material until walls, curb footings and utility work in area have been installed. For site elements dependent on engineered soil for foundation support, postpone installation until immediately after installation of engineered soil.
- B. Install subsurface drain lines as shown on Drawings prior to installation of engineered soil material.
- C. Excavate and compact proposed sub-grade to depths, slopes and widths as shown on Drawings. Maintain required angles of repose of adjacent materials as shown on Drawings. Do not over excavate compacted subgrades of adjacent pavement or structures.
- D. Confirm that subgrade is at proper elevation and compacted as required. Slope subgrade elevations parallel to finished grade and or toward subsurface drain lines as shown on Drawings.
- E. Clear excavation of construction debris, trash, rubble, and any foreign material. In the event that fuels, oils, concrete washout silts, or other material harmful to plants have been spilled into

subgrade material, excavate soil sufficiently to remove harmful material. Fill any over excavation with approved fill and compact to required subgrade compaction.

- F. Do not proceed with installation of engineered soil until utility work in area has been installed. Subsurface drainage systems shall be operational prior to installation of engineered soils.
- G. Protect adjacent walls, walks, and utilities from damage or staining by soil. Use 1/2-inch plywood or plastic sheeting as directed to cover existing concrete, metal, and masonry work and other items as directed during progress of the Work.
- H. Clean up trash and any soil or dirt spilled on any paved surface at end of each working day.
- I. Any damage to paving or architectural work caused by soils installation shall be repaired by Contractor at its expense.
- J. Maintain silt and sediment control devices required by applicable regulations. Provide adequate methods to assure that trucks and other equipment do not track soil from site onto adjacent property and public right of way.

3.5 INSTALLATION OF ENGINEERED SOIL MATERIAL

- A. Install engineered soil and compact in six (6) to eight (8) inch lifts to full depth, including where trees and plants will be placed. Compact final lift along with adjacent aggregate fill to create a level paving surface.
- B. Compact materials to 95 percent modified Proctor density. No compaction shall occur when moisture content exceeds maximum as specified.
- C. Delay compaction 24 hours if moisture content exceeds maximum allowable and protect engineered soil during delays in compaction with plastic or plywood as directed by Geotechnical Engineer or Engineer.
- D. Bring engineered soils to finished grades as shown on Drawings. Immediately protect engineered soil material from contamination by toxic materials, trash, debris, water containing cement, clay, silt, or materials that will alter particle size distribution of mix with plastic or plywood as directed by Geotechnical Engineer and Engineer.
- E. Install trees after engineered soil has been placed. Dig pit for root ball with a small backhoe operated from street in order to protect pavers. If engineered soil fails because tree pit is too steeply dug, soil will need to be recompacted.
- F. After tree is installed, backfill hole with engineered soil and recompact. Hand tamp area directly over root ball to avoid damage to tree. Compact other areas with a small plate compactor. Rest tree on a compacted mound of subgrade or on engineered soil.
- G. For perennials, scrap off engineered soil to allow for a minimum typical planting depth of 12 inches. Where perennials are adjacent to a tree, backfill engineered soil and compact to allow for modified topsoil borrow to be added to create perennial bed at top layer.
- H. Use filter fabric below perennial roots, between topsoil and engineered soil. In no way should filter fabric be used to restrict tree roots from engineered soil.

- I. Engineered soil should not be left exposed during winter. Cover open areas with a tarp and plywood.
- J. Geotechnical Engineer and Engineer may periodically check material being delivered and installed at site for color and texture consistency with approved sample provided by Contractor as part of submittal for engineered soil.
- K. In the event that installed material varies significantly from approved sample, Geotechnical Engineer and Engineer may request that Contractor test installed engineered soil.
- L. Remove any soil which varies significantly from approved testing results, as determined by Geotechnical Engineer and Engineer, and install new engineered soil meeting these specifications.

3.6 FINE GRADING

- A. After initial placement and rough grading of engineered soil but prior to start of fine grading, Contractor shall request review of rough grading by Geotechnical Engineer and Engineer. Contractor shall set sufficient grade stakes for checking finished grades.
- B. Adjust finish grades to meet field conditions as directed.
- C. Provide smooth transitions between slopes of different gradients and direction.
- D. Fill dips and remove any bumps in overall plane of slope.
- E. Tolerance for dips and bumps in engineered soil areas shall be a three (3) inch deviation from plane in 10 feet.
- F. Geotechnical Engineer and Engineer shall inspect and approve fine grading prior to installation of other items to be placed on engineered soil.
- G. Geotechnical Engineer and Engineer will inspect the Work upon request by Contractor.
- H. Geotechnical Engineer and Engineer shall receive request for inspection from Contractor at least 10 days before anticipated date of inspection.

3.7 ACCEPTANCE STANDARDS

- A. Geotechnical Engineer and Engineer will inspect the Work upon request by Contractor. Geotechnical Engineer and Engineer shall receive request for inspection at least 10 days before anticipated date of inspection.

3.8 CLEANUP

- A. Upon completion of engineered soil installation operations, thoroughly clean areas within the project limits.
- B. Remove excess fills, soils, and mix stockpiles and legally dispose of waste materials, trash and debris.
- C. Remove tools and equipment and provide a clean, clear site.

- D. Sweep, do not wash, paving and other exposed surfaces of dirt and mud until paving has been installed over engineered soil material.
- E. Do no washing until finished materials covering engineered soil material are in place.

END OF SECTION 312323

SECTION 312513 - EROSION AND SEDIMENT CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Equipment and materials for erosion and sediment control to minimize erosion and siltation during construction.
 2. Erosion and sediment control provisions detailed on Drawings and specified herein are minimum requirements for erosion control program.
 3. Contractor to provide additional erosion and sediment control materials and methods required by state or local ordinances, whichever is more stringent.
- B. Related Sections:
1. Applicable provisions of Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.

1.2 REFERENCES

- A. ASTM International (ASTM):
1. ASTM D4355 – Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
 2. ASTM D4491 – Test Methods for Water Permeability of Geotextiles by Permittivity.
 3. ASTM D4632 - Test Method for Grab Breaking Load and Elongation of Geotextiles.
 4. ASTM D4751 - Test Method for Determining Apparent Opening Size of a Geotextile.
- B. State of Florida Department of Environmental Protection, Stormwater Erosion and Sedimentation Control Inspector's Manual.
- C. State of Florida Department of Environmental Protection (FDEP)
http://www.flwaterpermits.com/home/floridawater_permits.html#EnvironmentalPermit
- D. State of Florida Department of Transportation Standard Specifications for Road and Bridge Construction, Current Edition.
- E. County of Okaloosa.
1. Ordinance for Construction Site Erosion Control.

1.3 DEFINITIONS

- A. Definitions shall be in accordance with the Stormwater Erosion and Sedimentation Control Inspector's Manual provided by the Florida Department of Environmental Protection, as defined by each topic.

1.4 SUBMITTALS

- A. Section 01 33 00 – Submittal Procedures, Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.

- B. Provide erosion control plan indicating proposed methods, materials, and schedule for effecting erosion and siltation control to prevent erosion damage to site and adjacent area.
- C. Plan shall include following:
 - 1. Proposed methods for erosion and siltation control.
 - 2. Erosion plan scale of 1 inch equals 40 feet, indicating location of erosion control materials, siltation basins, etc.
 - 3. Schedule for implementation of plan.
 - 4. Provision for maintenance and upkeep of erosion control and siltation materials, identifying persons responsible for said maintenance.

1.5 REGULATORY REQUIREMENTS

- A. Comply with County of Okaloosa ordinance for construction site erosion control.
- B. Comply with applicable state and federal rules and regulations governing erosion and siltation on construction sites.
- C. Permit
 - 1. Apply for, pay fee, and obtain State stormwater discharge permit.

1.6 EROSION CONTROL PRINCIPLES

- A. Keep disturbed area small.
- B. Stabilize disturbed areas with mechanical or structural and vegetative methods.
- C. Keep runoff low through use of short slopes, low gradients, and preservation of natural vegetative cover.
- D. Protect disturbed areas from storm water runoff.
- E. Retain sediment within site boundaries.
- F. Implement a thorough maintenance and follow-up program.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The following erosion control standards and practices shall be provided and installed in accordance with the State of Florida Department of Environmental Protection, Stormwater Erosion and Sedimentation Control Inspector's Manual.
- B. Stabilized Construction Exit;
 - 1. Provide stabilized construction exits at locations indicated on Erosion Control Plan.
 - 2. Stabilized construction exits shall meet the following requirements:
 - a. Aggregate size shall be FDOT No.1 Coarse Aggregate, 1-1/2 inch to 3-1/2 inch stone.
 - b. Exit thickness shall be a minimum of 6 inches, compacted to 95 percent modified proctor.
 - c. Entrance width shall extend full width of vehicular ingress or egress points.

- d. Entrance length shall be not less than 50 feet. Flare exit at road for turning radius requirements.
- e. Provide filter fabric under coarse aggregate to eliminate the migration of stone into the underlying soil from heavy construction traffic.
- f. Filter fabric shall be in accordance with specified silt fence requirements.
- g. Provide culvert under entrance at ditch line. Size culvert to handle anticipated flows.
3. Construction vehicle tire washing shall be implemented if mud and debris from construction site is not removed from driving on coarse aggregate entrance prior to entering onto public roads and streets.
4. Wash water shall be carried away from the entrance to a sediment trapping facility.

C. Silt Fence;

1. Provide silt fence at locations indicated on Erosion Control Plan.
2. Synthetic filter fabric shall be a pervious sheet of propylene, nylon, polyester, or polyethylene yarn. It shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0 degrees F. to 120 degrees F..
3. Stakes for a silt fence shall be 1 x 2 inches wood (preferred), or equivalent metal with a minimum length of 3 feet.
4. Wire fence reinforcement for silt fences using standard-strength filter cloth shall be a minimum of 36 inches in height, shall be a minimum of 14 gauge, and shall have a maximum mesh spacing of 6 inches.
5. Height of a silt fence shall not exceed 36 inches. Higher fences may impound volumes of water sufficient to cause failure of the structure.
6. Filter fabric shall be purchased in a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are necessary, filter cloth shall be spliced as described below.
7. Posts shall be spaced a maximum of 10 feet apart at the barrier location and driven securely into the ground a minimum of 12 inches.
8. When extra-strength fabric is used without the wire support fence, post spacing shall not exceed 6 feet.
9. A trench shall be excavated approximately 4 inches wide and 4 inches deep along the line of posts and upslope from the barrier.
10. When standard-strength filter fabric is used, a wire mesh support fence shall be fastened securely to the upslope side of the posts using heavy-duty wire staples at least 1 inch long, tie wires, or hog rings.
11. Wire shall extend into the trench a minimum of 2 inches and shall not extend more than 36 inches above the original ground surface.
12. Standard-strength filter fabric shall be stapled or wired to the fence, and 8 inches of the fabric shall be extended into the trench. Fabric shall not extend more than 36 inches above the original ground surface.
13. When extra-strength filter fabric and closer post spacing are used, the wire mesh support fence may be eliminated. In this case, the filter fabric is stapled or wired directly to the posts with all other provisions described above applying.
14. When attaching two silt fences together, place the end post of the second fence inside the end post of the first fence. Rotate both posts at least 180 degrees in a clockwise direction to create a tight seal with the filter fabric. Drive both posts into the ground and bury the flap.
15. Trench shall be backfilled and the soil compacted over the filter fabric.
16. The most effective application consists of a double row of silt fences spaced a minimum of 3 feet apart, so that if the first row collapses it will not fall on the second row. Wire or synthetic mesh may be used to reinforce the first row.

17. When used to control sediments from a steep slope, silt fences should be placed away from the toe of the slope for increased holding capacity.
18. Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized.

D. Filter Sock;

1. A synthetic filter sock shall be a photodegradable or biodegradable mesh netting material providing a minimum of 9 months of expected usable life at a temperature range of 0 degrees F. to 120 degrees F.
2. The media within the filter sock shall contain composted material suitable for removing solids and soluble pollutants from stormwater runoff.
3. Posts for the filter sock shall be 2 x 2 inches wood (preferred), or equivalent metal with a maximum height of 3 feet.
4. Posts shall be spaced a maximum of 10 feet apart at the barrier location and driven securely into the ground a minimum of 8 inches in clay soils or 12 inches for sand soils. For use on pavement, heavy concrete blocks shall be used behind the filter socks for stabilization.
5. When joining two filter socks together, overlap the two sections by about a foot. Drive a stake into the ground through each filter sock.
6. Filter socks shall be removed or cut open when they have served their useful purpose, but not before the upslope area is permanently stabilized.
7. Filter socks shall not be used in perennial, ephemeral, or intermittent streams.

E. Temporary Diversion Berm;

1. Maximum allowable drainage area is 5 acres.
2. Minimum allowable height measured from the upslope side of the berm is 18 inches. The top width shall be a minimum of 2 feet with a minimum base width of 4.5 feet.
3. Side slopes shall be 3:1 or flatter.
4. Channel behind the berm shall have a positive grade to a stabilized outlet. If the channel slope is less than or equal to 2 percent, no stabilization is required. If the slope is greater than 2 percent, the channel shall be stabilized in accordance with Stormwater Conveyance Channel Standard.
5. Diverted runoff, if free of sediment, must be released through a stabilized outlet or channel.
6. Sediment-laden runoff must be diverted and released through a sediment trapping facility.
7. Whenever feasible, the berm should be built before construction begins on the project.
8. Berm shall be adequately compacted to prevent failure.
9. Temporary or permanent seeding and mulch shall be applied to the berm within 15 days of construction.
10. Berm should be located to minimize damage by construction operations and traffic.

F. Temporary Fill Diversion;

1. Maximum allowable drainage area is 5 acres.
2. Minimum height of the supporting ridge shall be 9 inches.
3. Channel shall have a positive grade to a stabilized outlet.
4. Diverted runoff should be released through a stabilized outlet, slope drain, or sediment-trapping measure.
5. Diversion shall be constructed at the top of the fill at the end of each workday as needed.
6. Diversion shall be located at least 2 feet inside the top edge of the fill.
7. Supporting ridge of the lower side shall be constructed with a uniform height along its entire length.

G. Temporary Slope Drain;

1. Maximum allowable drainage area per drain is 5 acres.
2. Slope drain shall consist of heavy-duty flexible material designed for this purpose.
3. Diameter of the slope drain shall be equal over its entire length. Reinforced hold-down grommets shall be spaced at 10 foot maximum intervals.
4. For small flows and/or short slopes, an open top chute (Overside drain) may be used in place of a pipe.
5. Size of Slope Drain shall be as follows:

<u>Maximum Drainage Area (Acres)</u>	<u>Pipe Diameter (Inches)</u>
0.5	12
1.5	18
2.5	21
3.5	24
5.0	30

6. The entrance to the slope drain shall consist of a standard FDOT "Flared End-Section for Metal Pipe Culverts." Extension collars shall consist of a 12-inch long corrugated metal pipe. Watertight fittings shall be provided.
7. An earthen berm shall be used to direct stormwater runoff into the temporary slope drain and shall be constructed according to the Diversion Standard.
8. Height of the berm at the center line of the inlet shall be equal to the diameter of the pipe (D) plus 6 inches. Where the berm height is greater than 18 inches at the inlet, it shall be sloped at the rate of 3:1 or flatter to connect with the remainder of the berm.
9. Outlet of the slope drain shall be protected from erosion according to the Outlet Protection Standard.
10. Slope drain shall be placed on undisturbed soil or well-compacted fill.
11. Entrance section shall slope toward the slope drain at the minimum rate of 1/2-inch per foot.
12. Soil around and under the entrance section shall be hand-tamped in 8 inch lifts to the top of the berm to prevent piping failure around the inlet.
13. Slope drain shall be securely staked to the slope at the grommets provided.
14. Slope drain sections shall be securely fastened together and have watertight fittings.

H. Storm Drain Inlet Protection:

1. Drainage area shall be no greater than 1 acre.
2. Inlet protection device shall be constructed to facilitate the cleanout and disposal of trapped sediment and to minimize interference with construction activities.
3. Inlet protection devices shall be constructed so that any resultant ponding or stormwater will not cause excessive inconvenience or damage to adjacent areas or structures.

I. Fabric Drop Inlet Sediment Filter:

1. Fabric shall be cut from a continuous roll to avoid joints.
2. Stakes shall be 2 x 4 inches wood (preferred) or equivalent metal with a minimum length of 3 feet.
3. Staples shall be of heavy duty wire at least 1/2- inch long.
4. Stakes shall be spaced around the perimeter of the inlet a maximum of 3 feet apart and securely driven into the ground a minimum of 8 inches. A frame of 2 x 4 inches of wood shall be constructed around the top of the stakes for proper stability.
5. A trench shall be excavated approximately 4 inches wide and 4 inches deep around the outside perimeter of the stakes.

6. Fabric shall be stapled to the wooden stakes, and 8 inches of the fabric shall be extended into the trench. The height of the filter barrier shall be a minimum of 15 inches and shall not exceed 18 inches.
 7. Trench shall be backfilled and the soil compacted over the fabric.
- J. Gravel and Wire Mesh Drop Inlet Sediment Filter:
1. Wire mesh shall be laid over the drop inlet so that the wire extends a minimum of 1 foot beyond each side of the inlet structure.
 2. Hardware cloth or comparable wire mesh with 1/2- inch openings shall be used. If more than 1 strip of mesh is necessary, the strips shall be overlapped at least 1 foot.
 3. FDOT No. 1 Coarse Aggregate (1.5 to 3.5 inch) stone shall be placed over the wire mesh.
 4. Depth of the stone shall be at least 12 inches over the entire inlet opening.
 5. Stone shall extend beyond the inlet opening at least 18 inches on all sides.
 6. If the stone filter becomes clogged with sediment so that it no longer adequately performs its function, the stones must be pulled away from the inlet, cleaned, and replaced.
- K. Block and Gravel Drop Inlet Sediment Filter:
1. Place concrete blocks lengthwise on their sides in a single row around the perimeter of the inlet, with the ends of adjacent blocks abutting.
 2. Height of the barrier can be varied, depending on design needs, by stacking combinations of 4, 8, and 12 inch wide blocks.
 3. The barrier of blocks shall be at least 12 inches high and no greater than 24 inches high.
 4. Wire mesh shall be placed over the outside vertical face (webbing) of the concrete blocks to prevent stone from being washed through the holes in the blocks. Hardware cloth or comparable wire mesh with 1/2- inch openings shall be used.
 5. Provide FDOT No. 1 Coarse Aggregate (1.5 to 3.5 inch) stone shall be piled against the wire to the top of the block barrier.
 6. If the stone filter becomes clogged with sediment so that it no longer adequately performs its function, the stone must be pulled away from the blocks, cleaned, and replaced.
 7. As a very temporary alternative, pervious burlap bags filled with gravel may be placed around the inlet, provided that there are no gaps between the bags.
 8. Either of these two practices may be installed on pavement or bare ground.
- L. Sod Drop Inlet Sediment Filter:
1. Soil shall be prepared and sod installed according to the specifications in Sub-Article 7.6 – Sodding.
 2. Sod shall be placed to form a turf mat covering the soil for a distance of 4 feet from each side of the inlet structure.
- M. Prefabricated Drop Inlet Internal Filter Bag:
1. Remove the grate over the catch basin and insert the filter device, then replace the grate to hold the device in position.
 2. When sediments have accumulated to within 1 foot of the grate, the filter insert must be removed by a front-end loader or forklift.
 3. The filter may be discarded and replaced, or it may be emptied, cleaned, and reused.
- N. Filter Sock Drop Inlet Filter:
1. The filter sock should be placed around the entire circumference of the drop inlet and should allow for at least 1 foot of overlap on either side of the opening being protected. Stakes should be used to keep the sock in place.
 2. Under low-flow conditions, a 9-inch or 12-inch sock diameter should suffice.

3. Sediment will collect around the outside of the filter sock and should be removed when the sediment reaches one-half of the sock height.
- O. Prefabricated Drop Inlet External Filter:
1. Place the device over the inlet. If the inlet has a grate, the device shall be secured to the grate by means of a long toggle bolt. If the grate is not present, the device shall be bolted directly to the concrete.
 2. Sediments shall be removed when they have accumulated to within 1 foot of the top of the device. The filter fabric elements shall be cleaned or replaced at that time.
- P. Gravel Curb Inlet Sediment Filter:
1. Hardware cloth or comparable wire mesh with 1/2- inch openings shall be placed over the curb inlet opening so that at least 12 inches of wire extends across the top of the inlet cover and at least 12 inches of wire extends across the concrete gutter from the inlet opening.
 2. Stone shall be piled against the wire so as to anchor it against the gutter and inlet cover and to cover the inlet opening completely. FDOT No. 1 Coarse Aggregate shall be used.
 3. An overflow weir can be constructed of 2 x 4 inch boards to lessen ponding from this practice.
 4. If the stone filter becomes clogged with sediment so that it no longer adequately performs its function, the stone must be pulled away from the block, cleaned, and replaced.
- Q. Block and Gravel Curb Inlet Sediment Filter:
1. Two concrete blocks shall be placed on their sides abutting the curb at either side of the inlet opening.
 2. A 2 x 4 inch board shall be cut and placed through the outer holes of each spacer block to help keep the front blocks in place.
 3. Concrete blocks shall be placed on their sides across the front of the inlet and abutting the spacer blocks.
 4. Wire mesh shall be placed over the outside vertical face (webbing) of the concrete blocks to prevent stone from being washed through the holes in the blocks. Hardware cloth with 1/2- inch openings shall be used.
 5. FDOT No. 1 Coarse Aggregate shall be piled against the wire to the top of the barrier.
 6. If the stone filter becomes clogged with sediment so that it no longer adequately performs its function, the stone must be pulled away from the block, cleaned, and replaced.
 7. As an alternative, gravel-filled burlap bags may be stacked tightly around the curb inlet.
- R. Curb and Gutter Sediment Barrier:
1. Place gravel-filled burlap bags on gently sloping street segments according to the spacing chart.
 2. Place two or more bags at each interval in a manner that provides maximum support.
 3. When stacking several bags high, leave a one-bag gap to provide an overflow spillway.
 4. Sediments must be removed after each rain event.
- S. Temporary Sediment Trap:
1. The sediment trap must have an initial storage volume of 134 cubic yards, or 3,600 cubic feet per acre of drainage area, measured from the low point of the ground to the crest of the gravel outlet. Sediment should be removed from the basin when the volume is reduced by one-half.
 2. For a natural basin, the volume may be approximated as follows:
 - a. $V = 0.4 \times A \times D$
 - b. where:

- 1) V = the storage volume in cubic feet (ft³).
- 2) A = the surface area of the flood area at the crest of the outlet, in square feet (ft²).
- 3) D = the maximum depth, measured from low point in trap to crest of outlet, in ft.
3. If excavation is necessary to attain the required storage volume, the side slopes should be no steeper than 2:1.
4. The maximum height of the sediment trap embankment shall be 5 feet as measured from the low point. See the following table showing minimum top widths (W) and outlet heights (H_o) for various embankment heights (H). The side slopes of the embankment shall be 2:1 or flatter.
5. Minimum Top Width (W) and Outlet Height (H_o) Required for Sediment Trap Embankment According to Height of Embankment (feet) as follows:

H	H_o	W
2.0	1.0	2.0
2.5	1.5	2.5
3.0	2.0	2.5
3.5	2.5	3.0
4.0	3.0	3.0
4.5	3.5	4.0
5.0	4.0	4.5

6. Outlets shall be designed, constructed, and maintained so that sediment does not leave the trap and erosion of the outlet does not occur.
7. A trap may have several different outlets, with each outlet conveying part of the flow based on the criteria below.
8. The combined outlet capacity shall be sufficient for the drainage area. For example, a 12 foot earth outlet, adequate for 2 acres, and a 12 inch pipe outlet, adequate for 1 acre, could be used for a 3 acre drainage area.
9. There are four types of outlets for sediment traps. Each sediment trap is named according to the type of outlet that it has. Each type has different design criteria and will be discussed separately. The types are as follows:
 - a. An Earth Outlet Sediment Trap consists of a basin formed by excavation and/or an embankment.
 - 1) The trap has a discharge point over or cut into natural ground.
 - 2) The outlet width (feet) shall be equal to 6 times the drainage area (acres).
 - 3) If an embankment is used, the outlet crest shall be at least 1 foot below the top of the embankment.
 - 4) The outlet shall be free of any restriction to flow.
 - 5) The earthen embankment shall be seeded with temporary or permanent vegetation within 15 days of construction.
 - b. A Pipe Outlet Sediment Trap consists of a basin formed by an embankment, or an excavation and an embankment.
 - 1) The outlet for the trap is through a perforated riser and a pipe through the embankment.
 - 2) The outlet pipe and riser shall be made of corrugated metal. The riser diameter shall be of the same or larger diameter than the pipe.
 - 3) The top of the embankment shall be at least 1-1/2 feet above the crest of the riser. At least the top two-thirds of the riser shall be perforated with 1/2 inch diameter holes spaced 8 inches vertically and 10 to 12 inches horizontally.
 - 4) All pipe connections shall be watertight.

Minimum Pipe Diameter for Pipe Outlet Sediment Trap
According to Maximum Size of Drainage Area

Minimum Pipe Diameter in Inches	Maximum Drainage Area in Acres
12	1
18	2
21	3
24	4
30	5

- c. A Stone Outlet Sediment Trap consists of a basin formed by an embankment or excavation and an embankment.
 - 1) The outlet for the sediment trap shall consist of a crushed stone section of the embankment located at the low point in the basin.
 - 2) The minimum length of the outlet shall be 6 feet times the acreage of the drainage area. The crest of the outlet must be at least 1 foot below the top of the embankment, to ensure that the flow will travel over the stone and not the embankment. The outlet shall be constructed of FDOT No. 1 size crushed stone.
 - d. A Storm Inlet Sediment Trap consists of a basin formed by excavation or natural ground that discharges through an opening in a storm drain inlet structure.
 - 1) This opening can either be the inlet opening or a temporary opening made by omitting bricks or blocks in the inlet.
 - 2) The trap shall be between 1 and 2 feet deep, measured from the low point of the inlet.
 - 3) A yard drain inlet or an inlet in the median strip of a dual highway would use the inlet opening for an outlet.
 - 4) A curb inlet would require a temporary opening.
 - 5) The trap should be out of the roadway to avoid interference with construction.
 - 6) Placing the trap on the opposite side of the opening and diverting water from the roadway to the trap is one means of accomplishing this.
 - e. Other Trap Applications:
 - 1) At times a small trap may be constructed in a drainage channel using the culvert for a road crossing. Straw bales or gravel-filled bags may be used, provided that there are no gaps in the installation. In larger traps, baffles may be required to ensure adequate flow length and prevent short-circuiting.
10. Trap Installation Requirements:
- a. The area under the embankment shall be cleared, grubbed, and stripped of any vegetation and root mat. To facilitate cleanout, the pool area should be cleared.
 - b. Fill material for the embankment shall be free of roots or other woody vegetation, organic material, large stones, and other objectionable material.
 - c. The embankment should be compacted in 8 inch layers by traversing it with construction equipment.
 - d. The earthen embankment shall be seeded with temporary or permanent vegetation within 15 days of construction.
 - e. Construction operations shall be carried out so that erosion and water pollution are minimized.
 - f. The structure shall be removed and the area stabilized when the upslope drainage area has been stabilized.

- T. Temporary Sediment Basins:
 - 1. Site Preparation:

- a. Areas under the embankment and any structural works shall be cleared, grubbed, and stripped of topsoil to remove trees, vegetation, roots, or other objectionable material.
- b. To facilitate cleanout and restoration, the pool area, measured at the top of the principal spillway, will be cleared of all brush and trees.
2. Maximum drainage area, unless the structure is designed as a permanent pond by a qualified professional engineer, shall have a maximum allowable drainage area into the basin of 150 acres.
3. Basin design capacity shall be at least 134 cubic yards or 3,600 cubic feet per acre of drainage area measured from the bottom of the basin to the crest of the principal spillway (riser pipe).
4. Sediment should be removed from the basin when the volume of the basin has been reduced to 55 cubic yards per acre of drainage area.
5. The elevation of the sediment cleanout level should be calculated and clearly marked on the riser.
6. In no case shall the sediment cleanout level be higher than 1 foot below the top of the riser.
7. To improve the sediment-trapping efficiency of the basin, the effective flow length must be twice the effective flow width.
8. This basin shape may be attained by properly selecting the site of the basin, by excavation, or by the use of baffles.
9. The embankment must have a minimum top width of 8 feet.
10. The side slopes must be 2:1 or flatter.
11. The embankment may have a maximum height of 10 feet if the side slopes are 2:1. If the side slopes are 2.5:1 or flatter, the embankment may have a maximum height of 15 feet.
12. Spillway Design:
 - a. The outlets for the basin may consist of a combination of principal and emergency spillways or a principal spillway alone.
 - b. In either case, the outlet(s) must pass the peak runoff expected from the drainage area for a ten-year storm without damage to the embankment of the basin.
 - c. Runoff computations shall be based on the soil cover conditions that are expected to prevail during the life of the basin.
 - d. The spillways designed by the procedures contained in this BMP will NOT necessarily result in any reduction in the peak rate of runoff.
 - e. If a reduction in peak runoff is needed, the appropriate hydrographs should be generated to choose the basin and outlet sizes.
 - f. To increase the efficiency of the basin, the spillway(s) must be designed to maintain a permanent pool of water between storm events.
13. Principal Spillway Design:
 - a. The principal spillway shall consist of a solid (non-perforated), vertical pipe or box of corrugated metal or reinforced concrete joined by a watertight connection to a horizontal pipe (barrel) extending through the embankment, with an outlet beyond the downstream toe of the fill.
 - b. If the principal spillway is used in conjunction with an emergency spillway, the principal spillway shall have a minimum capacity of 0.2 cfs per acre of drainage area when the water surface is at the crest of the emergency spillway.
 - c. If no emergency spillway is used, the principal spillway must be designed to pass the entire peak flow expected from a 10-year storm.
14. Design Elevations:
 - a. If the principal spillway is used together with an emergency spillway, the crest of the principal spillway shall be a minimum of 1 foot below the crest of the emergency spillway.

- b. If no emergency spillway is used, the crest of the principal spillway shall be a minimum of 3 feet below the top of the embankment.
 - c. In either case, a minimum freeboard of 1 foot shall be provided between the design high water and the top of the embankment.
15. Antivortex Device and Trash Rack:
- a. An antivortex device and trash rack shall be attached to the top of the principal spillway to improve the flow of water into the spillway and prevent floating debris from being carried out of the basin.
 - b. The antivortex device shall be of the concentric type.
16. Dewatering:
- a. Dewatering shall be done in a way that removes the relatively clean water without removing any of the sediment that has settled out and without removing any appreciable quantities of floating debris.
 - b. As a minimum, provisions shall be made to dewater the basin down to the sediment cleanout elevation. This can be accomplished by providing a hole at the maximum sediment retention elevation. The dewatering hole shall be no larger than 4 inches in diameter.
 - c. It is also advantageous, but not required, to provide for dewatering of trapped sediment before cleanout. Basin underdrains are generally installed for this purpose.
17. Principal Spillway Base:
- a. The base of the principal spillway must be firmly anchored to prevent it from floating. If the riser of the spillway is greater than 10 feet in height, computations must be made to determine the anchoring requirements. As a minimum, a factor of safety of 1.25 shall be used (downward forces = 1.25 x upward forces).
 - b. For risers 10 feet or less in height, the anchoring may be done in one of the two following ways:
 - 1) A concrete base 18 inches thick and twice the width of riser diameter shall be used and the riser embedded 6 inches into the concrete.
 - 2) A square steel plate, a minimum of 1/4 inch thick and having a width equal to twice the diameter of the riser, shall be welded to the base of the riser. The plate shall then be covered with 2-1/1 feet of stone, gravel, or compacted soil to prevent flotation.
18. Principal Spillway Barrel:
- a. The barrel of the principal spillway, which extends through the embankment, shall be designed to carry the flow provided by the riser of the principal spillway with the water level at the crest of the emergency spillway.
 - b. The connection between the riser and the barrel must be watertight.
 - c. The outlet of the barrel must be protected to prevent erosion or scour of downstream areas.
19. Anti-Seep Collars:
- a. Anti-seep collars shall be used on the barrel of the principal spillway within the normal saturation zone of the embankment to increase the seepage length by at least 10%, if either of the following two conditions is met:
 - 1) The settled height of the embankment exceeds 10 feet.
 - 2) The embankment has a low silt-clay content (Unified Soil Classes SM or GM) and the barrel is greater than 10 inches in diameter.
 - b. Anti-seep collars shall be installed within the saturated zone.
 - c. Maximum spacing between collars shall be 14 times the projection of the collar above the barrel.
 - d. Collars shall not be closer than 2 feet to a pipe joint.

- e. Collars should be placed sufficiently far apart to allow space for hauling and compacting equipment.
 - f. Connections between the collars and the barrel shall be watertight.
20. Emergency Spillway Design:
- a. Emergency spillway shall consist of an open channel constructed next to the embankment over undisturbed material or properly compacted fill.
 - b. Emergency spillway shall have a control section at least 20 feet in length. The control section is a level portion of the spillway channel at the highest elevation in the channel.
 - c. The primary spillway and the emergency spillway shall both discharge to stabilized outlets.
21. Emergency Spillway Capacity:
- a. The emergency spillway shall be designed to carry the peak rate of runoff expected from a 10-year storm, less any reduction due to the flow through the principal spillway.
22. Emergency Spillway Design Elevations:
- a. The design high water through the emergency spillway shall be at least 1 foot below the top of the embankment.
 - b. The crest of the emergency spillway channel shall be at least 1 foot above the crest of the principal spillway.
23. Emergency Spillway Location:
- a. Emergency spillway channel shall be located to avoid fill material.
 - b. If emergency spillway channel is constructed on fill, the fill will be properly compacted in lifts.
 - c. Emergency spillway channel shall be located so as to avoid sharp turns or bends.
 - d. Emergency spillway channel shall return the flow of water to a defined channel downstream from the embankment.
24. Emergency Spillway Maximum Velocities:
- a. Maximum allowable velocity in the emergency spillway channel depends on the type of lining used.
 - b. For non-erodible linings, such as concrete or asphalt paving and riprap, design velocities may be increased.
 - c. However, the emergency spillway channel shall return the flow to the natural channel at a non-eroding velocity.
25. Stabilization of the Embankment and Basin:
- a. Embankment of the sediment basin shall be temporarily seeded within 15 days after its completion.
 - b. If excavation is required in the basin, side slopes should not be steeper than 2:1.
26. Sediment Cleanout:
- a. Sediment shall be removed from the basin when the capacity is reduced to 55 cubic yards per acre of drainage area.
 - b. This elevation should be clearly marked, preferably on the riser.
 - c. Plans for the sediment basin shall state the methods for disposing of sediment removed from the basin.
 - d. Possible alternatives are the use of the material in fill areas onsite or removal to an approved offsite dump.
27. Sediment Basin Removal:
- a. Sediment basin plans shall show the final disposition of the sediment basin after the upstream drainage area is stabilized.
 - b. The plans shall specify methods for the removal of excess water lying over the sediment, the stabilization of the basin site, and the disposal of any excess material.
 - c. Sediment shall not be flushed into the stream or drainageway.
28. Public Safety:

- a. Sediment basins can be very dangerous to the general public, therefore, they should be fenced or otherwise made inaccessible to people or animals unless this is deemed unnecessary due to the remoteness of the site or other circumstances.
 - b. Strategically placed signs around the impoundment reading "DANGER—QUICKSAND" should also be installed. In any case, local ordinances and regulations regarding health and safety must be adhered to.
29. Cutoff Trench:
- a. For earth fill embankments, a cutoff trench shall be excavated along the centerline of the dam. Minimum depth shall be 2 feet.
 - b. Cutoff trench shall extend up both abutments to the riser crest elevation. The minimum bottom width shall be 4 feet, but wide enough to allow the operation of compaction equipment.
 - c. Side slopes shall be no steeper than 1:1. Compaction requirements shall be the same as those for the embankment.
 - d. Trench shall be drained during the backfilling and compacting operations.
 - e. Embankment fill material shall be taken from approved borrow areas.
 - f. Fill material shall be clean mineral soil, free of roots, woody vegetation, oversized stones, rocks, or other objectionable material.
 - g. Areas on which fill is to be placed shall be scarified prior to the placement of fill.
 - h. Fill material should contain sufficient moisture so that it can be formed by hand into a ball without crumbling.
 - i. If water can be squeezed out of the ball, it is too wet for proper compaction.
 - j. Fill material will be placed in 6 to 8 inch continuous layers over the entire length of the fill.
 - k. Compaction shall be obtained by routing the hauling equipment over the fill so that the entire surface of the fill is traversed by at least 1 wheel or tread track of the equipment, or by using a compactor.
 - l. Embankment shall be constructed to an elevation 10 percent higher than the design height to allow for settlement if compaction is obtained with hauling equipment.
 - m. If compactors are used for compaction, the overbuild may be reduced to not less than 5 percent.
30. Principal Spillway Installation:
- a. Riser of the principal spillway shall be securely attached to the barrel by a watertight connection.
 - b. Barrel and riser shall be placed on a firm, compacted soil foundation.
 - c. Base of the riser shall be firmly anchored according to design criteria to prevent its floating.
 - d. Pervious material such as sand, gravel, or crushed stone shall not be used as backfill around the barrel or anti-seep collars.
 - e. Fill material shall be placed around the pipe in 4 inch layers and compacted by hand at least to the same density as the embankment.
 - f. A minimum of 2 feet of fill shall be hand-compacted over the barrel before crossing it with construction equipment.
31. Emergency Spillway Installation:
- a. Emergency spillway should not be constructed over fill material.
 - b. Design elevations, widths, and entrance and exit channel slopes are critical to the successful operation of the spillway and should be adhered to closely during construction.
32. Vegetative Stabilization:
- a. Embankment and emergency spillway of the sediment basin shall be stabilized with temporary vegetation within 15 days of completion of the basin.

33. Erosion and Sediment Control:
 - a. Construction of the sediment basin shall be carried out in a manner such that erosion and water pollution are minimized downstream.
34. Final Disposal:
 - a. When temporary structures have served their intended purpose and the contributing drainage area has been properly stabilized, the embankment and resulting sediment deposits are to be leveled or otherwise disposed of according to the approved pollution control plan.

U. Temporary Check Dam;

1. Drainage area of the ditch or swale being protected should not exceed 10 acres.
2. Maximum height of the check dam should be 2 feet.
3. Center of the check dam must be at least 6 inches lower than the outer edges.
4. Maximum spacing between the dams should be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam.
5. Stone check dams should be constructed of FDOT No. 1 Coarse Aggregate 1.5 to 3.5 inch stone.
6. Hand or mechanical placement will be necessary to achieve complete coverage of the ditch or swale and to ensure that the center of the dam is lower than the ends.
7. Check dams should be checked for sediment accumulation after each significant rainfall.
8. Sediment shall be removed when it reaches one-half of the original height or before.
9. Regular inspections should be made to ensure that the center of the dam is lower than the edges.
10. Erosion caused by high flows around the edges of the dam should be corrected immediately.
11. Check dams shall be removed when their useful life has been completed.
12. In temporary ditches and swales, check dams should be removed and the ditch filled in when it is no longer needed.
13. In permanent structures, check dams should be removed when a permanent lining can be installed.
14. In grass-lined ditches, check dams should be removed when the grass has matured sufficiently to protect the ditch or swale.
15. The area beneath the check dams should be seeded and mulched or sodded, depending on runoff velocity, immediately after the dams are removed.
16. If stone check dams are used in grass-lined channels that will be mowed, care should be taken to remove all the stone from the dam when the dam is removed.
17. This should include any stone that has washed downstream.

V. Exfiltration Trench;

1. Trenches in Rock:
 - a. Exfiltration facilities cut into permeable rock are often used in the Miami vicinity.
 - b. These trenches are the least expensive infiltration system to construct; however, the following conditions must be met:
 - 1) Rock must be able to support a specified wheel load on a covering concrete slab or other suitable cover.
 - 2) Rock must be amenable to excavation without blasting.
 - c. The inlet to the system can be placed directly over the slab cover, with discharge directly into the trench.
 - d. A more acceptable method is to set the inlet and catch basin adjacent to the trench and pipe the inflow to the trench. This technique lessens the introduction of debris into the system.
 - e. Manhole access must be provided to facilitate cleaning and inspection.

2. Trenches in Stable Soil:
 - a. In this type of trench, perforated or slotted pipe is normally used as the conduit.
 - b. Coarse aggregate between the pipe and trench wall prevents sidewall collapse and distributes collected water to the trench walls.
 - c. Whether the pipe is included or not, the trench is usually 4 to 5 feet wide and deep enough to reach a permeable soil layer.
 - d. Coarse aggregate or other free-draining material is generally placed in the bottom of the trench and brought up to a specified pipe flowline grade, generally a minimum of 2 feet.
 - e. Perforated or slotted pipe is then placed in the trench, which is backfilled with coarse aggregate to the design storage elevation.
 - f. A typical Dade County installation includes a 6 inch thickness of finer-textured filter material or pea rock placed over the aggregate backfill.
 - g. Trench is normally covered with a geotextile to prevent the sand or fill used for cover from piping and possible surface subsidence.
 - h. These trench cross-sections are typical of most installations in extreme southern Florida.
 - i. The configuration is applicable in other areas where the soil or substrate is stable and provides sufficient infiltration capacity.
 - j. Even where infiltration rates are marginal, the system could supplement the drainage requirements of a positive outfall system by storing and infiltrating a portion of the stormwater into the soil, thus reducing the downstream requirements of the positive system.
3. Trenches in Cohesionless Soil or Sand:
 - a. Although trenches in cohesionless soil require a different type of construction, the design, final shape, and size are the same as for a trench in stable soil.
 - b. Side slopes of 1.5:1 or 2:1 may be required, if the walls are not shored during construction.
 - c. Filter cloth must be used along the periphery of the trench to prevent the migration of soil fines into the coarse aggregate backfill.
 - d. In a trench system where perforated pipe is used, a non-perforated section some 6 to 8 feet in length is used to connect the trench to the catch basin or inlet.
 - e. A concrete slab is generally placed around the catch basin or inlet.
 - f. In the design of a trench system, any one of the above types, or a combination, may be used.
 - g. A positive overflow pipe or bypass is also required to allow for large storm events.
4. General Construction Recommendations (Exfiltration Trenches):
 - a. Before the entire development site is graded, the area planned for the trench should be roped off to prevent heavy equipment from compacting the underlying soils.
 - b. Diversion berms should be placed around the perimeter of the trench during all phases of construction.
 - c. Sediment and erosion control plans for the site should be oriented to keep sediment and runoff completely away from the trench area.
 - d. Otherwise, the actual construction of the trench should not begin until after the site is completely stabilized.
 - e. Trench should be excavated using a backhoe or trencher equipped with tracks or oversized tires. Normal rubber tires should be avoided, since they compact the subsoil and may reduce infiltration capability.
 - f. For the same reason, the use of bulldozers or front-end loaders should be avoided.
 - g. Sediment control is critical, and thus it is important that sediment and erosion controls be inspected following each storm to make sure they still work.

- h. If a vegetated buffer strip is planned for the pretreatment of runoff entering the facility, grass should be established immediately, preferably by sodding.
 - i. When hydroseeding is used, reinforced silt fences must be placed between the buffer and trench to prevent sediment entry before the buffer becomes fully established.
5. Perforated or Slotted Pipe:
- a. When perforated pipe is used for conveyance and distribution, a liberal number of holes should be provided to ensure free and rapid flow in and out of the walls of the pipe.
 - b. Large-diameter pipe adds to total storage volume in the trench. The use of a pipe in the trench system also allows for ease of maintenance.
 - c. The pipe serves as a catchment for sediment without reducing overall efficiency.
 - d. Pipes manufactured of plastic, steel, aluminum, concrete, or other materials are available for this application.
 - e. Perforated metal pipes usually have 3/8 inch diameter perforations uniformly spaced around the full periphery of the pipe.
 - f. Specifications stipulate not less than 30 perforations per square foot of pipe surface. Other perforations not less than 5/16 inch in diameter or slots are permitted if they provide a total opening area of not less than 3.31 square inches per square foot of pipe surface.
 - g. FDOT and industry have developed tentative specifications for slotted concrete pipe with cast slots, based on field performance and cooperative testing.
 - h. Concrete pipe with 3/8 inch wide slots is usually specified. The slots should be circumferential in direction, approximately 3/8 inch wide and not less than 4 inches long at the inside of the pipe.
 - i. Four rows of slots are generally specified for pipe 30 inches in diameter or less. Six rows are specified for pipe 36 inches in diameter and larger.
6. Pipe Backfill:
- a. Coarse aggregate backfill material supports the sides and top of an infiltration trench following construction.
 - b. Aggregates for this purpose must be sound and must comply with FDOT-established specifications for durability.
 - c. Aggregate material must provide sufficient void space to allow for the storage of the required volume of runoff.
 - d. Provide an allowance for the accumulation of the normally encountered fine sands, silts, silty clays, and other material in stormwater that will pass through the perforations or slots in the pipe conduit into the backfill during the expected life of the facility.
 - e. Clean, washed stone aggregate should be placed in the excavated trench in lifts, lightly compacted to form the base.
 - f. Unwashed stone has enough associated sediment to pose a clear risk of clogging at the soil/filter cloth interface.
 - g. Granite, washed pea gravel, or river rock is usually acceptable. Where possible, the use of crushed limestone aggregate shall not be used.
 - h. Pea Rock or gravel is often placed in a 6 inch layer over the top of the aggregate for the pipe backfill.
 - i. This layer serves as a granular filter below the filter fabric.
 - j. Gradation for this layer should consist of 100 percent material passing.
7. Synthetic Filter Fabrics:
- a. When fine native materials are encountered in the excavation, a filter cloth envelope or wrap should be placed around the coarse aggregate backfill. This practice prevents the migration of fine sediments from the surrounding soil that could clog the trench following reverse flow conditions resulting from high ground water.

- b. A number of plastic woven or nonwoven filter fabrics can be used for this purpose. Care should be taken to prevent tearing or puncturing the fabric.
 - c. Adjacent fabric sheets should be overlapped 12 to 18 inches and secured to prevent openings from developing.
 - d. To ensure good performance, synthetic fabrics, either woven or nonwoven, must be carefully selected, based on the properties required.
 - e. As with aggregate filters, fabric filters must provide two very important functions, as follows:
 - 1) They must be able to prevent clogging of the drain by the migration of erodible soil or other material from the substrate into the trench, which could also result in erosion, piping, or other problems.
 - 2) They must not inhibit the free flow of water.
 - f. Care should be taken in selecting the proper kind of filter fabric, as available brands differ significantly in their permeability and strength.
8. Observation Well:
- a. The installation of an observation well is recommended in every infiltration trench. It serves the following two primary functions:
 - 1) It indicates how quickly the trench dewater following a storm.
 - 2) It provides a method of observing how quickly the trench fills up with sediments.
 - b. Provide an observation well consisting of perforated polyvinyl chloride (PVC) pipe 4 to 6 inches in diameter located in the center of the facility and is constructed flush with the ground elevation of the trench.
 - c. Top of the well should be capped and locked to discourage vandalism and tampering.
 - d. Monitor the performance of the trench through observation well measurements.
 - e. Measure drain time by placing a graduated dipstick down the well immediately after a storm and again 24 and 48 hours later.
 - f. For the first year after the completion of construction, the well should be monitored quarterly and after every large storm. It is recommended that a logbook be maintained, indicating the rate at which the facility dewater after large storms and the depth of the well at each observation.
 - g. Once the performance characteristics of the structure have been verified, the monitoring schedule can be reduced to a semiannual basis, unless the performance data indicate that a more frequent schedule is required.
 - h. A monitoring well in the top foot of stone aggregate is required when the trench has a stone surface. Sediment buildup in the top foot of stone aggregate or the surface inlet should be monitored on the same schedule as the observation well.
 - i. The sediment deposited shall not be allowed to build up to the point where it significantly reduces the rate of infiltration into the trench.
9. Overflow:
- a. Unless the facility is designed to accommodate the total amount of anticipated runoff from a large design storm, some provisions should be made for overflow.
 - b. To provide the maximum benefit in reducing downstream flood peaks, these structures shall be designed to overflow before the total storage capacity is reached.
 - c. There are many ways to accomplish this. Pipes can be used, for instance, to connect a sequence of infiltration facilities, so that when the first one fills, it passes water through to the next one, and so on.
 - d. Generally, several smaller facilities are more effective than one large facility, though the latter may be necessary when there are space limitations.
 - e. The capacity and cost of overflow discharge systems can be reduced by allowing temporary storage space above the infiltration trenches.

- f. Because of the small drainage areas controlled by the exfiltration trench, an emergency spillway usually is not necessary.
 - g. In all cases, however, the overland flow path of any surface runoff exceeding the capacity of the trench should be evaluated to preclude the development of an uncontrolled, erosive watercourse.
10. Seepage Analysis and Control:
- a. An analysis shall be made to determine any possible adverse effects of seepage zones when there are nearby building foundations, roads, parking lots, or sloping sites.
 - b. Developments on sloping sites often require the use of extensive cut-and-fill operations.
 - c. The use of infiltration trenches on fill sites with steep slopes is not recommended.
 - d. Fill areas can be very susceptible to slope failure due to slippage along the interface of the undisturbed soil and the fill material.
 - e. This condition could be further aggravated if the fill material is allowed to become saturated using retention practices.
 - f. The methods for seepage analysis and the estimation of infiltration rates using Darcy's law and flow nets can be used to conduct the seepage analysis.
 - g. When exfiltration trenches are used in residential areas, special care must be taken to prevent seepage from causing unstable soil conditions near foundations.
 - h. Trenches 3 or more feet deep shall be located at least 10 feet downgradient from foundation walls.
 - i. Trenches should also be no closer than 100 feet from wells or septic tanks.

W. Underdrain and Filtration Systems:

- 1. All drains shall be laid to line and grade, surrounded by at least 3 inches of washed gravel, and wrapped in filter fabric.
- 2. Trench bottom must be uniformly smooth and made up of either undisturbed soil or properly compacted fill, especially if the trench is cut into rock.
- 3. Joints between sections of rigid pipe shall not exceed 1/4 inch.
- 4. The ends of pipes shall be capped, or preferably connected to cleanouts.
- 5. Backfill shall be as outlined in accordance with Section 31 23 17 – Site Excavation, Backfill and Compaction.

X. Swales:

- 1. Site Preparation:
 - a. Swale location should be staked for construction.
 - b. All trees, stumps, brush, and similar material should be removed from the site and disposed of, so as to not interfere with the proper functioning of the system.
 - c. Design and construction survey notes should be kept according to standard engineering practice.
- 2. Excavation:
 - a. Soil removed from the swale should be deposited where it will not interfere with the flow of water into the swale. It can be used to fill low spots or build diversions to keep runoff from the swale during vegetation establishment as approved by Engineer/Architect or Owner's Representative.
 - b. Topsoil should be saved and spread in the constructed swale if necessary to ensure the establishment of a good vegetative cover.
 - c. When this is done, the swale should be over-excavated to allow for the replacement of the topsoil without encroaching on the design cross-section.
- 3. Establishing Vegetation:
 - a. The method used to establish grass in a swale depends on the severity of the conditions encountered.

- b. Table below lists the four different alternatives for grass establishment and the conditions under which each method should be used.
- c. For each technique, if any one of the four sets of conditions is exceeded, the next technique below it must be used.

Establishment Technique Conditions

<u>Establishment Technique</u>	<u>Conditions</u>
1.a. - Hydroseeding	<ul style="list-style-type: none"> 1. Slopes less than 5%. 2. Velocity less than 3 feet per second.
1.b. Establishing Bermuda grass away from channel by sprigging	<ul style="list-style-type: none"> 1. Majority of drainage can be diverted during germination and establishment. 2. Erosion-resistant soil.
2. Seeding with straw mulch and jute mesh or erosion netting	<ul style="list-style-type: none"> 1. Slopes less than 5%. 2. Velocity less than 5 feet per second. 3. Majority of drainage cannot be diverted from channel during germination and establishment. 4. Moderately erodible soil.
3. Sodding	<ul style="list-style-type: none"> 1. Slopes greater than 5%. 2. Velocity between 5 and 6 feet per second. 3. Majority of drainage cannot be diverted away from channel during germination and establishment. 4. Highly erodible soil.

- 4. The details for each alternative are as follows:
 - a. (1a.) Hydroseeding.
 - 1) All seeding shall be done in accordance with Section 32 92 00 – Turf and Grasses.
 - 2) When mulching, use 2 tons per acre small grain straw with an acceptable tacking agent.
 - b. (1b.) Establishing Bermuda Grass by Sprigging.
 - 1) Irrigation water must be available during the first four weeks.
 - 2) Divert drainage away from the channel during the first three weeks of the establishment period by using temporary berms, silt fencing, or straw bale barriers.
 - c. (2.) Seeding with Straw Mulch and Jute Mesh or Erosion Netting.
 - 1) In addition to Item 1.a above, secure straw mulch with netting. If using jute mesh, use only 1 ton per acre small grain straw, evenly distributed.
 - 2) If using a light plastic or paper erosion netting, 1-1/2 to 2 tons per acre of straw is appropriate.
 - 3) Care should be taken to staple the mesh or netting.
 - d. (3.) Sodding.
 - 1) When using strip sod, sod shall be grown through a plastic mesh that offers additional strength and erosion resistance.

- 2) Swale and its outlet shall be protected against erosion by vegetative cover as soon after construction as practical and before diversions or other channels are connected to them.
5. Details of Swale Block Construction:
- a. Swale blocks may be constructed using a variety of materials, including wood, concrete, asphalt, metal, natural soil, or a mixture of each.
 - b. The most common application is the use of native, in-place soil shaped into the form of a low berm.
 - c. Regardless of the material or materials chosen to form the restriction, the designer should take proper precautions to ensure that the facility is not subject to undercutting and erosion, especially along its toe.
 - d. Swale block height should be limited to 1.5 feet for public safety and roadway subgrade protection.
 - e. It is also recommended that the following guidelines be applied to ensure good structural integrity and easy maintenance (mowing):
 - 1) The front and back slope of the structure shall not be steeper than 10 feet horizontal to 1 foot vertical, unless pavement or another equally stable material is used to protect the berm from erosion during overflow conditions.
 - 2) Berms should be constructed of clean, stable material suitable for the construction of embankments.
 - 3) Embankment material should be free from tree roots, construction debris, and other extraneous material. Inorganic silts, organic silts, and organic clays, as well as peat or other highly organic soil, should not be considered.
 - 4) Sod should be used to protect these embankments from erosion. Protection should be provided extending at least 2 feet from the toe of the berm along both the face and back slope of the structure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation of all erosion control shall be in accordance with the Florida Stormwater Erosion and Sedimentation Control Inspector's Manual and State of Florida Department of Transportation Standard Specifications and manufacturer's written instructions.

3.2 MAINTENANCE

- A. Inspect erosion control devices within 24 hours after each rainfall or daily during periods of prolonged rainfall.
- B. Repair or replace damaged or defective materials or installation immediately.
- C. Remove sediment deposits within 24 hours after each storm event or when deposits reach one-half height of fence or barrier, whichever occurs first.
- D. Apply replacement bales or additional mulch, netting, or matting immediately to maintain suitable cover.
- E. Where vegetative cover has been placed, inspect until vegetative cover is established and functioning as intended.

3.3 REMOVAL OF EROSION CONTROL DEVICES

- A. Maintain erosion control measures disturbed earth has been paved or vegetated.
- B. Remove erosion control devices prior to final inspection and acceptance of Project site by Owner.
- C. Restore or replace areas disturbed or damaged by removal of erosion control devices to satisfaction of Engineer/Architect or Owner's Representative.

END OF SECTION 312513

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SECTION 32 17 14 - STEEL GUARDRAIL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel channel guard and steel posts.
 - 2. Excavating for post bases.

1.2 REFERENCES

- A. American Society for Testing and Materials:
 - 1. ANSI/ASTM A 123 - Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
 - 2. ASTM A 36 - Structural Steel.
 - 3. ASTM A 500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
 - 4. ASTM C 94 - Ready-mixed Concrete.
- B. SDHPT - 1982 Standard Specifications for Construction of Highways, Streets and Bridges.

1.3 SYSTEM DESCRIPTION

- A. Steel Channel: C9 x 15, unless otherwise indicated on drawings.
- B. Guardrail Height: Top of top-rail 1'-10," above finish grade, unless shown otherwise on drawings.
- C. Post: As indicated on drawings.
- D. Post Spacing: At intervals, as indicated on drawings, but not exceeding 8-feet, o.c.
- E. Post Foundation Depth: minimum 2-feet below finish grade.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, anchorage, and schedule of components.

1.5 FIELD MEASUREMENTS

- A. Verify that field measurements are as instructed by manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Guardrail Channel: ASTM A 36 hot rolled steel "C" channel.
- B. Steel Posts: ASTM A 500 hollow structural steel tubes.
- C. Concrete: ASTM C 94; Normal Portland Cement, 3,000 psi strength at 28 days.

2.2 FINISHES

- A. Channels and Posts: Galvanized to ANSI/ASTM A 123; 2.0 oz/sq.ft. coating.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install rails and posts in accordance with approved shop drawings.
- B. Weld channels to posts with fillet welds at top and bottom flanges of steel channel.

3.2 ERECTION TOLERANCES

- A. Posts - Maximum Variation from Plumb: 1/4".
- B. Rail - Maximum Offset from True Position: 1".
- C. Rail - Maximum Variation from True Height: 1/4".
- D. Components shall not infringe adjacent property lines.

END OF SECTION

SECTION 32 17 23 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Painted markings applied to asphalt and concrete pavement.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data for each type of product including tested physical and performance properties.
- B. Shop Drawings: Submit plans Indicating pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
 - 1. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.
- C. Samples: Submit For each exposed product and for each color and texture specified; on rigid backing, 8 inches (200 mm) square.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of DOT FHWA's Manual on Uniform Traffic Control Devices for Streets and Highways, as adopted by the Florida Department of Transportation, for pavement markings.
 - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.
- B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of DOT FHWA's Manual on Uniform Traffic Control Devices for Streets and Highways, as adopted by the Florida Department of Transportation, for pavement markings.
 - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.
- C. Preinstallation Conference: Conduct conference at project site.
 - 1. Review methods and procedures related to marking pavement including, but not limited to, the following:
 - a. Pavement aging period before application of pavement markings.
 - b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 degrees F (4.4 degrees C) for alkyd materials and 55 degrees F (12.8 degrees C) for water-based materials, and not exceeding 95 degrees F (35 degrees C).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Environmental Regulations: Comply with local laws, rules, and regulations of governmental authorities having jurisdiction.
- B. Accessibility Requirements: Comply with applicable requirements.
 - 1. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (2004 ADAAG) Standards for Accessible Design 2010.
 - 2. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
 - 3. Florida Accessibility Code for Building Construction.

2.2 MATERIALS

- A. Manufacturers: Subject to compliance with requirements, provide “Durable Paint products, approved by the Florida Department of Transportation, by one of the following:
 - 1. Ennis-Flint, Inc, (formerly Ennis Paint, Inc. dba Ennis-Flint)
 - 2. Pride Enterprises dba Baker Paint.
 - 3. Pride Enterprises dba Pride of Florida
 - 4. Sherwin-Williams Company, SW Highway
 - 5. Safety Coatings, Inc.
- B. Pavement Marking Paint: Water based alkyd resin type, lead and chromate free, ready mixed, industrial quality or better, complying with AASHTO M 248, Type F; colors complying with jurisdictional requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.
- B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.2 APPLICATION

- A. Do not apply pavement marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for a minimum of 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Striping: Provide straight edged uniform line width of 4 inches.
 - 1. Stall Divisions: Provide standard size parking stalls with white striping.
 - 2. Arrows and Pavement Signage: Apply directional markings and stencils in accordance with manufacturers written instructions.
 - 3. Fire Lane Markings: Comply with local Fire Marshal’s requirements. Use approve stencils for lettering and graphics.

- E. Apply graphic symbols and lettering with paint resistant, die cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.

3.3 PROTECTING AND CLEANING

- A. Protect pavement markings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 32 31 13 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Chain link fences.
 - 2. Privacy slats.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data including construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - 1. Fence and gate posts, rails, and fittings.
 - 2. Chain link fabric, reinforcements, and attachments.
 - 3. Accessories: Privacy slats.
 - 4. Hardware.
- B. Shop Drawings: Submit plans, elevations, sections, details, and attachments to other work.
 - 1. Include accessories, and hardware.
- C. Samples: When requested by Architect, submit for each type of component with factory applied finish:
 - 1. Polymer Coated Components: In 6 inch (150-mm) lengths for components and on full sized units for accessories.
- D. Delegated Design Submittal: Submit delegated design structural performance of chain link fence and gate frameworks, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Certificates: Submit certificates for each type of chain link fence.
- B. Product Test Reports: For framework strength according to ASTM F 1043, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Field quality control reports.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing fence grounding; member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
- B. Mockups: Build mockups to set quality standards for fabrication and installation.
 - 1. Build mockup for typical chain link fence, including accessories.
 - a. Size: 10 foot (3 m) length of fence.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

- C. Preinstallation Conference: Conduct conference at site.
 - 1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
 - 2. Review sequence of operation for each type of gate operator.
 - 3. Review coordination of interlocked equipment specified in this Section and elsewhere.
 - 4. Review required testing, inspecting, and certifying procedures.

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.6 WARRANTY

- A. Written warranty signed by manufacturer and Installer in which to repair or replace components of chain link fences and gates that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to comply with performance requirements.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - c. Faulty operation of gate operators and controls.
 - 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design chain link fence and gate frameworks.
- B. Structural Performance: Chain link fence and gate frameworks shall withstand the design wind loads and stresses for fence height(s) and under exposure conditions indicated according to ASCE/SEI 7.
 - 1. Design Wind Load: Indicated on Drawings.
 - a. Minimum Post Size: Determine according to ASTM F 1043 for post spacing not to exceed 10 feet (3 m) for Material Group IA, ASTM F 1043, Schedule 40 steel pipe.
 - b. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified.
- C. Lightning Protection System: Maximum resistance to ground value of 25 ohms at each grounding location along fence under normal dry conditions.
- D. UL Standard: Manufacture and label gate operators according to UL 325.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 CHAIN LINK FENCE FABRIC

- A. Provide fabric in single piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to CLFMI Product Manual and requirements indicated:

1. Fabric Height: Indicated on Drawings.
2. Steel Wire for Fabric: Wire diameter of 0.192 inch (4.88 mm).
 - a. Mesh Size: 1-1/4 inch (30 mm).
 - b. Zinc Coated Fabric: ASTM A 392, Type II, Class 2, 2.0 oz./sq. ft. (610 g/sq. m) with zinc coating applied after weaving.
 - c. Coat selvage ends of metallic coated fabric before the weaving process with manufacturer's standard clear protective coating.
3. Selvage: Twisted top and knuckled bottom.

2.3 FENCE FRAMEWORK

- A. Posts and Rails: ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:
 1. Fence Height: As indicated on Drawings.
 2. Heavy Industrial Strength Material: Group IA, round steel pipe, Schedule 40.
 - a. Line Post: 4.0 inches (102 mm) in diameter.
 - b. End, Corner, and Pull Posts: 4.0 inches (102 mm) in diameter.
 3. Horizontal Framework Members: Intermediate, top and bottom rails according to ASTM F 1043.
 4. Brace Rails: ASTM F 1043.
 5. Metallic Coating for Steel Framework:
 - a. Type A: Not less than minimum 2.0-oz./sq. ft. (0.61-kg/sq. m) average zinc coating according to ASTM A 123/A 123M or 4.0-oz./sq. ft. (1.22-kg/sq. m) zinc coating according to ASTM A 653/A 653M.

2.4 TENSION WIRE

- A. Metallic Coated Steel Wire: 0.177-inch (4.5 mm) diameter, marcelled tension wire according to ASTM A 817 or ASTM A 824, with the following metallic coating:
 1. Type II: Zinc coated (galvanized) by hot dip process, with the following minimum coating weight:
 - a. Matching chain link fabric coating weight.

2.5 FITTINGS

- A. Provide fittings according to ASTM F 626.
- B. Post Caps: Provide for each post.
 1. Provide line post caps with loop to receive tension wire or top rail.
- C. Rail and Brace Ends: For each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
 1. Top Rail Sleeves: Pressed steel or round steel tubing not less than 6 inches (152 mm) long.
 2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails to posts.
- E. Tension and Brace Bands: Pressed steel.
- F. Tension Bars: Steel, length not less than 2 inches (50 mm) shorter than full height of chain link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

- G. Truss Rod Assemblies: Steel, hot dip galvanized after threading rod and turnbuckle or other means of adjustment.

2.6 PRIVACY SLATS

- A. Fiber Glass Reinforced Plastic Slats: UV light stabilized fiber glass reinforced plastic, not less than 0.06 inch (1.5 mm) thick, sized to fit mesh specified for direction indicated, with vandal resistant fasteners and lock strips.
- B. Color: Selected by Architect.
- C. Nonshrink, Nonmetallic Grout: Factory packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.

2.7 CONCRETE

- A. Concrete for post footings shall have a 28-day compressive strength as required by the delegated design engineering documents..

2.8 GROUNDING MATERIALS

- A. Connectors and Grounding Rods: Listed and labeled for complying with UL 467.
 - 1. Connectors for Below Grade Use: Exothermic welded type.
 - 2. Grounding Rods: Copper clad steel, 5/8 by 96 inches (16 by 2440 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
 - 1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- B. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

- A. Stake locations of fence lines and terminal posts. Do not exceed intervals of 20 feet (152 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 CHAIN LINK FENCE INSTALLATION

- A. Install chain link fencing according to ASTM F 567 and more stringent requirements specified.
- B. Post Excavation: Drill or hand excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 - 1. Verify posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Exposed Concrete: Extend 2 inches (50 mm) above grade; shape and smooth to shed water.
 - b. Concealed Concrete: Place top of concrete 2 inches (50 mm) below grade to allow covering with surface material.
 - c. Posts Set into Sleeves in Concrete: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.
 - d. Posts Set into Holes in Concrete: Form or core drill holes not less than 5 inches (127 mm) deep and 3/4 inch (20 mm) larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.
- D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment as indicated on Drawings. For runs exceeding 500 feet (152 m), space pull posts an equal distance between corner or end posts.
- E. Line Posts: Space line posts uniformly at 96 inches (2440 mm) o.c., maximum, see drawings for aesthetic considerations.
- F. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
 1. Locate horizontal braces at midheight of fabric 72 inches (1830 mm) or higher, on fences with top rail, and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- G. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120 inch (3.05 mm) diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches (610 mm) o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
 1. Extended along top and bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches (152 mm) of bottom of fabric and tie to each post with not less than same diameter and type of wire.
- H. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- I. Intermediate and Bottom Rails: Secure to posts with fittings.
- J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches (380 mm) o.c.
- K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain link fabric, wrap wire around post a minimum of 180 degrees, and attach other

end to chain link fabric according to ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches (300 mm) o.c. and to braces at 24 inches (610 mm) o.c.

L. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

M. Privacy Slats: Install slats in direction indicated, securely locked in place.

1. Diagonally for privacy factor of 80 to 85, and as indicated on Drawings.

N. Excavation: Hand excavate holes for posts, pedestals, and equipment bases/pads, in firm, undisturbed soil to dimensions and depths and at locations according to gate operator component manufacturer's written instructions and as indicated.

3.4 GROUNDING AND BONDING

A. Fence and Gate Grounding:

1. Ground for fence and fence posts shall be a separate system from.
2. Install ground rods and connections at maximum intervals of 1500 feet (450 m).
3. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m).
 - a. Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (457 mm) below finished grade.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a ground rod located a maximum distance of 150 feet (45 m) on each side of crossing.

C. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (152 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

1. Make grounding connections to each barbed wire strand with wire-to-wire connectors designed for this purpose.
2. Make grounding connections to each barbed tape coil with connectors designed for this purpose.
3. Bonding for Gates: Connect bonding jumper between gate post and gate frame.

D. Connections:

1. Make connections with clean, bare metal at points of contact.
2. Make aluminum to steel connections with stainless steel separators and mechanical clamps.
3. Make aluminum to galvanized steel connections with tin plated copper jumpers and mechanical clamps.
4. Make above grade ground connections with mechanical fasteners.
5. Make below grade ground connections with exothermic welds.
6. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

E. Bonding to Lightning Protection System: Ground fence and bond fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor according to NFPA 780.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests.
- B. Grounding Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance no fewer than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two point method according to IEEE 81.
- C. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
- D. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

3.6 DEMONSTRATION

- A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain link fences and gates.

END OF SECTION

SECTION 32 31 19 - DECORATIVE METAL FENCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Decorative aluminum fences.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data including construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Submit plans, elevations, sections, post spacing, mounting details , and grounding details.
- C. Samples: Provide sample 12 inches (300 mm) in length for linear materials.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality control reports.
- B. Product Test Reports: Submit reports for decorative metallic coated steel tubular picket fences, including finish, indicating compliance with referenced standard and specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Submit data for gate operators to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer having minimum 5 years documented experience who is the fabricator of decorative metal fences and gates.
- B. Preinstallation Conference: Conduct conference at site.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Wind Loading:
 - 1. Fence Height: To match existing.
 - 2. Wind Exposure Category: See Drawings.
 - 3. Design Wind Speed: See Drawings.
 - 4. Design Wind Pressure: See Drawings.
- B. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

2.2 DECORATIVE ALUMINUM FENCES

- A. Decorative Aluminum Fences: Fences made from aluminum extrusions.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Alumi-Guard, Inc.
 - b. Ameristar Fence Products; an ASSA ABLOY company.
 - c. Elite Fence Products, Inc.
 - d. Ideal Aluminum Products.
 - e. Iron Eagle Industries, Inc.
 - f. Merchants Metals.
 - g. Superior Aluminum Products, Inc.
 - h. Ultra Aluminum Mfg., Inc.
 - i. Virginia Railing and Gates, LLC.
- B. Posts: Square extruded tubes.
 - 1. Line Posts: Overall size and wall thicknesses to match existing.
 - 2. End and Corner Posts: Overall size and wall thicknesses to match existing.
- C. Post Caps: Aluminum castings that cover entire top of posts, project at least 1/4 inch (6 mm) beyond posts, to match existing.
- D. Rails: Extruded aluminum channels, Profile and dimensions to match existing..
- E. Pickets: Extruded aluminum tubes, square – sized to match existing fence, including wall thickness.
 - 1. Terminate tops of pickets at top rail for flush top appearance.
 - 2. Picket Spacing: estimated 4 inches (101.6 mm) clear, to match existing.
- F. Fasteners: Concealed fastening system.
- G. Fabrication: Assemble fences into sections by welding pickets to rails.
 - 1. Fabricate sections with clips welded to rails for field fastening to posts.
 - 2. Drill clips for fasteners before finishing.
- H. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.
- I. Finish: Baked enamel or powder coating, to match existing fencing.

2.3 MATERIALS

- A. Aluminum: Provide alloys and tempers with not less than the strength and durability properties of alloy and temper designated in paragraphs below for each aluminum form required.
 - 1. Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
 - 2. Tubing: ASTM B 429/B 429M, Alloy 6063-T6.
 - 3. Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
 - 4. Die and Hand Forgings: ASTM B 247 (ASTM B 247M), Alloy 6061-T6.
 - 5. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - 1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.
- B. Concrete: Dry, packaged, normal weight concrete mix complying with ASTM C 387/C 387M mixed with potable water according to manufacturer's written instructions.
- C. Nonshrink Grout: Factory packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M and specifically recommended by manufacturer for exterior applications.

2.5 GROUNDING MATERIALS

- A. Grounding Conductors: Size as indicated on Drawings. Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 - 1. Material above Finished Grade: Aluminum.
 - 2. Material on or below Finished Grade: Copper.
 - 3. Bonding Jumpers: Braided copper tape, 1-5/8 inch (41 mm) wide and 1/16 inch (1.6 mm) thick, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
- B. Grounding Connectors and Grounding Rods: Comply with UL 467.

2.6 FINISHES

- A. Aluminum:
 - 1. Baked Enamel or Powder Coat Finish: AAMA 2603 except with a minimum dry film thickness of 2 mils (0.05 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - a. Color and Gloss: Selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and conditions affecting performance of the work.
- B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- C. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 DECORATIVE FENCE INSTALLATION

- A. Install fences according to manufacturer's written instructions.
- B. Post Excavation: Drill or hand excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches (600 mm) plus 3 inches (75 mm) for each foot (300 mm) or fraction of a foot (300 mm) that fence height exceeds 4 feet (1.2 m).
- C. Post Setting: Set posts in concrete at spacing, to match existing fencing, into firm, undisturbed soil.
 - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - 2. Concrete Fill: Place concrete around posts and sleeves and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Concealed Concrete: Top 2 inches (51 mm) below grade to allow covering with surface material. Slope top surface of concrete to drain water away from post.
 - 3. Posts Set in Concrete: Extend post to within 6 inches (150 mm) of specified excavation depth, but not closer than 3 inches (75 mm) to bottom of concrete.
 - 4. Space posts uniformly at spacing to match existing fence.

3.4 GROUNDING AND BONDING

- A. Fence Grounding: Install at maximum intervals of 1500 feet (450 m) except as follows:
 - 1. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m).
- B. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (150 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.
- C. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
 - 1. Use electroplated or hot tin coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum to steel connections with stainless steel separators and mechanical clamps.
 - 4. Make aluminum to galvanized-steel connections with tin plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- D. Bonding to Lightning Protection System: If fence terminates at lightning protected building or structure, ground the fence, and bond the fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor, complying with NFPA 780.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections.
 - 1. Grounding Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace

- of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.

END OF SECTION

SECTION 330501 - DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Ductile iron pipe and fittings, linings, and coatings for water main.
 - 2. Ductile iron pipe and fittings, linings, and coatings for gravity sewer and sanitary force main.
- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
 - 2. Section 31 23 17 - Site Excavation, Backfill, and Compaction.
 - 3. Section 33 10 13 – Water Main Installation.
 - 4. Section 33 12 13 – Water Service Laterals.
 - 5. Section 33 13 16 - Corrosion Control - Pipe and Fittings.

1.2 REFERENCES

- A. Okaloosa County, Florida – Water/Sewer District Utilities Standards Manual – Section 2: Technical Specifications.
- B. ASTM International (ASTM):
 - 1. ASTM D1248 – Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
- C. American Water Works Association (AWWA):
 - 1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 - 2. AWWA C110 - Ductile Iron and Gray-Iron Fittings, 3 In. Through 48 In. for Water.
 - 3. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - 4. AWWA C150 - Thickness Design of Ductile Iron Pipe.
 - 5. AWWA C151 - Ductile Iron Pipe, Centrifugally Cast, for Water and Other Liquids.
 - 6. AWWA C153 - Ductile Iron Compact Fittings, 3 In. Through 24 In. and 54 In. through 61 In., for Water Service.
- D. NSF International:
 - 1. NSF 61 - Drinking Water System Components - Health Effects.

1.3 SUBMITTALS

- A. Section 01 33 00 – Submittal Procedures, Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.
- B. Product Data: Submit data indicating pipe, joints, fittings, and pipe accessories.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Pipe shall be Thickness Class 52, 53, 54, 55 or 56, diameter as shown on Drawings, and shall conform to AWWA C150.
- B. Pipe shall be Pressure Class 250, 300 or 350, diameter as shown on Drawings, and shall conform to AWWA C151.
- C. Joints shall meet the requirements of AWWA C111.
- D. All pipe and fittings shall meet the requirements of Section 01 40 00 – Quality Requirements, Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework of this Project Manual.
- E. Ductile iron pipe and fittings shall be products of a single manufacturer in the United States of America.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Identification: Pipe shall be readily identified and shall contain weight, Class, or nominal thickness, and casting period clearly painted on each piece.
- B. Load and unload pipe, fittings, and accessories by lifting with hoists or skidding to avoid shock or damage.
- C. Under no circumstances shall material be dropped.
- D. Do not roll or skid pipe handled on skidways against other pipes or ground.
- E. Pad hooks or pipe tongs and use to prevent damage to exterior surface of pipe.
- F. Keep stored pipe free of damage.
- G. Keep interiors of all pipe, fittings, and other appurtenances free from dirt or foreign matter.
- H. Use timbers to separate pipe stored on ground from ground and other pipes.
- I. Store gaskets for mechanical and push-on joints in cool location out of direct sunlight and out of contact with petroleum products.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Ductile iron pipe and fittings shall be manufactured in the United States of America.

- B. Acceptable Manufacturers:
1. American Cast Iron Pipe Company.
 2. Clow Water Systems Company.
 3. Griffin Pipe Products Company.
 4. McWane Cast Iron Pipe Company.
 5. United States Pipe and Foundry Company.
 6. Substitutions: In accordance with Section 01 25 00 – Substitution Procedures, Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework Not Permitted.

2.2 PIPE

- A. Pipe shall be centrifugally cast in metal or sand-lined molds.
- B. Design pipe with bell and spigot, mechanical joint and flanged ends designed for rubber gasket joints.
- C. Manufacturer's mark, year of production, and "DI" or "DUCTILE" shall be cast or stamped on pipe.
- D. Pipe shall be cement mortar lined and have internal and external bituminous coats.

2.3 FITTINGS

- A. Fittings shall be centrifugally cast in metal or sand-lined molds.
- B. Use of compact fittings conforming to AWWA C153 shall be acceptable.
- C. Wherever mechanical joints are used, joint bolts and nuts shall be corrosion resistant steel, NSS Technologies Core-Blue or equal.
- D. In no case shall fitting grade rating less than adjoining pipe.
- E. Fittings shall be from same manufacturer as pipe.

2.4 JOINTS

- A. Pipe and fittings shall be joined by means of a compression type rubber gasket push-on or mechanical joint conforming to AWWA C111.
- B. Nuts and bolts shall be corrosion resistant steel, NSS Technologies, Inc. Cor-Blue or approved equal.
- C. Wherever it is necessary to deflect joint pipe from a straight line, deflection shall not exceed that shown on table below:

Size of Pipe (Inches)	Deflection (18-foot length) Push-On Joint (Inches)	Deflection (18-foot length) Mechanical Joint (Inches)
3 – 4	19	31
6	19	27
8 – 12	19	29
14 – 16	11	13.5
18 – 20	11	11
24	11	9
30	7.5	9
36	7.5	8
42 – 48	7.5	7.5

D. Supply joint with a heavy-duty gasket designed to form a pressure-tight seal.

N.T.S. – The following table of available push-on and mechanical joint gaskets should be used for selecting a specific gasket type for project. Maximum service temperatures are based on lowest temperature rated mechanical joint applications and will also be suitable for push-on joint applications. Consult a pipe manufacturer if gasket types for a specific project are in question. Typical gasket installation for water main and sewage is Plain Rubber – Styrene Butadiene (SBR) gaskets. Other gasket descriptions and usage for specialized applications are as follows:

Common Name Or Trade Name	Chemical Name	Temperature Capability	Common Uses
Plain Rubber	Styrene Butadiene (SBR)	120° F	Fresh Water, Salt Water, Sanitary Sewage
Neoprene	Polychloroprene (CR)	200° F	Fresh Water, Sewage, Outdoor Exposure
Fluoroelastomer	FKM	225° F	Aromatic Hydrocarbons, Gasoline, Refined Petroleum Products, most Chemicals and Solvents, High Temperature, Air
Nitrile	Acrylonitrile Butadiene	120° F	Non-Aromatic Hydrocarbons, Petroleum Oil, Hydraulic Fluids, Fuel Oil, Fats, Oil, Grease
EPDM	Ethylene Propylene Diene Monomer	225° F	Water, Sewage, Ketones, Dilute Acids and Alkalies, Vegetable Oil, Alcohols, Outdoor Exposures, Air

- E. Gaskets shall be [Styrene Butadiene (SBR) – Plain Rubber] [Polychloroprene (CR) - Neoprene] [FKM - Fluoroelastomer] [Acrylonitrile Butadiene - Nitrile] [Ethylene Propylene Diene Monomer - EPDM].
- F. Joint shall be boltless, freely deflecting, ball and socket of the push-on type. Joint restraint shall be provided by a ductile iron restraining ring.
- G. Allow a maximum joint deflection of 15 degrees.

2.5 CEMENT MORTAR LINING

- A. Pipe and fittings shall be cement lined in conformance with AWWA C104.
- B. Thickness of lining shall be:
 - 1. Pipe sizes 3 through 12 inches: 1/16-inch.
 - 2. Pipe sizes 14 through 24 inches: 3/32-inch.
 - 3. Pipe sizes 30 through 64 inches: 1/8-inch.

2.6 DISINFECTION

- A. Take precautions to protect interiors of pipes, fittings, and valves against contamination. Disinfection of water mains shall conform to requirements of Section 33 13 00 – Water Main Disinfection.

2.7 COATINGS

- A. Buried Ductile Iron Pipe
 - 1. Inside Coating:
 - a. Coat entire inside of socket, including gasket cavity, with a minimum of 8 mils of epoxy to prevent joint corrosion.
 - b. Pipe shall be seal coated over cement lining.
 - 2. Outside Coating:
 - a. Coat last 6 inches of spigot, including spigot face with 8 mils of epoxy to prevent joint corrosion.
 - b. Coat remainder of pipe with an asphaltic coating, minimum 1-mil thickness.
- B. Above Grade Ductile Iron Pipe
 - 1. Inside Coating:
 - a. Coat entire inside of socket, including gasket cavity, with a minimum of 8 mils of epoxy to prevent joint corrosion.
 - b. Pipe shall be seal coated over cement lining.
 - 2. Outside Coating:
 - a. Above Grade – Exterior: (Mild Exposure)
 - 1) Standard 1-mil asphaltic coating per AWWA C151.
 - 2) Asphaltic coating is not provided for and is not suitable with bonded topcoats.
 - b. Above Grade – Interior/Non-immersion: (Mild Exposure)
 - 1) NSF 61 certified for use in potable water systems.
 - 2) Shop coat thickness: 2.0-4.0 mils dry film thickness.
 - 3) Acceptable topcoats include alkyds, aluminums, epoxies including polyamide, polyamidoamine, water-borne and coal tar, and urethanes.
 - c. Interior, Exterior, or Immersion: (Aggressive Exposure)

- 1) NSF 61 certified for use in potable water systems.
- 2) Shop coat thickness: 3.0-8.0 mils dry film thickness.
- 3) Acceptable topcoats include epoxies (amine, polyamide, polyamidoamine, water-borne & coal tar) and urethanes.

2.8 POLYETHYLENE ENCASEMENT

- A. Encase pipe in polyethylene conforming to requirements of ASTM D1248 and Section 33 13 16 – Corrosion Control - Pipe and Fittings.

PART 3 - EXECUTION (Not Used)

END OF SECTION 330501

SECTION 330505 - POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Polyvinyl Chloride (PVC) Sewer Pipe and Fittings for gravity sanitary and storm sewer system piping.
- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
 - 2. Section 31 23 17 - Site Excavation, Backfill and Compaction.
 - 3. Section 33 40 13 – Storm Sewer Installation.

1.2 REFERENCES

- A. Okaloosa County, Florida – Water/Sewer District Utilities Standards Manual – Section 2: Technical Specifications.
- B. ASTM International (ASTM):
 - 1. ASTM D2321 - Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
 - 2. ASTM D3034 - Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings. Nominal sizes 4-inch through 15-inch.
 - 3. ASTM D3212 - Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
 - 4. ASTM F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - 5. ASTM F679 - Specification for Polyvinyl Chloride (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings.
 - 6. ASTM F794 - Specification for Polyvinyl Chloride (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter, Nominal sizes 4-inches through 48-inches.
 - 7. ASTM F913 - Specification for Thermoplastic Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.3 SUBMITTALS

- A. Section 01 33 00 – Submittal Procedures, Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.
- B. Product Data: Submit data indicating pipe, joints, fittings and pipe accessories.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Pipe, joints and fittings shall meet requirements of ASTM Standards.
- B. Products shall be marked and shall affirm that product was manufactured, inspected, sampled, and tested in accordance with ASTM Specification and has been found to meet requirements of specification.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Load and unload pipe, fittings, and accessories by lifting with hoists or skidding to avoid shock or damage.
- B. Under no circumstances shall material be dropped.
- C. Do not roll or skid pipe handled on skidways against pipe or ground.
- D. Pad hooks or pipe tongs and use to prevent damage to exterior surface of pipe.
- E. Keep stored pipe free of damage.
- F. Keep interiors of pipe, fittings, and other appurtenances free from dirt or foreign matter.
- G. Use timbers to separate pipe stored on ground from ground and other pipe.
- H. Store gaskets for push-on joints in cool location out of direct sunlight and out of contact with solvents and petroleum products.
- I. Clearly mark pipe at intervals of not less than five feet with the following information:
 - 1. Manufacturer's name or trademark and code.
 - 2. Nominal pipe size.
 - 3. PVC cell classification.
 - 4. Type of pipe material and ASTM Designation for pipe.
- J. Clearly mark fittings with following information:
 - 1. Manufacturer's name or trademark.
 - 2. Nominal size.
 - 3. Material designation.
 - 4. Type of material and ASTM designation.

PART 2 - PRODUCTS

2.1 GRAVITY [SANITARY SEWER] [AND] [STORM SEWER] PIPE

- A. PVC Pipe: ASTM D3034 SDR 26 and 35 Polyvinyl Chloride (PVC); Type PSM SDR 26 PVC Sewer Pipe and Type PSM SDR 35 PVC Sewer Pipe; Nominal diameter 4-inches through 15-inches as designated on Drawings; integral gasketed joint.

2.2 FITTINGS

- A. Pipe used in fabricated fittings shall meet quality and dimensional requirements listed in standard for that pipe. Fittings shall use same joint system as pipe.
- B. Pipe used in fabricated fittings shall have a wall thickness equal to or greater than wall thickness of pipes to which fitting, or that part of fitting, will be joined.
- C. No part of spur or branch shall protrude into waterway of fitting more than 0.070-inch.
- D. All edges and joints exposed to sewage shall be rounded and free from any rough parts that could catch solids.
- E. No fitting shall have an inside diameter dimension smaller than base inside diameter for that pipe size and DR.

2.3 JOINTS

- A. Flexible elastomeric seals shall comply with requirements of ASTM F477, natural or synthetic rubber, ASTM F913, thermoplastic elastomers, for joints that require no internal or external pressure to effect initial seal.
- B. Lubricant shall be of such composition that it will in no way damage gasket or pipe due to prolonged exposure and shall not affect sealing capability of gasket.

2.4 ACCESSORIES

- A. Pipe Couplings:
 - 1. Dresser, Inc, Addison, TX.
 - 2. Fernco, Inc., Davison MI.
 - 3. Or an approved equal.
- B. Identification Warning Tape: Aluminum underground warning tape, 2-inch width. Color-Bright Green, warning message "Caution Buried SANITARY, STORM or SEWER Below," to repeat every 30 inches.
- C. Tracer Wire: 45-mil solid copper, No. 12 HMW-PE yellow jacket coating. Installed to enable electronic locating of underground utility.

PART 3 - EXECUTION (Not Used)

END OF SECTION 330505

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SECTION 330506 - POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Polyvinyl Chloride (PVC) pressure pipe for water main.
 - 2. Polyvinyl Chloride (PVC) pressure pipe for sanitary force main.
- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
 - 2. Section 31 23 17 - Site Excavation, Backfill, and Compaction.
 - 3. Section 33 10 13 – Water Main Installation.

1.2 REFERENCES

- A. Okaloosa County, Florida – Water/Sewer District Utilities Standards Manual – Section 2: Technical Specifications.
- B. ASTM International (ASTM):
 - 1. ASTM D3139 – Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 - 2. ASTM F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- C. American Water Works Association (AWWA):
 - 1. AWWA C110 - Ductile-Iron and Gray-Iron Fittings, 3 Inches Through 48 Inches for Water.
 - 2. AWWA C153 - Ductile Iron Compact Fittings, 3 Inches Through 24 Inches and 54 Inches Through 64 Inches for Water Service.
 - 3. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Through 12 Inches for Water Distribution.
 - 4. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 Inches Through 48 Inches for Water Transmission and Distribution.

1.3 SUBMITTALS

- A. Section 01 33 00 – Submittal Procedures, Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.
- B. Product Data: Submit data indicating pipe, joints, fittings and pipe accessories.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Pipe, joints, and fittings shall meet requirements of ASTM and AWWA Standards.

- B. Products shall be marked and manufacturer shall affirm that product was manufactured, inspected, sampled, and tested in accordance with ASTM and AWWA Standards and have been found to meet requirements of Standards.

1.5 PRODUCT DELIVERY, HANDLING, AND STORAGE

- A. Load and unload pipe, fittings, and accessories by lifting with hoists or skidding to avoid shock or damage.
- B. Under no circumstances shall material be dropped.
- C. Do not roll or skid pipe handled on skidways against pipe or ground.
- D. Pad hooks or pipe tongs and use to prevent damage to exterior surface of pipe.
- E. Keep stored pipe free of damage.
- F. Keep interiors of pipe, fittings, and other appurtenances free from dirt or foreign matter.
- G. Use timbers to separate pipe stored on ground from ground and other pipe.
- H. Store gaskets for mechanical and push-on joints in cool location out of direct sunlight and out of contact with solvents and petroleum products.
- I. Clearly mark pipe at intervals of not less than five feet with the following information:
 - 1. Manufacturer's name or trademark and code.
 - 2. Nominal pipe size.
 - 3. PVC cell classification.
 - 4. Type of pipe material and ASTM Designation for pipe.
- J. Clearly mark fittings with following information:
 - 1. Manufacturer's name or trademark.
 - 2. Nominal size.
 - 3. Material designation.
 - 4. Type of material and ASTM designation.

PART 2 - PRODUCTS

2.1 WATER MAIN AND FORCE MAIN

- A. PVC Pipe: AWWA C900 Polyvinyl Chloride (PVC); nominal diameter 4-inch through 12-inch; DR-25, pressure class 100; DR-18, pressure class 150; DR-14, pressure class 200; as designated on Drawings; integral gasketed joint.

2.2 FITTINGS

- A. Fittings shall be fabricated from polyvinyl chloride and shall conform to AWWA C900; nominal diameter 4-inch to 12-inch. or C905; nominal diameter 14-inch to 48-inch.

- B. Ductile iron fittings shall be connected to PVC pipe with mechanical joint restraints as manufactured by EBAA Iron Sales, Inc., Eastland, TX, Ford Meter Box Company, Inc., Wabash, IN, or an approved equal.
- C. Pipe used in fabricated fittings shall meet quality and dimensional requirements listed in standard for that pipe.
- D. Pipe used in fabricated fittings shall have a wall thickness equal to or greater than wall thickness of pipes to which fitting, or that part of fitting, will be joined.
- E. No fitting shall have an inside diameter dimension smaller than base inside diameter for that pipe size and DR.

2.3 JOINTS

- A. Flexible elastomeric seals shall comply with requirements of ASTM F477 natural or synthetic rubber for push-on joints that require no internal or external pressure to affect initial seal.
- B. Lubricant, if used, shall be of such composition that it will in no way damage gasket or pipe due to prolonged exposure and shall not affect sealing capability of gasket.
- C. Joints shall be made in accordance with ASTM D3139.

2.4 ACCESSORIES

- A. Joint Restraints: Cast iron, circular or pair of semi-circles with wedges that grip ductile iron or PVC pipe.
 - 1. Manufacturers:
 - a. Megalug as manufactured by EBAA Iron, Inc., Eastland, Texas.
 - b. Uni-Flange as manufactured by Ford Meter Box Company, Inc., Wabash, Indiana.
 - c. Or an approved equal.
- B. Pipe Couplings:
 - 1. Manufacturers:
 - 2. Dresser, Inc., Addison, TX.
 - 3. Fernco, Inc., Davison, MI.
 - 4. Or Approved Equal.
- C. Identification Warning Tape: Aluminum underground warning tape, 2-inch width. Color-Bright Blue or Bright Green, warning message "Caution Buried WATER MAIN or SANITARY SEWER Below," to repeat every 30 inches, installed 30 inches above top of pipe.
- D. Tracer Wire: 45 mil solid copper, No. 12 HMW-PE yellow jacket coating. Installed to enable electronic locating of underground utility.

PART 3 - EXECUTION (Not Used)

END OF SECTION 330506

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SECTION 330508 - HIGH-DENSITY POLYETHYLENE STORM WATER PIPE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. High-density polyethylene (HDPE) pipe for storm water drainage system.

B. Related Sections:

1. Applicable provisions of Division 01 – General Requirements shall govern Work under this Section.
2. Section 31 23 17 – Site Excavation, Backfill, and Compaction.
3. Section 33 40 13 - Storm Sewer Installation.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO Designation M294 – Standard Specification for Corrugated Polyethylene Pipe, 12-inch to 48-inch Diameter.

B. ASTM International (ASTM):

1. ASTM C923 – Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
2. ASTM D618 – Practice for Conditioning Plastics for Testing.
3. ASTM D883 – Terminology Relating to Plastics.
4. ASTM D1693 – Test Method for Environmental Stress-Cracking of Ethylene Plastics.
5. ASTM D2122 – Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.
6. ASTM D2321 – Practice for Underground Installation of Thermoplastic Pipe and Sewers and Other Gravity Flow Applications.
7. ASTM D2412 – Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
8. ASTM D2444 – Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight).
9. ASTM D3212 – Specification for Joints for Drain and Sewer Plastic Pipe Using Flexible Elastomeric Joints.
10. ASTM D3350 – Specification for Polyethylene Plastics Pipe and Fittings Material.
11. ASTM F412 – Terminology Relating to Plastic Piping Systems.
12. ASTM F477 – Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
13. ASTM F585 - Practice for Insertion of Flexible Polyethylene Pipe Into Existing Sewers.
14. ASTM F1668 - Guide for Construction Procedures for Buried Plastic Pipe.
15. ASTM F1962 - Guide for Use of Maxi-Horizontal Directional Drilling for Place.
16. ASTM F2306 - Specification for 12 to 60 in. [300 to 1500 mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications.
17. ASTM F2510 - Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures and Corrugated High Density Polyethylene Drainage Pipes

18. ASTM F2648 - Specification for 2 to 60 inch [50 to 1500 mm] Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications.

- C. State of Florida Department of Transportation:
1. Standard Specifications for Road and Bridge Construction, Current Edition with latest supplements. (FDOT)

1.3 SUBMITTALS

- A. Section 01 33 00 – Submittal Procedures, Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.
- B. Product Data: Submit data indicating pipe, joints, fittings and pipe accessories.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that product meets or exceeds specified requirements.

1.4 QUALITY ASSURANCE

- A. Pipe, joints, and fittings shall meet requirements of listed ASTM and AASHTO Standards.
- B. Mark products and affirm that product was manufactured, inspected, sampled, and tested in accordance with ASTM and AASHTO Specifications and to meets specification requirements.

1.5 REGULATORY REQUIREMENTS

- A. Contractor shall comply with applicable rules and regulations of State of
1. Florida Department of Environmental Protection.
- B. Contractor shall also comply with requirements of other local, state, and federal agencies having jurisdiction related to Work of this Section.
- C. Contractor shall comply with and be solely responsible for compliance with U.S. Department of Labor OSHA Part 1926 Safety and Health Regulations for Construction for this Work.
- D. Contractor performing Work of this Section shall be solely responsible for identifying, furnishing, installing and maintaining equipment and materials required by state and federal regulations to establish safe working conditions during Work of this Section.

1.6 PRODUCT DELIVERY, HANDLING, AND STORAGE

- A. Load and unload pipe, fittings, and accessories by lifting with hoists or skidding to avoid shock or damage.
- B. Under no circumstances shall material be dropped.
- C. Do not roll or skid pipe handled on skidways against other pipe or ground.
- D. Pad hooks or pipe tongs and use to prevent damage to exterior surface of pipe.

- E. Keep stored pipe free of damage.
- F. Keep interiors of pipe, fittings, and other appurtenances free from dirt or foreign matter.
- G. Use timbers to separate pipe stored on ground from other pipe and ground.
- H. Clearly make pipe at intervals of not less than five feet with the following information:
 - 1. Manufacturer's name or trademark and production code.
 - 2. Nominal pipe outside diameter.
 - 3. HDPE cell classification.
 - 4. Type of pipe material, AASHTO or ASTM Designation for pipe.
 - 5. Dimensional ratio or pressure rating.
- I. Clearly mark fittings with the following information:
 - 1. Manufacturer's name or trademark.
 - 2. Nominal size.
 - 3. Material designation.
 - 4. AASHTO or ASTM Designation for pipe.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:
 - 1. Advanced Drainage Systems, Inc. (ADS); Type N-12 Pipe and Fittings.
 - 2. Hancor, Inc.; N-12 HP Storm Sewer Pipe and Fittings.
 - 3. Prinsco, Inc.: Goldflo WT.
 - 4. Substitutions in accordance with [Section 01 25 00 – Substitution Procedures] [Division 01 – General Requirements] [Section 31 02 00 – General Requirements for Sitework].

2.2 STORM SEWER DRAINAGE PIPING

- A. HDPE Pipe: ASTM F2648 (AASHTO M294), Type S inner liner, corrugated outside liner, fabricated from ASTM D3350 polyethylene materials.

2.3 FITTINGS

- A. Fittings shall conform to ASTM F2306 and be manufactured by Pipe Manufacturer's identified above. Pipe and fittings shall be provided by same manufacturer. Fittings shall provide a:
 - 1. Silt-Tight Connection.
 - 2. Water-Tight Connection.
- B. Fitting shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.
- C. Pipe used in fabricated fittings shall meet quality and dimensional requirements listed in standard for that pipe.
- D. Pipe used in fabricated fittings shall have wall thickness equal to or greater than wall thickness of pipe to which fitting or that part of fitting will be joined.

- E. No fitting shall have an inside diameter dimension smaller than base inside diameter for that pipe size and wall thickness.
- F. Fittings shall be provided by specified pipe manufacturer. Intermixing of pipe and fittings from different manufacturers is prohibited.

2.4 JOINTS

- A. Pipe: ASTM D3212 bell and spigot joints with ASTM F477 gasket; rated to handle same stresses and loads as piping.
- B. Joints shall sustain longitudinal pullout and trust forces caused by contraction or expansion of piping and external and internal loading.
- C. Non water-tight connections to manholes, catch basins, and inlets shall be made by using non-shrink grout.
- D. Pack grout from outside and inside of drainage structure at connection of pipe entrance into structure. Trowel grout smooth.
- E. Water-tight connections to manholes, catch basins and inlets shall be made by using smooth outside wall adaptor pipe section and ASTM C923 flexible boot connectors.
- F. Water-tight connections to manholes, catch basins and inlet, ASTM F2510 flexible boot connectors.
- G. Provide adaptor pipe section with smooth outside wall attached to corrugated pipe end. Connect smooth outside wall adaptor pipe to corrugated pipe as required by pipe manufacturer.
- H. Insert smooth adaptor pipe section into flexible boot and clamp watertight.

2.5 CURVED ALIGNMENT

- A. Pipe curvatures shall be made by using fittings, when pipe curvature exceeds limitations of bending listed below.
- B. Limitations for pipe bending is as follows:

Angular Joint Misalignment (Degrees)	Bending Radius			
	20 feet	13 feet	10 feet	5 feet
1	1146	745	573	286
2	573	346	286	143
3	382	248	191	96
4	287	186	143	72
5	229	149	115	57

PART 3 - EXECUTION

3.1 TRENCH METHOD

- A. Install pipe in accordance with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 - Site Excavation, Backfill, and Compaction, ASTM D2321, ASTM F1668, and pipe manufacturer’s written instructions.

3.2 FIELD CUTTING PIPE

- A. Cut pipe with sawing equipment that produces a flush tight-fitting connection.
- B. Cut pipe to be connected to a manhole, catch basin, or inlet without a flexible connector through corrugation valley of pipe.

3.3 TESTING

- A. Perform deflection tests for all high-density polyethylene (HDPE) pipe installations in accordance with ASTM D2122.
- B. Perform deflection test using a rigid ball or mandrel without a mechanical pulling device.
- C. Mandrel settings for testing shall be as follows:

<u>Nominal Pipe Diameter</u>	<u>Pipe Base Diameter</u>	<u>Mandrel Setting</u>
4-inch	3.87 inches	3.50 inches
6-inch	5.80 inches	5.36 inches
8-inch	7.73 inches	7.15 inches
10-inch	9.66 inches	8.94 inches
12-inch	11.60 inches	10.73 inches
15-inch	14.50 inches	13.41 inches
18-inch	17.40 inches	16.09 inches
21-inch	20.30 inches	18.78 inches
24-inch	23.20 inches	21.46 inches

- D. Testing for system water-tightness is required, refer to Section 33 37 00 – Sanitary Sewer and Manhole Testing.

END OF SECTION 330508

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SECTION 331013 - WATER MAIN INSTALLATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Installation of AWWA C900 or C905 poly vinyl chloride (PVC) water main.
2. Installation of AWWA C600 ductile iron water main.
3. Installation of AWWA C901 or C906 polyethylene (PE) water main.
4. Installation of ductile iron or poly vinyl chloride or [polyethylene fittings.
5. Installation of system valves, and valve boxes.
6. Installation of system hydrants.

B. Related Sections:

1. Applicable provisions of Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
2. Section 31 23 17 – Site Excavation, Backfill, and Compaction.
3. Section 33 05 01 – Ductile Iron Pipe and Fittings.
4. Section 33 05 06 – Polyvinyl Chloride (PVC) Pressure Pipe.
5. Section 33 12 13 - Water Service Laterals.
6. Section 33 13 16 – Corrosion Control - Pipe and Fittings.

1.2 REFERENCES

A. Okaloosa County, Florida – Water/Sewer District Utilities Standards Manual – Section 2: Technical Specifications.

B. American Water Works Association: (AWWA)

1. AWWA C110 - Standard for Ductile-Iron and Gray-Iron Fittings, 3-In. Through 48-In., for Water.
2. AWWA C111 - Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C151 – Standard for Ductile-Iron Pipe, Centrifugally Cast for Water and Other Liquids.
4. AWWA C153 - Standard for Ductile-Iron Compact Fittings, 3-In. Through 24-In., and 54-In. Through 64-In., for Water Service.
5. AWWA C600 – Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.
6. AWWA C605 - Standard for Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
7. AWWA C651 - Standard for Disinfecting Water Mains.
8. AWWA C800 - Standard for Underground Service Line Valves and Fittings.
9. AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-In. Through 12-In., for Water Distribution.
10. AWWA C901 - Standard for Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In., for Water Service.
11. AWWA C905 - Standard for Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14-In. Through 48-In., for Water Transmission and Distribution.

12. AWWA C906 - Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 63 In. for Water Distribution and Transmission.
13. AWWA C907 - Standard for Polyvinyl Chloride (PVC) Pressure Fittings for Water 4-In. Through 8-In., for Water Distribution.

1.3 SUBMITTALS

- A. Division 01 – General Requirements, Section 01 33 00 - Submittal Procedures, Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.
- B. Manufacturer's Installation Instructions: Submit special procedures required to install Products specified.
- C. Record horizontal location and vertical depth of pipe runs, fittings, connections, hydrants, valves, and valve vaults installed.

1.4 REGULATORY REQUIREMENTS

- A. Comply with applicable rules and regulations of:
 1. State of Florida Department of Environmental Protection (FDEP) and Department of Community Affairs (FDCA) and local code if more stringent for materials and installation of the Work of this section.
- B. Comply with and be solely responsible for compliance with U.S. Department of Labor OSHA Part 1926 Safety and Health Regulations for Construction for this Work.
- C. Contractor performing Work of this Section shall be solely responsible for identifying, furnishing, installing and maintaining equipment and materials required by state and federal regulations to establish safe working conditions during Work of this Section.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Load and unload pipe, fittings, valves, hydrants, and accessories in accordance with manufacturer's published recommendations.
- B. Adherence to pipe manufacturer's unloading requirements are stressed when temperatures are below 32 degrees F.
- C. Under no circumstances shall material be dropped.
- D. Pipe handled on skidways shall not be rolled or skidded against pipe on ground.
- E. Pad slings, hooks, or pipe tongs and use to prevent damage to exterior surface or internal lining of pipe.
- F. Keep stored material stored free of damage.
- G. Keep interior of pipe, fittings, and other appurtenances free from dirt or foreign matter.
- H. Drain valves and hydrants and store to protect them from damage by freezing.
- I. Use timbers to separate pipe stored on ground from ground and other pipe.

- J. Store gaskets for mechanical and push-on joints in cool location out of direct sunlight and contact with petroleum products.
- K. Distribute (string) pipe as close to trench as practical and on opposite side of trench from excavated earth stockpile.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Pipe shall not be laid in water.
- B. Pipe shall not be laid in trenches where, in opinion of Engineer/Architect, Owner's Representative or Construction Manager, conditions are unsuitable.
- C. Blocking shall not be used to change pipe grade or to intermittently support pipe across excavated sections.
- D. Remove ledge rock, boulders, cobbles, and large stones to provide 6-inch embedment cushion on each side of and below pipe and appurtenances.
- E. If trench passes over a previously excavation, compact trench bottom to provide support equal to that of adjacent undisturbed native soil or conform to specific regulatory requirements to prevent damage to existing installed facility.
- F. Separation of water main and sanitary and storm sewers shall be in accordance with State of Florida requirements.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Pipe and fittings, valves, and hydrants shall each be products of a single manufacturer and shall be fabricated in the United States of America. Intermixing of any material type from multiple manufacturers is prohibited.

2.2 WATER MAIN PIPE MATERIALS

- A. Ductile Iron Pipe: Shall meet requirements of Section 33 05 01 – Ductile Iron Pipe and Fittings.
- B. Polyvinyl Chloride (PVC) Pressure Pipe: Shall meet requirements of Section 33 05 06 – Poly Vinyl Chloride (PVC) Pressure Pipe.

2.3 FIELD EXAMINATION

- A. Contractor and Engineer/Architect, Owner's Representative or Construction Manager shall inspect and accept materials for construction of water mains prior to beginning construction.
- B. Examine pipe, fittings, valves, hydrants, and other appurtenances carefully for damage and other defects prior to installation.

- C. Mark defective material identified by Contractor and hold for inspection by Engineer/Architect, Owner's Representative or Construction Manager, who will prescribe corrective repairs or reject material.

2.4 PIPE LOCATION MATERIALS

- A. Mark all non-conductive lateral pipes with a locating wire system.
- B. Locating wire system consists of the following:
 - 1. Tracer Wire: 45-mil solid copper, No. 12 HMW-PE yellow jacket coating. Install to enable electronic locating of underground utility.
 - 2. Tracer Wire Locating Box: 2-1/2-inch diameter, minimum, ABS pipe with 2-point terminal box and cast iron cover.
 - a. Manufacturer: Valco, Inc. Model C.P. Mini Box, or an approved equal.]
- C. Identification Warning Tape: Heavy plastic underground warning tape, 2-inch width. Color-Bright Blue] warning message "Caution Buried WATER Below" to repeat every 30 inches.
- D. Tracer Wire: 45-mil solid copper, No. 12 HMW-PE yellow jacket coating. Install to enable electronic locating of underground utility.

PART 3 - EXECUTION

3.1 NOTIFICATION

- A. Contractor, prior to any excavation work, shall notify (1) a designated locating service; (2) utilities, governmental agencies, entities, known to, or which can reasonably be assumed to have above or below ground pipe, conduit cables, structures, or similar items within limits of project; to locate and mark location of such items.
- B. In accordance with Florida Statutes Chapter 556, "Underground Facility Damage Prevention and Safety Act," every "Person" as defined in 556.102(9) shall be solely responsible to provide advance notice to "Sunshine State One-Call of Florida, Inc." (800-432-4770) not more than five nor less than two working days prior to commencement of any Excavation or Demolition, as defined in the statute, required to perform work contained in this Project, and further said "Person" shall comply with all other requirements of this Statute relative to Excavator's Work.

3.2 PROTECTION

- A. Perform excavation, backfilling and compaction in accordance with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction for protection of public and private property.
- B. Exercise care during excavation to avoid damage to existing buildings, structures, roadways, sidewalks, utilities, and survey identification markings.

3.3 INSTALLATION OF PIPE

- A. Lay and maintain water mains to lines and grades established by Drawings with fittings, valves, tapped or bossed outlets, and hydrants at required locations.

- B. Trench preparation shall proceed in advance of pipe installation only as far as can be backfilled in same day.
- C. Contractor shall not deviate from types of excavation indicated on Drawings or in Project Manual without prior concurrence of Engineer/Architect, Owner's Representative or Construction Manager except in case of roadways, driveways, and obstructions requiring short tunnel sections that may be indicated on Drawings as open trench sections.
- D. Support tunnel sections exceeding 2 feet in length in accordance with applicable codes.
- E. Install water mains without use of wood blocking.
- F. Lower pipe, fittings, valves, and hydrants carefully into trench by means of a derrick, ropes, or other suitable tools or equipment, in a manner to prevent damage to water main materials and protect coatings and linings.
- G. Lay pipe with bell ends facing direction of laying. When grade exceeds 2 feet of rise per 100 feet of trench, bells shall face upgrade.
- H. Provide holes for bells at each joint but no larger than necessary for joint assembly and assurance that pipe barrel will lie flat on trench bottom. Push-on type joints require only minimum depressions for bell holes.
- I. Trench bottom shall be true and even in order to provide support for full length of pipe barrel, except a slight depression may be provided to allow withdrawal of pipe slings or other lifting tackle.
- J. Remove lumped subsoil, boulders, and rock up to 1/3 cubic yard, measured by volume. Larger material will be removed under Section 31 23 18 - Rock Removal.
- K. When rock is encountered, remove to provide a clearance of at least 6 inches below and on each side of pipe, valves, and fittings for pipe sizes 24 inches or smaller, and 9 inches for pipe sizes 30 inches and larger.
- L. When excavation is complete, place a layer of appropriate bedding material on bottom of trench to depths indicated, level, and compact. Take every precaution to prevent foreign material from entering pipe while it is being placed in line.
- M. If pipe laying crew cannot put pipe into trench and in place without getting earth into it, Engineer/Architect, Owner's Representative or Construction Manager may require that before lowering pipe into trench, a heavy, tightly woven, canvas bag of suitable size be placed over each end and left there until connection is made to adjacent pipe.
- N. Do not place debris, tools, clothing, or other materials in pipe during laying operations.
- O. Assemble joint and bring pipe to correct line and grade as each length of pipe is placed in trench.
- P. Take precautions to prevent foreign materials from entering joint space and carefully check joint recess for foreign material before installing gasket.
- Q. Secure pipe in place with bedding material, keeping bell end open.

- R. Upon daily and temporary completion of pipe installation, close open ends of pipe by a water-tight plug or other means approved by Engineer/Architect, Owner's Representative or Construction Manager. This provision applies during daytime inactivity as well as overnight and weekends.
- S. If water is in trench, maintain pipe seal in place until water level is lowered four inches below pipe invert.
- T. Whenever it becomes necessary to lay a main over, under, or around a known obstruction, furnish and install required fittings. Laying of such fittings will be paid for at unit price bid for each size of main. No additional compensation will be paid to Contractor for any expenses incurred because of such obstruction.
- U. When an unknown underground structure interferes with Work to such an extent that an alteration of Drawings is required and alteration results in a change in cost to Contractor, Engineer/Architect, Owner's Representative or Construction Manager will issue a written order for such altered work, specifying basis of payment or credit for such altered work.
- V. Keep interior and exterior of pipe clean and free from foreign material before installation. Provide necessary means to wipe, brush, swab, or air blast to remove any foreign material from interior of pipe as instructed by pipe manufacturer and as directed by Engineer/Architect, Owner's Representative or Construction Manager.
- W. Install colored marker tape continuous over top of pipe; coordinate with Section 31 23 16 - Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction.

3.4 WATER AND SEWER SEPARATION

- A. Install water main at minimum required distances away from adjacent sanitary and storm sewers and laterals as stipulated by:
 - 1. State of Florida Department of Environmental Protection (FDEP) and local code if more stringent for materials for the Work of this Section.

3.5 TRACER WIRE INSTALLATION

- A. Install tracer wire continuous over top of pipe. Secure tracer wire to top of pipe with industrial strength tape; coordinate with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction.
- B. Lateral tracer wire originates and terminates in tracer wire access box located at right-of-way line. Install conductor tracer wire in one continuous loop.
- C. Tape conductor tracer wire to top of pipe at minimum 10-foot intervals. Wrapping conductor tracer wire around pipe is prohibited.
- D. Field test each locating wire after installation is completed.

3.6 RUBBER GASKET JOINTS

- A. Join pipe and fittings by means of a compression type push-on rubber gasket unless another joint type is specified on Drawings or in Contract Documents.
 - 1. Gasketed bell joint integral with pipe or fitting, AWWA C900, C905 or C907.
 - 2. Gasketed Coupling-double-gasketed coupling AWWA C900, C905 or C907.
 - 3. Gasketed bell joint integral with pipe or fitting, AWWA C111 and AWWA C600.
 - 4. Mechanical Joint - Gaskets and bolts manufactured in accordance with AWWA C110, C111 or C153.
- B. Wipe bell and spigot of each pipe clean and dry. Gaskets and sealing surfaces shall be clean prior to lubrication and assembly.
- C. Apply lubricant, furnished by or approved by pipe manufacturer, in accordance with manufacturer's published instructions.
- D. Assemble joints under conditions that ensure clean mating and sealing surfaces by using equipment, materials, and procedures in accordance with manufacturer's written recommendations.
- E. Assemble integral bell gasketed joints and gasket coupling joints by positioning elastomeric gasket in groove of bell or coupling, if gasket is not preinstalled by manufacturer, and inserting spigot end of pipe into bell or coupling.
- F. Use only gaskets supplied by pipe and fitting manufacturer with their pipe and fittings.
- G. Apply a thin film of manufacturer recommended non-toxic lubricant to inside surface of portion of gasket in contact with entering pipe.
- H. Place entering pipe in approximate alignment with receiving bell and insert until pipe end is lined up with setting line indicated on pipe exterior.
- I. Apply sufficient pressure on entering pipe to socket/spigot end in bell. Use care to protect end of pipe from damage:
 - 1. Use a leverage bar or other approved method on pipe 12 inches in diameter or smaller.
 - 2. Use a jack and two choker-slings or other approved method on pipe larger than 12 inches in diameter.
- J. Assemble mechanical joint in accordance with fitting manufacturer's written recommendations. Pipe spigot bevels may require shortening for use with mechanical joints or fitting joints.
- K. Whenever necessary, PVC pressure pipe of 12-inch diameter and less may accommodate longitudinal bending with the following limitations.
 - 1. Contractor shall block or brace pipe joints to ensure that bending of PVC pressure pipe does not result in axial deflection in gasketed or mechanical joints that exceeds manufacturer's published limits.
 - 2. Embedment Types 1 and 2 contained in AWWA C605 shall not be permitted for longitudinal bent pipe segments.
 - 3. Longitudinal bending in PVC pipe barrel shall not result in a bending radius more than maximum limits established in the following table.

ALLOWABLE BENDING FOR PVC PRESSURE PIPE

Nominal Size (Inches)	Minimum Curve Radius (Feet)	Offset (Inches)
4	56	17
6	88	12
8	108	9
10	138	7
12	164	6

- L. Whenever it is necessary to deflect ductile iron pipe from a straight line, either in vertical or horizontal plane, amount of deflection shall not exceed that shown in the following table for appropriate pipe length.

MAXIMUM JOINT DEFLECTION
FULL LENGTH DUCTILE IRON PIPE WITH RUBBER GASKET JOINTS

Pipe Size (Inches)	Maximum Permissible Deflection per Length (Inches)		Approximate Radius of Curve (Feet)	
	18'	20'	18'	20'
3	19	21	205	230
4	19	21	205	230
6	19	21	205	230
8	19	21	205	230
10	19	21	205	230
12	19	21	205	230
14	11	12	340	380
16	11	12	340	380
18	11	12	340	380
20	11	12	340	380
24	11	12	340	380
30	11	12	340	380
36	11	12	340	380
42	11	12	340	380
48		12		380
54		12		380
60		12		380
64		12		380

3.7 WATER AND SEWER SEPARATION

- A. Install water main at minimum required distances away from adjacent sanitary and storm sewers and laterals as stipulated by:
1. State of Florida Department of Environmental Protection (FDEP) and local code if more stringent for materials for the Work of this Section.

3.8 TRACER WIRE INSTALLATION

- A. Install tracer wire continuous over top of pipe. Secure tracer wire to top of pipe with industrial strength tape; coordinate with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction and Section 31 23 17 – Site Excavation, Backfill, and Compaction.
- B. Lateral tracer wire originates and terminates in tracer wire access box located at right-of-way line. Install conductor tracer wire in one continuous loop.
- C. Tape conductor tracer wire to top of pipe at minimum 10-foot intervals. Wrapping conductor tracer wire around pipe is prohibited.
- D. Field test each locating wire after installation is completed.

3.9 MECHANICAL JOINTS

- A. Clean foreign matter and paint last 8 inches of outside of spigot and inside of bell with a soap solution.
- B. Slip cast iron gland on spigot end with lip extension toward socket bell end.
- C. Place rubber gasket in spigot end with thick edge toward gland.
- D. Nuts and bolts used in joint assembly shall be corrosion resistant steel.
- E. Push entire section of pipe forward to seat spigot end in bell. Take care to locate gasket evenly around entire joint.
- F. Tighten nuts with a suitable torque-limiting wrench. Torque for various sizes of bolts shall be as follows:

<u>Joint Size</u>	<u>Bolt Size (Inches)</u>	<u>Range of Torque</u>
3-inch	5/8	40-60
4-24 inches	3/4	75-90
30-36 inches	1	100-120
42-48 inches	1-1/4	120-150

- G. Tighten nuts alternately in order to produce an equal pressure on all parts of gland.
- H. After a joint is assembled and securely tightened, completely coat nuts and bolts with an approved bituminous protective coating, Koppers Company, Inc. Bitumastic Super Tank or an approved equal.
- I. Whenever it is necessary to deflect pipe from a straight line, either in vertical or horizontal plane, amount of deflection shall not exceed that shown in the following table.

MAXIMUM JOINT DEFLECTION
MECHANICAL JOINT DUCTILE IRON PIPE

Pipe Size (Inches)	Maximum Permissible Deflection per Length (Inches)		Approximate Radius of Curve (Feet)	
	18'	20'	18'	20'
	3	31	35	125
4	31	35	125	140
6	27	30	145	160
8	20	22	195	220
10	20	22	195	220
12	20	22	195	220
14	13.5	15	285	320
16	13.5	15	285	320
18	11	12	340	380
20	11	12	340	380
24	9	10	450	500

3.10 FUSION JOINTS

A. Butt Fusion:

1. Persons making heat fusion joints shall have received training in manufacturer's recommended procedure.
2. Heat fusion equipment shall meet manufacturer's requirements including 400 degree F temperature and 75 psi interfacial fusion pressure. Equipment shall be capable of logging temperature and fusion pressure and displaying graphic representation of fusion cycle.
3. Clamp pipes to be joined in place in above ground fusion machine. Face each pipe to provide smooth, flat joining surfaces.
4. Heat pipe ends for time and to temperature recommended by pipe manufacturer for pipe diameter.
5. At end of heating time, carefully remove heater so as not to displace melt and bring pipe ends together within 3 seconds. Join with sufficient pressure to roll melt swell beads over to pipe surface. Maintain pressure for time recommended by pipe manufacturer for pipe diameter.
6. Allow an additional 3 minutes of cooling before removing from fusion machine and an additional 10 to 60 minutes, depending on pipe diameter, before rough handling or testing.

B. Electrofusion:

1. Slide adapter over pipe, place second pipe, and locate adapter over joint.
2. Connect processor fusion leads to adapter or fitting.
3. Use processor barcode wand to scan barcode on adapter or fitting.
4. Enter ambient temperature into processor.
5. Using temperature and barcode information, processor will heat embedded coils to fuse pipes.
6. Disconnect processor leads and allow fused pipes to cool.

3.11 CUTTING OF PLASTIC PIPE

- A. Cut pipe at right angles to centerline of pipe.
- B. Perform cutting in a neat workmanlike manner without damage to pipe and leaving a smooth end.
- C. Pipes may be cut with a circular saw or hand saw.
- D. Pipe spigot ends shall be deburred and beveled and insertion line shall be re-marked.
- E. Length and angle of field bevels shall match factory bevels.

3.12 CUTTING OF DUCTILE IRON PIPE

- A. Cut pipe at right angles to centerline of pipe.
- B. Perform cutting in a neat, workmanlike manner without damage to pipe and leaving a smooth end.
- C. Cut pipes with an approved mechanical cutter.
- D. Taper cut end of pipe to be used with rubber gasket joints by grinding or filing about 1/8-inch back at an angle of approximately 30 degrees with centerline of pipe, and remove any sharp or rough edges.

3.13 FITTINGS AND VALVES

- A. Provide fittings and valves as specified.
- B. Place valves with operating stems vertical, except place butterfly valves with operating stems horizontal.
- C. Pipes shall not carry full weight of valves or fittings.
- D. Provide fittings, valves, and valve boxes with individual support using minimum 16 x 8 x 4-inch solid concrete block set on a compacted trench bottom.
- E. Anchor valves for thrust and torque. Provide thrust or torque restraint in accordance with Section 33 05 19 – Pressure Pipe Restraints.

3.14 HYDRANT SETTING

- A. Provide hydrants, hydrant lead valves, fittings, and branch T-connectors with independent support of minimum 16 x 8 x 4-inch solid concrete block or 3000 psi formed concrete pad.
- B. Place crushed clear stone, Type A5 as specified in Section 31 05 16 – Aggregates for Earthwork, below base of hydrant to 6 inches above drain holes in hydrant stem.
- C. Set hydrant plumb and centerline of hydrant vertical.
- D. Solidly buttress hydrant against trench wall.

- E. Set lowest hose connection to utility standard dimension above proposed finished grade or, in absence of standard, to a minimum of 18 inches.

3.15 WATER SERVICE LATERALS

- A. Water Service Laterals, including tapping of main, shall be in accordance with Section 33 12 13 – Water Service Laterals.

3.16 THRUST RESTRAINT

- A. Thrust restrain water main in accordance with Section 33 05 19 – Pressure Pipe Restraints.

END OF SECTION 331013

SECTION 331100 - SITE WATER SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Site Piping.
2. Pipe Fittings.
3. Valves.
4. Fire Hydrants.
5. Domestic Water Services.

B. Related Sections:

1. Applicable provisions of Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
2. Section 31 05 16 - Aggregates for Earthwork.
3. Section 31 23 17 – Site Excavation, Backfill, and Compaction.
4. Division 22 – Plumbing.

1.2 REFERENCES

A. State of Florida Administrative Code, Department of Community Affairs Chapter 9B and International Plumbing Code, Current Edition.

B. American Society of Mechanical Engineers: (ASME)

1. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

C. ASTM International: (ASTM)

1. ASTM A276 – Standard Specification for Stainless Steel Bars and Shapes.
2. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
3. ASTM A575 - Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
4. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
5. ASTM C33 - Standard Specification for Concrete Aggregates.
6. ASTM C150 - Standard Specification for Portland Cement.
7. ASTM D2774 – Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
8. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
9. ASTM D 3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
10. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
11. ASTM F594 - Standard Specification for Stainless Steel Nuts.

D. American Welding Society: (AWS)

1. AWS A5.8 - Brazing Filler Metal.

E. American Water Works Association: (AWWA)

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C105 - Polyethylene Encasement for Ductile Iron Pipe Systems.
3. AWWA C110 - Ductile Iron and Grey Iron Fittings 3-In. Through 48-In., for Water.
4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C150 – Thickness Design of Ductile-Iron Pipe.
6. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
7. AWWA C153 - Ductile-Iron Compact Fittings, 3-In. Through 24-In., for Water Service.
8. AWWA C502 - Dry Barrel Fire Hydrants.
9. AWWA C504 - Rubber Seated Butterfly Valves.
10. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 In. through 24 In. NPS.
11. AWWA C509 - Resilient Seated Gate Valves for Water Supply Service.
12. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
13. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
14. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution.
15. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. Through 3 In., for Water Service.
16. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In., for Water Transmission and Distribution.
17. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 63 In., for Water Distribution and Transmission.

F. NSF International: (NSF)

1. NSF 14 - Plastics Piping System Components and Related Materials.
2. NSF 61 - Drinking Water System Components - Health Effects.

1.3 SUBMITTALS

- A. Division 01 – General Requirements, Section 01 33 00 - Submittal Procedures, Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
- C. Manufacturer's Instructions: Indicate special procedures required to install Products specified.
- D. Certificates: Certify that products meet or exceed specified requirements.

1.4 SUBMITTALS AT PROJECT CLOSEOUT

- A. Division 01 – General Requirements, Section 01 70 00 - Execution and Closeout Requirements Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.
- B. Division 01 – General Requirements, Section 01 70 00 - Execution and Closeout Requirements Section 01 78 23 - Operation and Maintenance Data: Submit operation and maintenance data.
- C. Division 01 – General Requirements, Section 01 70 00 - Execution and Closeout Requirements Section 01 78 39 – Project Record Documents: Submit Project Record Documents.
 1. Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.

2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with requirements of:
 1. State of Florida Administrative Code, Department of Community Affairs Chapter 9B and International Plumbing Code and local code if more stringent for materials and installation of the Work of this Section.

1.6 QUALITY ASSURANCE

- A. Perform work in accordance with requirements of Okaloosa County Water Utility for public connections and modifications where applicable.
- B. Valves and Hydrants: Mark manufacturer's name and pressure rating on body.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 01 – General Requirements, Section 01 60 00 – Product Requirements, Section 31 02 00 – General Requirements for Sitework.
- B. Deliver and store valves and gaskets in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.1 GENERAL

- A. An acceptable certifying organization shall evaluate, test, and certify products intended for contact with potable water for conformance with NSF 61 and health effects portion of NSF 14.
- B. Pipe, fittings, valves, hydrants, and valve boxes shall be manufactured in the United States of America.
- C. Provide materials in accordance with:
 1. State of Florida Administrative Code, Department of Community Affairs Chapter 9B and International Plumbing Code and local code if more stringent for materials for the Work of this Section.

2.2 WATER PIPE

- A. Ductile Iron Pipe: AWWA C151, Ductile Iron Pipe for water [with AWWA C104 Cement Lining. [Thickness Class 52 in accordance with AWWA C150].
 1. Fittings: Ductile iron, [AWWA C110 Standard] [or] [AWWA C153 Compact].
 2. Joints: AWWA C111, Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings Mechanical Joint or Push on Joint.
 3. Corrosion Protection: AWWA C105 polyethylene encasement double layer, half lapped, 8 mil polyethylene.
 4. Ductile Iron Pipe and Fitting Manufacturers:
 - a. American Cast Iron Pipe Company.

- b. Griffin Pipe Products Company.
 - c. McWane Cast Iron Pipe Company.
 - d. Tyler Pipe Company.
 - e. U.S. Pipe & Foundry Company Division of Mueller Water Products. Inc.
 - f. Substitutions: In accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework.
- B. PVC Pipe: AWWA C900, Class 100, DR 25, 150, DR 18, 200, or DR 14, AWWA C905, DR-18, 235 psi pressure rating or DR-21, 200 psi pressure rating or DR-25, 165 psi pressure rating or DR-32.5, 125 psi pressure rating or DR-41, 100 psi pressure rating:
- 1. PVC Pipe and Fitting Manufacturers:
 - a. Diamond Plastics Corporation.
 - b. JM Eagle Company.
 - c. North American Pipe Corporation.
 - d. Substitutions in accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework.
 - 2. Fittings: Ductile iron, AWWA C110 Standard or AWWA C153 Compact or PVC, AWWA C907.
 - 3. Joints: In accordance with ASTM D3139 using ASTM F477 elastomeric gaskets.
- C. Polyethylene Tubing: AWWA C901.
- 1. Manufacturers:
 - a. A-D Technologies.
 - b. Everett J. Prescott, Inc.
 - c. JM Eagle.
 - d. Substitutions in accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework.
 - 2. AWWA C901, ASTM D3350 PE 3408 material, dimension ratio (DR) 17, PC 100, [13.5, PC 125, 11, PC 160, 9, PC 200.
 - 3. Joints: Butt fusion.
- D. Polyethylene (PE) Pressure Pipe: AWWA C906, Pressure Class PC100, PC125, PC160, PC200, ASTM D3350 PE3408 Material.
- 1. Manufacturers:
 - a. Charter Plastics, Inc.
 - b. Performance Pipe, Division of Chevron Phillips Chemical Company LLC.
 - c. PolyPipe, Inc.
 - d. Substitutions in accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework.
 - 2. Fittings: AWWA C906, molded or fabricated.
 - 3. Joints: Butt fusion or Electrofusion.
- E. Copper Tubing:
- 1. ASTM B88, Seamless Copper Water Tube, Type K, Form A Straight or B Coiled, annealed.
 - 2. Fittings: ASME B16.22, wrought copper pressure fitting.
 - 3. Joints: Compression connection or AWS A5.8, BCuP silver braze.

2.3 GATE VALVES

- A. Manufacturers:

1. American Flow Control.
2. Kennedy Valve Company, Division of McWane, Inc.
3. Mueller Company, Division of Mueller Water Products, Inc.
4. U.S. Pipe and Foundry Company, Division of Mueller Water Products, Inc.
5. Substitutions in accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework.

- B. AWWA C509, Iron body, bronze trim, non-rising stem with square nut, single resilient wedge, mechanical joint ends, control rod, post indicator, extension box and valve key.

2.4 SWING CHECK VALVES - 2 INCH TO 24 INCH

A. Manufacturers:

1. Kennedy Valve Company, Division of McWane, Inc.
2. Mueller Company, Division of Mueller Water Products, Inc.
3. Henry Pratt Company, Division of Mueller Water Products, Inc.
4. Substitutions in accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework.

- B. AWWA C508, iron body, bronze trim, 45 or 22 degree swing disc, renewable disc and seat, flanged ends.

2.5 BUTTERFLY VALVES - FROM 2 INCH TO 24 INCH

A. Manufacturers:

1. Mueller Company, Division of Mueller Water Products, Inc.
2. Clow Valve Company, Division of McWane, Inc.
3. Henry Pratt Company, Division of Mueller Water Products, Inc.
4. Substitutions in accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework.

- B. AWWA C504, iron body, bronze disc, resilient replaceable seat, water or lug ends, ten or infinite position lever handle.

2.6 CAST IRON VALVE BOXES

A. Manufacturers:

1. Bingham & Taylor Corporation.
2. Tyler Pipe Company.
3. Substitutions in accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework.

- B. Cast Iron Valve Box: 5-1/4 inch diameter shaft; round base; 5-1/4 inch drop lid marked "WATER"; length of assembly sized to span top of main to finished grade with a minimum adjustment remaining for an additional 3 inches.

2.7 VALVE BOX ADAPTERS

- A. Gate Valve Adaptor: Epoxy-coated, 1/4-inch steel with 1/2-inch rubber gasket, size to fit valve. Similar and equal to adaptors manufactured by Adaptor, Inc., West Allis, WI.

- B. Butterfly Valve Adaptor: Epoxy-coated, 1/4-inch steel, size to fit valve. Similar and equal to adaptors manufactured by Adaptor, Inc., West Allis, WI.

2.8 HYDRANTS

- A. Manufacturers:
 - 1. American Flow Control - Waterous Pacer WB-67-250.
 - 2. Clow, Division of McWane Corporation – Medallion.
 - 3. Kennedy Valve, Division of McWane, Inc. – Guardian K-81D.
 - 4. Mueller Company, Division of Mueller Water Products, Inc. – Super Centurion A423.
 - 5. U.S. Pipe and Foundry Company, Division of Mueller Water Products, Inc. – [Metropolitan/M-94] [Sentinel 250].
 - 6. Substitutions in accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework.
- B. Hydrant: Type as required by Municipal Utility.
- C. Hydrant: Hydrant materials and manufacture in accordance with AWWA C502; main valve shall be synthetic rubber reinforced with steel and shall close with water pressure; O-ring seal between upper and lower barrels; all operating parts including valve seat shall remove through barrel; one pumper connection sized to municipal standard; two 2-1/2 inch nozzles shall be 1/4 turn type with O-ring seals and stainless steel retaining screws; national standard fire hose screw threads; breakaway traffic flange; 1-inch bronze operating nut, opening left; 6-inch mechanical joint; minimum six foot cover.
- D. Hydrant Extensions: Fabricate in multiples of 6 inches with rod and coupling to increase barrel length. Maximum of one (1) extension per hydrant may be used. If additional extension is necessary on hydrant with existing extension, remove existing extension and replace with single, adequate extension.
- E. Hose and Streamer Connection: Match sizes with municipal utility, two hose nozzles, one pumper nozzle.
- F. Finish: Primer and two coats of enamel in color required by Municipal Utility.

2.9 SERVICE FITTINGS

- A. Manufacturers:
 - 1. Mueller Company.
 - 2. Ford Meter Box Company, Inc.
 - 3. A.Y. McDonald Mfg. Co.
 - 4. Substitutions in accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework.
- B. Components:
 - 1. Saddles:
 - a. Mueller Company, H-10500 Series.
 - b. The Ford Meter Box Company, Style F202.
 - c. A.Y. McDonald Mfg. Co, Model 3825.
 - d. Substitutions in accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework.

2. Corporation Stops:
 - a. Mueller Company, H-15000 Series.
 - b. The Ford Meter Box Company, FB-600.
 - c. A.Y. McDonald Mfg. Co. 4701B.
 - d. Substitutions in accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework.
3. Curb Stops:
 - a. Mueller Company, H-15154 Series.
 - b. The Ford Meter Box Company, B22M Series.
 - c. A.Y. McDonald Mfg. Co., 6104 Series.
 - d. Substitutions in accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework.
4. Curb Boxes (1-inch services):
 - a. Mueller Company, Series H-10302.
 - b. The Ford Meter Box Company, Series EM2-XX-56.
 - c. A. Y. McDonald Mfg., Co., Series 5614.
 - d. Substitutions in accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework.
5. Curb Boxes (1-1/4 inch and 1-1/2 inch services):
 - a. Mueller Company, Series H-10304.
 - b. The Ford Meter Box Company, Series EM2-XX-57.
 - c. A. Y. McDonald Mfg., Co., Series 5615.
 - d. Substitutions in accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework

2.10 ACCESSORIES

- A. Thrust Restraint:
 1. Concrete: ASTM C150 Portland cement and ASTM C33 aggregates, air-entrained concrete with minimum compressive strength of 3000 psi.
 2. Wedge-Action Joint Restraints: Cast iron, circular or a pair of semi-circles with wedges that grip ductile iron or PVC pipe. Product shall be Megalug as manufactured by EBAA Iron Sales, Eastland, TX, Uni-Flange as manufactured by Ford Meter Box Company, Inc., Wabash, IN., or an approved equal.
 3. Rod Restraints: ASTM A575 carbon steel, threaded rods with bitumastic coating and ASTM A563 nuts or ASTM A276 stainless steel threaded rods with ASTM F594 nuts.
 4. Anchor Pipe: Ductile iron, thickness class 53, mechanical joint.
- B. Backflow Preventer:
 1. FEBCO, CMB Industries, Inc., Fresno, CA.
 2. Watts Regulator Company, North Andover, MA.
 3. Zurn/Wilkins Water Control Products, Paso Robles, CA.
 4. Substitutions in accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework.
- C. Meter:
 1. Badger Meter, Inc., Milwaukee, WI.
 2. ABB Water Meter, Inc., Ocala, FL.
 3. Sensus Technologies, Inc., Uniontown, PA.
 4. Substitutions in accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework.

D. Pipe Location Materials:

1. Identification Warning Tape: Aluminum underground warning tape, 2-inch width. Color-Bright Blue, warning message "Caution Buried WATER MAIN Below" to repeat every 30 inches.
2. Tracer Wire: 45-mil solid copper, No. 12 HMW-PE yellow jacket coating. Installed to enable electronic locating of underground utility.

2.11 TRACER WIRE MATERIALS

A. Mark non-conductive lateral pipes with a locating wire system.

B. Locating wire system consists of the following:

1. Tracer Wire: 45-mil solid copper, No. 12 HMW-PE yellow jacket coating. Install to enable electronic locating of underground utility.
2. Tracer Wire Locating Box: 2-1/2-inch diameter, minimum, ABS pipe with 2 point terminal box and cast iron cover.
 - a. Manufacturer: Valco, Inc., Model C.P. Mini Box, or an approved equal.]

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with Type A2 aggregate as specified in Section 31 05 16 – Aggregates for Earthwork.
- B. Remove large stones or other hard matter that could damage pipe or impede consistent backfilling or compaction.
- C. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- D. Remove scale and dirt on inside and outside before assembly.
- E. Prepare pipe connections to equipment with flanges or unions.

3.3 BEDDING

- A. Excavate pipe trench in accordance with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Form and place concrete for pipe thrust restraints at any change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide [] square feet thrust restraint bearing on subsoil.
- C. Place bedding material in trench bottom, level fill materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent modified Proctor density.

- D. Backfill around sides and top of pipe with bedding material to a depth of 18 inches above pipe, and compact to 95 percent modified Proctor density.
- E. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

- A. Maintain separation of water main from sewer piping in accordance with:
 - 1. State of Florida Administrative Code, Department of Community Affairs Chapter 9B and International Plumbing Code and local code if more stringent for installation of the Work of this Section.]
- B. Install pipe to indicated elevation to within tolerance of 5/8-inch.
- C. Install ductile iron piping and fittings in accordance with AWWA C600.
- D. Install PVC pipe in accordance with AWWA C605.
- E. Install [PVC] [polyethylene] pipe in accordance with ASTM D2774.
- F. Route pipe in straight line.
- G. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- H. Install access fittings to permit disinfection of water system performed under Section 33 13 00 – Water Main Disinfection.
- I. Slope water pipe and position drains at low points.
- J. Form and place concrete for thrust restraints at each elbow or change of direction of pipe main.
- K. Establish elevations of buried piping to ensure not less than 3 foot of cover.
- L. Install tracer wire continuous over top of pipe. Secure tracer wire to top of pipe with industrial strength tape; coordinate with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction.
- M. Backfill trench in accordance with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction. Do not displace or damage pipe when compacting.

3.5 INSTALLATION - VALVES AND HYDRANTS

- A. Set valves on solid concrete block bearing.
- B. Center and plumb valve box over valve. Set box cover flush with finished grade.
- C. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway.
- D. Set hydrants to grade, with nozzles a minimum of 20 inches above finished grade.
- E. Locate hydrant valve on hydrant lead a minimum of 24 inches from hydrant.

- F. Provide a drainage pit 36 inches square by 24 inches deep filled with [6] inches of Type A5 clear stone, as specified in Section 31 05 16 – Aggregates for Earthwork. Encase elbow of hydrant in clear stone to 6 inches above drain opening. Do not connect drain opening to sewer.

3.6 TRACER WIRE INSTALLATION

- A. Lateral tracer wire originates and terminates in tracer wire access box located at right-of-way line. Install conductor tracer wire in one continuous loop.
- B. Tape conductor tracer wire to top of pipe at minimum 10-foot intervals. Wrapping conductor tracer wire around pipe is prohibited.
- C. Field test each locating wire after installation is completed.

3.7 DISINFECTION OF POTABLE WATER SYSTEM PIPING

- A. Flush and disinfect system in accordance with Section 33 13 00 – Water Main Disinfection.

3.8 SERVICE CONNECTIONS

- A. Provide water service [to utility company requirements with reduced pressure backflow preventer and water meter yoke with by-pass valves and sand strainer.
- B. Provide sleeve in retaining wall for service main. Support with reinforced concrete bridge. Caulk enlarged sleeve watertight.
- C. Provide 18 gage galvanized sheet metal sleeve surrounding service main to 6 inches above floor and 6 feet minimum below grade. Size for minimum of 2 inches of foam insulation.

3.9 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements, Section 01 40 00 - Quality Requirements, Section 31 02 00 – General Requirements for Sitework: Field inspection and testing.
- B. Request inspection prior to [and immediately after] placing bedding.
- C. Perform moisture content testing and compaction testing in accordance with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction.
- D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
- E. Frequency of Tests: As determined by Engineer/Architect, Owner’s Representative, Construction Manager or Testing Agency.
- F. Pressure Test: Test in accordance with Section 33 17 00 – Water Main Testing, and
 - 1. State of Florida Administrative Code, Department of Community Affairs Chapter 9B and International Plumbing Code, and local code if more stringent for installation of the Work of this Section.

3.10 PROTECTION OF FINISHED WORK

- A. Division 01 – General Requirements, Section 01 70 00 - Execution and Closeout Requirements, Section 31 02 00 – General Requirements for Sitework: Protecting installed work.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 331100

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SECTION 331119 - FIRE SUPPRESSION WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fire Service Main Installation.
 - 2. Fittings.
 - 3. Hydrants.
 - 4. Fire Department Connections.
 - 5. Boxes.

- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
 - 2. Section 31 05 16 – Aggregates for Earthwork.
 - 3. Section 31 23 17 – Site Excavation, Backfill, and Compaction.
 - 4. Section 33 13 16 – Corrosion Control - Pipe and Fittings.

1.2 REFERENCES

- A. State of Florida Administrative Code, Department of Community Affairs Chapter 9B and International Plumbing Code, Current Edition.

- B. ASTM International: (ASTM)
 - 1. ASTM A276 – Standard Specification for Stainless Steel Bars.
 - 2. ASTM A563 – Standard Specification for Carbon and Alloy Steel Nuts.
 - 3. ASTM A575 – Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
 - 4. ASTM C33 - Standard Specification for Concrete Aggregates.
 - 5. ASTM C150 – Standard Specification for Portland Cement.
 - 6. ASTM D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 - 7. ASTM D4976 – Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
 - 8. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - 9. ASTM F594 – Standard Specification for Stainless Steel Nuts.

- C. American Water Works Association: (AWWA)
 - 1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 - 2. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.
 - 3. AWWA C110 - Ductile Iron and Gray-Iron Fittings, 3 Inches Through 48 Inches (75 mm Through 1200 mm) for Water.
 - 4. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast, for Water and Other Liquids.
 - 5. AWWA C153 - Ductile Iron Compact Fittings, 3 Inches Through 24 Inches (76 mm Through 610 mm) and 54 Inches through 61 Inches (1,400 mm Through 1,600 mm), for Water Service.
 - 6. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.

7. AWWA C502 - Dry Barrel Fire Hydrants.
8. AWWA C504 - Rubber-Seated Butterfly Valves.
9. AWWA C509 - Resilient-Seated Gates Valves for Water Supply Service.
10. AWWA C550 - Protective Epoxy Interior Coatings for Valves and Hydrants.
11. AWWA C600 - Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.
12. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings.
13. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution.
14. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm), for Water Transmission and Distribution.

D. FM Global: (FM)

1. FM 1110 – Approval Standard for Indicator Posts.
2. FM 1120/1130 - Approval Standard for Fire Service Water Control Valves (OS&Y and NRS Type Gate Valves).

E. National Fire Protection Association: (NFPA)

1. NFPA-24 - Installation of Private Fire Service Mains and Their Appurtenances.

F. NSF International: (NSF)

1. NSF 14 - Plastics Piping System Components and Related Materials.
2. NSF 61 - Drinking Water System Components - Health Effects.

G. Underwriters Laboratories, Inc.: (UL).

1. UL-262 - Standard for Gate Valves for Fire-Protection Service.
2. UL 789 - Indicator Posts for Fire-Protection Service.

1.3 SUBMITTALS

- A. Division 01 – General Requirements, Section 01 33 00 - Submittal Procedures, Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.
- B. Product Data: Submit data indicating pipe, joints, fittings, and pipe accessories.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.4 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with requirements of:
 1. State of Florida Administrative Code, Department of Community Affairs Chapter 9B and International Plumbing Code and local code if more stringent for materials and installation of the Work of this Section.
 2. Other local, state, and federal agencies having jurisdiction related to Work of this Section.
- B. Comply with NFPA 24 where requirements are more stringent.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Load and unload pipe, fittings, valves, hydrants, and accessories by lifting with hoists or skidding to avoid shock or damage.
- B. Under no circumstances shall material be dropped.
- C. Do not roll or skid pipe handled on skidways against other pipe or ground.
- D. Pad slings, hooks, or pipe tongs and use to prevent damage to exterior surface or internal lining of pipe.
- E. Keep stored material free of damage.
- F. Keep interior of pipe, fittings, and other appurtenances free from dirt or foreign matter.
- G. Valves and hydrants shall be drained and stored to protect them from damage by freezing.
- H. Use timbers to separate pipe stored on ground from ground and other pipe.
- I. Store gaskets for mechanical and push-on joints in cool location out of direct sunlight and contact with petroleum products.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Pipe shall not be laid in water.
- B. Pipe shall not be laid in trenches where, in opinion of Engineer/Architect, Owner's Representative or Construction Manager, conditions are unsuitable.

PART 2 - PRODUCTS

2.1 FIELD EXAMINATION

- A. Materials used in construction of water mains shall be field inspected and accepted prior to installation.
- B. Carefully examine pipe, fittings, valves, hydrants, and other appurtenances for damage and other defects immediately before installation.
- C. Mark defective materials and hold for inspection by of Engineer/Architect, Owner's Representative or Construction Manager, who may prescribe corrective repairs or reject materials.

2.2 DUCTILE IRON PIPE WATER MAIN

- A. Ductile Iron Pipe:
 - 1. Pipe shall be centrifugally cast in metal or sand-lined molds.
 - 2. Pipe shall be designed with bell and spigot ends designed for rubber gasket push-on joints.
 - 3. Pipe shall have a cement mortar lining and internal and external bituminous coats.
 - 4. Pipe shall conform to requirements of AWWA C151.

B. Fittings:

1. Fittings shall be centrifugally cast in metal or sand-lined molds.
2. Fittings shall be designed with bell and spigot ends designed for rubber gasket push-on joints.
3. Fittings shall have a cement mortar lining and internal and external bituminous coats.
4. Fittings shall conform to requirements of AWWA C110.
5. Compact fittings [conforming to AWWA C153] will [not] be acceptable.
6. Wherever mechanical joints are used, joint bolts and nuts shall be corrosion resistant steel, NSS Technologies, Inc. Core-Blue or approved equal.
7. In no case shall fitting grade be rated less than adjoining pipe.
8. Fittings shall be from same manufacturer as ductile iron pipe and shall be manufactured in the United States.

C. Joints:

1. Join pipe and fittings by means of compression type rubber gasket [push on] [flanged] [mechanical] [river crossing] joints.
2. Nuts and bolts shall be corrosion resistant steel, NSS Technologies, Inc. Core-Blue or approved equal.
3. Equip joint with a heavy-duty rubber gasket designed to form a pressure-tight seal.
4. Allow a maximum deflection of 15 degrees.

D. Cement Mortar Lining:

1. Pipe and fittings shall be cement lined.
2. Cement lining shall conform to AWWA C104.
3. Thickness of lining shall be a minimum of 0.0625-inch for 4-inch to 12-inch pipe, and 0.1875-inch for 14-inch to 24-inch pipe.

E. Disinfection:

1. Take precautions to protect interiors of pipes, fittings, and valves against contamination.
2. Perform disinfection in accordance with Section 33 13 00 – Water Main Disinfection.

F. Coatings:

1. Inside Coating:
 - a. Coat entire inside of socket, including gasket cavity, with a minimum of 8 mils of epoxy to prevent joint corrosion.
 - b. Seal coat pipe over cement lining.
2. Outside Coating:
 - a. Coat last 6 inches of spigot, including spigot face with 8 mils of epoxy to prevent joint corrosion.
 - b. Coating shall be an asphaltic coating a minimum of 1 mil thick.

G. Corrosion Control:

1. Encase pipe in polyethylene film in accordance with requirements of AWWA C105.
2. Polyethylene Film: Polyethylene film conforming to ASTM D4976, Type I, Class B, color black, Grade E-1, 1200 psi tensile strength, minimum thickness of 8 mil. Tube diameter or sheet width shall conform to AWWA C105.
3. Bolts and Nuts: Corrosion resistant alloyed nuts and bolts for mechanical joints.

2.3 POLY VINYL CHLORIDE WATER MAIN

A. Pipe:

1. PVC Pipe: AWWA C900 Poly (Vinyl Chloride) (PVC); nominal diameter 4-inch through 12-inch; DR-25, pressure class 100; DR-18, pressure class 150; DR-14, pressure class 200; as designated on Drawings; integral gasketed joint.
2. PVC Pipe: AWWA C905 Poly (Vinyl Chloride) (PVC); DR-18, 235 psi pressure rating, DR-21, 200 psi pressure rating, DR-25, 165 psi pressure rating, DR-32.5, 125 psi pressure rating, DR-41, 100 psi pressure rating; nominal diameter 14-inch through 48-inch with cast iron outside diameter, as designated on Drawings; integral bell gasketed joint.

B. Fittings:

1. Fabricate fittings shall be fabricated from polyvinyl chloride and conform to AWWA C900; nominal diameter 4-inch to 12-inch or C905; nominal diameter 14-inch to 48-inch.

C. Fittings:

1. Fabricate fittings from ductile iron, conform to AWWA C110 or AWWA C153, and provide mechanical joints.
2. Connect ductile iron fittings to PVC pipe with mechanical joint restraints similar and equal to those manufactured by EBAA Iron Sales, Inc., Ford Meter Box Company, Inc., or an approved equal.
3. Pipe used in fabricated fittings shall meet quality and dimensional requirements listed in standard for that pipe.
4. Pipe used in fabricated fittings shall have a wall thickness equal to or greater than wall thickness of pipes to which fitting (or that part of fitting) is joined.
5. No part of spur or branch shall protrude into waterway of fitting more than 0.070 inch.
6. No fitting shall have an inside diameter dimension smaller than base inside diameter for that pipe size and DR.

D. Joints:

1. Flexible elastomeric seals shall comply with requirements of ASTM F477 natural or synthetic rubber for push-on joints that require no internal or external pressure to effect initial seal.
2. Lubricant, if used, shall be of such composition that it will in no way damage gasket or pipe due to prolonged exposure and shall not affect sealing capability of gasket.
3. Make joints in accordance with ASTM D3139.

2.4 PIPE LOCATION MATERIALS

- A. Identification Warning Tape: Aluminum underground warning tape, 2-inch width. Color-Bright Blue, warning message "Caution Buried WATER MAIN Below" to repeat every 30 inches.
- B. Tracer Wire: 45-mil solid copper, No. 12 HMW-PE yellow jacket coating. Installed to enable electronic locating of underground utility.

2.5 TRACER WIRE MATERIALS

- A. Mark non-conductive lateral pipes with a locating wire system.
- B. Locating wire system consists of the following:
 1. Tracer Wire: 45-mil solid copper, No. 12 HMW-PE yellow jacket coating. Install to enable electronic locating of underground utility.
 2. Tracer Wire Locating Box: 2-1/2-inch diameter, minimum, ABS pipe with 2-point terminal box and cast iron cover.

- a. Manufacturer: Valco, Inc., Model C.P. Mini Box, or an approved equal.

2.6 VALVES AND BOXES

A. Manufacturers - Resilient-Seated Gate Valves:

1. Valve Division of McWane, Inc. - Kennedy Resilient Seat Gate Valve - Ken-Seal II.
2. American Flow Control – Resilient Wedge Gate Valve – Series 500.
3. Mueller Company - Resilient Wedge Gate Valve – 2360 Series.
4. Substitutions: In accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework.

B. Materials - Resilient-Seated Gate Valves:

1. Resilient Seated Gate Valve: Conform to AWWA C509; non-rising bronze stem, 200 psi working pressure; internal parts accessible without removing main body from pressure line; internal cast iron surfaces to be coated with 2 coats of corrosion resistant coating; internal diameter of valve equal to or greater than connection pipe diameter; valve opens counter-clockwise[mechanical joint ends, push-on joint ends; furnished with 2 inch operating nut.

C. Manufacturers - Butterfly Valves:

1. DeZURIK, Division of Sartell Valves, Inc.
2. Henry Pratt Company.
3. Mueller Company.
4. Substitutions: In accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework.

D. Material - Butterfly Valves:

1. Butterfly Valve: Conform to AWWA C504; cast iron body and disc; Type 304 stainless steel shaft; synthetic rubber seat simultaneously molded in, vulcanized and bonded to body; self-locking, manual operator with a 2-inch square traveling nut, closing with a counter-clockwise rotation, designed to hold valve in any intermediate position between full open and fully closed; pressure class 150B; internal cast iron surfaces to be coated with two coats of corrosion resistant coating; internal diameter of valve equal to or greater than connection pipe diameter; mechanical joint ends.

E. Post Indicator Valves:

1. Post Indicator: From same source as resilient wedge gate valve or compatible thereto; meeting UL 789 and FM Global approved; sized to fit valve with attachment hardware; post and rod extension assemblies based on location and grade; open and shut plate; supervisory switch; minimum dimension 38-inches finished grade to top of operator; exterior finished in accordance with AWWA C509.

F. Protective Finishes:

1. On valves 3 through 16 inches, apply standard AWWA coating, 2 coats asphalt varnish, in accordance with AWWA C509.
2. On valves 20 through 60 inches, apply standard AWWA coatings, 2 coats asphalt varnish, in accordance with AWWA C500 are acceptable for all but final exterior coat, after complete assembly.
3. Final exterior coat shall be an epoxy conforming to ASTM C550 applied to exposed ferrous elements, except for stainless steel.

G. Valve Box Adaptors:

1. Gate Valve Adaptor: Epoxy-coated, 1/4-inch steel with 1/2-inch rubber gasket, size to fit valve. Similar and equal to adaptors manufactured by Adaptor, Inc., West Allis, WI.
2. Butterfly Valve Adaptor: Epoxy-coated, 1/4-inch steel, size to fit valve. Similar and equal to adaptors manufactured by Adaptor, Inc., West Allis, WI.

H. Manufacturers - Cast Iron Valve Boxes:

1. Bingham & Taylor Corporation.
2. Tyler Pipe Company.
3. Substitutions in accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework.

I. Valve Box Materials:

1. Cast Iron Valve Box: 5-1/4 inch diameter shaft; round base; 5-1/4 inch drop lid marked "WATER"; length of assembly sized to span top of main to finished grade with a minimum adjustment remaining for an additional 3 inches. Valve boxes shall be manufactured in the United States.

2.7 HYDRANTS

A. Manufacturer:

1. Make and model of hydrant shall be standard used by Municipal Water Utility and/or local Fire Department.
2. American Flow Control - Waterous Pacer WB-67-250.
3. Clow, Division of McWane Corporation – Medallion.
4. Kennedy Valve, Division of McWane, Inc. – Guardian K-81D.
5. Mueller Company Division of Mueller Water Products, Inc. – Super Centurion A423.
6. U.S. Pipe and Foundry Company Division of Mueller Water Products, Inc. – [Metropolitan/ M-94] [Sentinel 250].
7. Substitutions in accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework.

B. Hydrant:

1. Hydrant materials and manufacture in accordance with AWWA C502;
2. Main valve shall be synthetic rubber reinforced with steel and shall close with water pressure;
3. O-ring seal between upper and lower barrels;
4. Operating parts including valve seat shall remove through barrel;
5. Nozzles shall be 1/4 turn type with O-ring seals and stainless steel retaining screws;
6. National standard fire hose screw threads; breakaway traffic flange;
7. One-inch bronze operating nut, opening left; 6-inch mechanical joint; minimum six-foot cover.

C. Hydrant Extensions:

1. Fabricate in multiples of 6 inches with rod and coupling to increase barrel length.
2. Maximum of one (1) extension per hydrant may be used.
3. If additional extension is necessary on hydrant with existing extension, remove existing extension and replace with single, adequate extension.

D. Hose and Streamer Connection: Match sizes with municipal utility, two hose nozzles, and one pumper connection.

- E. Finish: Primer and two coats of enamel in color required by Municipality.

2.8 PIPE RESTRAINT MATERIALS

- A. Buttress Concrete: ASTM C150 Portland cement and ASTM C33 aggregates, air-entrained concrete with minimum compressive strength of 3000 psi.
- B. Wedge-Action Joint Restraints: Cast iron, circular or a pair of semi-circles with wedges that grip ductile iron or PVC pipe. Product shall be similar and equal to Megalug as manufactured by EBAA Iron Sales, Uni-Flange as manufactured by Ford Meter Box Company, Inc., or an approved equal.
- C. Rod Restraints: ASTM A575 carbon steel, threaded rods with bitumastic coating and ASTM A563 nuts or ASTM A276 stainless steel threaded rods with ASTM F594 nuts.
- D. Anchor Pipe: Ductile iron, thickness class 53, mechanical joints.

PART 3 - EXECUTION

3.1 NOTIFICATION

- A. Contractor, prior to any excavation work, shall notify (1) a designated locating service; (2) utilities, governmental agencies, and entities, known to, or which can reasonably be assumed to have above or below ground pipe, conduit cables, structures, or similar items within limits of project; to locate and mark location of such items.
- B. In accordance with Florida Statutes Chapter 556, "Underground Facility Damage Prevention and Safety Act," every "Person" as defined in 556.102(9) shall be solely responsible to provide advance notice to "Sunshine State One-Call of Florida, Inc." (800-432-4770) not more than five nor less than two working days prior to commencement of any Excavation or Demolition, as defined in the statute, required to perform work contained in this Project, and further said "Person" shall comply with other requirements of this Statute relative to Excavator's Work.

3.2 VERIFICATION OF CONDITIONS

- A. Fire mains shall be laid and maintained to lines and grades established by Drawings with fittings, valves, tapped or bossed outlets and hydrants at required location.

3.3 PROTECTION

- A. Exercise care during excavation to avoid damage to existing structures.

3.4 INSTALLATION OF PIPE

- A. Trench preparation, in conformance with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction, shall proceed in advance of pipe installation for only as far as stated.
- B. Contractor shall not deviate from type of excavation indicated on drawings or in Contract Documents without written approval of of Engineer/Architect, Owner's Representative or

Construction Manager, except in case of roadways, driveways, and obstructions requiring short tunnel sections that may have been indicated on Drawings as open trench sections.

- C. Support tunnel sections exceeding two feet in length in accordance with applicable codes.
- D. Install water mains without use of wood blocking.
- E. Carefully lower pipe, fittings, valves, and hydrants trench by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to water main materials and protect coatings and linings.
- F. Lay pipe with bell ends facing direction of laying. When grade exceeds 2 feet of rise per 100 feet of trench, bells shall face upgrade.
- G. Provide holes for bells at each joint but shall be no larger than necessary for joint assembly and assurance that pipe shall bear throughout its full length and not be supported by blocks or bell ends.
- H. When rock is encountered, remove rock to provide a clearance of at least 6 inches below and on each side of pipe, valves, and fittings for pipe sizes 24 inches or smaller, and 9 inches for pipe sizes 30 inches and larger.
- I. When excavation is completed, place a layer of appropriate backfill material, conforming to Section 31 23 16 - Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction, on bottom of trench to depths indicated, leveled, and tamped.
- J. Take every precaution to prevent foreign material from entering pipe while it is being placed in line.
- K. If pipe laying crew cannot put pipe into trench and in place without getting earth into it, of Engineer/Architect, Owner's Representative or Construction Manager may require that before lowering pipe into trench, a heavy, tightly woven canvas bag of suitable size be placed over each end and left there until connection is to be made to adjacent pipe.
- L. No debris, tools, clothing, or other materials shall be placed in pipe during laying operations.
- M. Assemble joint and bring pipe to correct line and grade as each length of pipe is placed in trench.
- N. Take precautions to prevent foreign materials from entering joint space and carefully check joint recess for foreign material before gasket is installed.
- O. Secure pipe in place with bedding material, keeping bell end open. Remove pipe and fittings which do not allow a sufficient and uniform space for joints and replace with pipe and fittings of proper dimensions to insure such uniform space.
- P. At times when pipe laying is not in progress, close open ends of pipe by a water tight plug or other means approved by of Engineer/Architect, Owner's Representative or Construction Manager. This provision shall apply during noon hour as well as overnight.
- Q. If water is in trench, seal shall remain in place until trench is pumped completely dry.

- R. Whenever it becomes necessary to lay a main over, under, or around a known obstruction, Contractor will furnish and install required fittings. Laying of such fittings will be paid for at unit price bid for each size of main. No additional compensation will be paid to Contractor of any expenses incurred because of such obstruction.
- S. When an unknown underground structure interferes with work to such an extent that an alteration of work plan is required, which alteration results in a change in cost to Contractor, of Engineer/Architect, Owner’s Representative or Construction Manager will issue a written order for such altered work, specifying basis of payment or credit for such altered work.
- T. Keep interior and exterior of pipe clean and free from foreign material before being installed. Provide necessary means to wipe, brush, swab, or air blast or remove any foreign material from interior of pipe as directed of Engineer/Architect, Owner’s Representative or Construction Manager.
- U. Restrain tees, plugs, caps, bends and hydrant branches against movement.

3.5 RUBBER GASKET JOINTS

- A. Join pipe and fittings by means of a compression type push-on rubber gasket unless another type joint is specified on Drawings or in Contract Documents.
- B. Wipe bell and spigot of each pipe clean and dry.
- C. Insert gasket, large round end first, into gasket seat inside of bell.
- D. Apply a thin film of non-toxic lubricant recommended by pipe manufacturer to inside surface of that portion of gasket that comes in contact with entering pipe.
- E. Place entering pipe in approximate alignment with receiving bell and insert until it just makes contact with gasket.
- F. Apply sufficient pressure on entering pipe until spigot end sockets in bell. This can be accomplished by one of following methods:
 - 1. Leverage bar or other approved method shall be used on pipe 12 inches in diameter or smaller.
 - 2. Jack and 2 choker-slings, or other approved method, may be used on pipe larger than 12 inches in diameter.
- G. Whenever it is necessary to deflect pipe from a straight line, either in vertical or horizontal plane, amount of deflection shall not exceed that shown in following table:

ALLOWABLE BENDING FOR PVC PRESSURE PIPE

Nominal Size (Inches)	Minimum Curve Radius (Feet)	Offset (Inches)
4	56	17
6	88	12
8	108	9
10	138	7
12	164	6

MAXIMUM JOINT DEFLECTION
 FOR DUCTILE IRON PIPE WITH RUBBER GASKET JOINTS

Size of Pipe (Inches)	Maximum Permissible Deflection per Length (Inches)		Approximate Radius of Curve	
	PIPE LENGTH		PIPE LENGTH	
	<u>18'</u>	<u>20'</u>	<u>18'</u>	<u>20'</u>
3	19	21	205	230
4	19	21	205	230
6	19	21	205	230
8	19	21	205	230
10	19	21	205	230
12	19	21	205	230
14	11	12	340	380
16	11	12	340	380
18	11	12	340	380
20	11	12	340	380
24	11	12	340	380
30	11	12	340	380
36	11	12	340	380
42	11	12	340	380
48		12		380
54		12		380
60		12		380
64		12		380

3.6 MECHANICAL JOINTS

- A. Clean foreign matter and paint with a soap solution last 8 inches of outside of spigot and inside of bell.
- B. Slip cast iron gland on spigot end with lip extension toward socket or bell end.
- C. Paint rubber gasket with soap solution and place in spigot end with thick edge toward gland.
- D. Nuts and bolts used in joint assembly shall be corrosion resistant steel.
- E. Push entire section of pipe forward to seat spigot end in bell. Take care to locate gasket evenly around entire joint.
- F. Nuts may be tightened with a suitable torque-limiting wrench. Torque for various sizes of bolts shall be as follows:

<u>Joint Size</u>	<u>Bolt Size (Inches)</u>	<u>Range of Torque</u>
3-inch	5/8	40-60
4-24 inches	3/4	75-90
30-36 inches	1	100-120
42-48 inches	1-1/4	120-150

- G. Tighten nuts alternately in order to produce an equal pressure on all parts of gland.
- H. After a joint is assembled and securely tightened, completely coat nuts and bolts with an approved bituminous protective coating, Koppers 50, 505, or an approved equal.
- I. Whenever it is necessary to deflect pipe from a straight line, either in vertical or horizontal plane, amount of deflection shall not exceed that shown in following table:

MAXIMUM JOINT DEFLECTION FOR MECHANICAL JOINT DUCTILE IRON PIPE

<u>Pipe Size (Inches)</u>	<u>Maximum Permissible Deflection per Length (Inches)</u>		<u>Approximate Radius of Curve (Feet)</u>	
	<u>Pipe Length 18'</u>	<u>Pipe Length 20'</u>	<u>Pipe Length 18'</u>	<u>Pipe Length 20'</u>
3	31	35	125	140
4	31	35	125	140
6	27	30	145	160
8	20	22	195	220
10	20	22	195	220
12	20	22	195	220
14	13.5	15	285	320
16	13.5	15	285	320
18	11	12	340	380
20	11	12	340	380
24	9	10	450	500

3.7 CUTTING OF PVC PIPE

- A. Cut pipe at right angles to centerline of pipe.
- B. Perform cutting in a neat workmanlike manner without damage to pipe and leave a smooth end.
- C. Pipes may be cut with a circular saw or hand saw.
- D. Pipe spigot ends shall be deburred, beveled, and re-marked with insertion line.
- E. Length and angle of field bevels shall match factory bevels.

3.8 CUTTING OF DUCTILE IRON PIPE

- A. Cut pipe at right angles to centerline of pipe.

- B. Perform cutting in a neat, workmanlike manner without damage to pipe and leaving a smooth end.
- C. Cut pipes with an approved mechanical cutter.
- D. Taper cut end of pipe to be used with rubber gasket joints by grinding or filing about 1/8-inch back at an angle of approximately 30 degrees with centerline of pipe and remove any sharp or rough edges.

END OF SECTION 331119

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SECTION 331213 - WATER SERVICE LATERALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Tapping new water mains for lateral services.
2. New lateral service extension.
3. Existing building lateral service connections.
4. Service piping.
5. Tracer wire.
6. Saddles.
7. Corporation stops.
8. Curb stops.
9. Curb boxes.
10. Insulation.

B. Related Sections:

1. Applicable provisions of Division 01 – General Requirements shall govern Work under this Section.
2. Section 31 23 17 – Site Excavation, Backfill, and Compaction.
3. Section 33 05 01 – Ductile Iron Pipe and Fittings.
4. Section 33 05 06 – Polyvinyl Chloride (PVC) Pressure Pipe.
5. Section 33 10 13 - Water Main Installation.
6. Section 33 13 16 – Corrosion Control - Pipe and Fittings.

1.2 REFERENCES

A. Okaloosa County, Florida – Water/Sewer District Utilities Standards Manual – Section 2: Technical Specifications.

B. ASTM International: (ASTM)

1. ASTM B62 – Specification for Composition Bronze or Ounce Metal Castings.
2. ASTM B88 – Specification for Seamless Copper Water Tube.
3. ASTM C518 - Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
4. ASTM C578 – Specification for Rigid, Cellular Polystyrene Thermal Insulation.
5. ASTM D1621 - Test Method for Compressive Properties Of Rigid Cellular Plastics.
6. ASTM D2842 - Test Method for Water Absorption of Rigid Cellular Plastics.

C. American Water Works Association: (AWWA)

1. AWWA C150 – Thickness Design of Ductile Iron Pipe.
2. AWWA C151 – Ductile-Iron Pipe, Centrifugally Cast, For Water.
3. AWWA C800 - Underground Service Line Valves and Fittings.
4. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Through 12 Inches for Water Distribution.
5. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. Through 3 In., for Water Service.

6. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 63 In., for Water Distribution and Transmission.

1.3 SUBMITTALS

- A. Division 01 – General Requirements, Section 01 33 00 - Submittal Procedures, Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.
- B. Division 01 – General Requirements, Section 01 70 00 – Execution and Closeout Requirements, Section 01 78 23 – Operation and Maintenance Data, Section 31 02 00 – General Requirements for Sitework: Submit operation and maintenance information

1.4 REGULATORY REQUIREMENTS

- A. Contractor shall comply with applicable rules of:
 1. State of Florida Department of Environmental Protection and Department of Community Affairs and local code if more stringent for materials and installation of the Work of this section.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Load and unload pipe, fittings, valves, and accessories by lifting with hoists to avoid shock or damage.
- B. Under no circumstances shall material be dropped.
- C. Keep stored material free of damage.
- D. Keep interior of pipe, fittings, and other appurtenances free from dirt or foreign matter.
- E. Use timbers to separate pipe stored on ground from ground and other pipe.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Pipe shall not be laid in water.
- B. Pipe shall not be laid in trenches where, in opinion of Engineer/Architect, Owner's Representative or Construction Manager, conditions are unsuitable.

PART 2 - PRODUCTS

2.1 WATER SERVICE PIPING – 2 INCH AND UNDER

- A. Piping for water laterals shall be ASTM B88, Type K, soft annealed seamless copper tubing.
- B. Permanently and plainly mark name or trademark of manufacturer and a mark indicating type on tubing at intervals not greater than 18 inches.
- C. Fittings for copper tubing shall conform to AWWA C800 and be of cast brass having an alloy of 85 percent copper, 5 percent tin, 5 percent zinc and 5 percent lead (copper alloy C83600 also known as "red brass") in accordance with ASTM B62.

- D. Fittings shall have uniformity in wall thickness and strength, and free of any defect that may affect their serviceability. Fittings shall be of [flared] [compression] type only. Unions shall be extra heavy 3-part union only.
- E. Copper tubing shall be single piece, without joints, from corporation stop to curb stop.
- F. Encase copper tubing in polyethylene sheeting and tape secure, in accordance with Section 33 13 16 – Corrosion Control - Pipe and Fittings.
- G. Piping for water laterals shall be polyethylene tubing conforming to AWWA C901, Pressure Class 200.
- H. Make pipe connections with pack joint connections including a Buna-N beveled gasket for sealing to outside diameter of pipe.
- I. Integrate a split clamp locking device with stainless steel hardware into connection fittings to securely restrain the pipe from hydraulic pressure and external loading caused by shifting and settling.
- J. Provide stainless steel insert stiffeners for pack joint connection fittings used with polyethylene tubing.
- K. Fittings for polyethylene tubing shall conform to AWWA C800 and be of cast brass having an alloy of 85 percent copper, 5 percent tin, 5 percent zinc and 5 percent lead (copper alloy C83600 also known as "red brass") in accordance with ASTM B62.
- L. Fittings shall have uniformity in wall thickness and strength, and free of any defect that may affect their serviceability.
- M. Polyethylene tubing shall be single piece, without joints, from corporation stop to curb stop.

2.2 WATER SERVICE PIPING - 3 INCH AND OVER

- A. Piping for water laterals shall be ductile iron pipe conforming to requirements of Section 33 05 01 – Ductile Iron Pipe and Fittings and AWWA C150 and C151.
- B. Encase ductile iron pipe in polyethylene in accordance with Section 33 13 16 – Corrosion Control - Pipe and Fittings.
- C. Piping for water lateral shall be polyvinyl chloride pipe conforming to requirements of Section 33 05 06 – Polyvinyl Chloride (PVC) Pressure Pipe and AWWA C900.

2.3 TRACER WIRE MATERIALS

- A. Mark all non-conductive lateral pipes with a locating wire system.
- B. Locating wire system consists of the following:
 - 1. Tracer Wire: 45-mil solid copper, No. 12 HMW-PE yellow jacket coating. Install to enable electronic locating of underground utility.
 - 2. Tracer Wire Locating Box: 2-1/2-inch diameter, minimum, ABS pipe with 2 point terminal box and cast iron cover.
 - a. Manufacturer: Valco, Inc. Model C.P. Mini Box, or an approved equal.

2.4 SERVICE FITTINGS

A. Manufacturers:

1. Mueller Company, Decatur, IL
2. The Ford Meter Box Company, Inc., Wabash, IN
3. A.Y. McDonald Mfg. Co., Dubuque, IA
4. Substitutions: In accordance with Division 01 – General Requirements.

B. Saddles:

1. Mueller Company, H-10500 Series.
2. The Ford Meter Box Company, Style F202.
3. A.Y. McDonald Mfg., Model 3825.
4. Substitutions: In accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework Not permitted.

C. Corporation Stops:

1. Mueller Company, H-15000 Series.
2. The Ford Meter Box Company, FB-600.
3. A.Y. McDonald Mfg., 4701B.
4. Substitutions: In accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework Not permitted.

D. Curb Stops:

1. Mueller Company, H-15154 Series.
2. The Ford Meter Box Company, B22M Series.
3. A.Y. McDonald Mfg., 6104 Series.
4. Substitutions: In accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework Not permitted.

E. Curb Boxes - 1-inch Services:

1. Mueller Company; Series H-10302.
2. The Ford Meter Box Company; Series EM2-XX-56.
3. A. Y. McDonald Mfg., Series 5614.
4. Substitutions: In accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework Not permitted.

F. Curb Boxes - 1-1/4 inch and 1-1/2 inch Services:

1. Mueller Company; Series H-10304.
2. The Ford Meter Box Company, Series EM2-XX-57.
3. A. Y. McDonald Mfg., Series 5615.
4. Substitutions: In accordance with Division 01 – General Requirements, Section 01 25 00 – Substitution Procedures, Section 31 02 00 – General Requirements for Sitework Not permitted

G. Curb boxes shall have a minimum 1-1/2-inch inside diameter.

- H. Service boxes shall have a minimum length of 7 feet when extended without use of extension sections.

PART 3 - EXECUTION

3.1 WATER AND SEWER SEPARATION

- A. Water services 2-1/2 inches or larger shall be installed at least 8 feet horizontally from any sanitary sewer.
- B. Water services 2 inches and smaller shall be installed at least 30 inches horizontally from any sanitary sewer.
- C. No water service may be installed within 6 inches of a storm sewer.
- D. Where water main crosses above a sanitary sewer, bottom of water main must be at least 12 inches above top of sewer within 10 feet of point of crossing.
- E. Where water main crosses below a sanitary sewer, top of water main must be at least 18 inches below bottom of sewer within 10 feet of point of crossing.
- F. Locate water services at least ten feet horizontally from any existing or proposed sewer line.
- G. Building water service and building drain or sewer may be installed in the same trench provided that water service is placed on a solid shelf a minimum of 18 inches above building drain or sewer.
- H. Whenever a water service crosses above a sewer, following conditions must be met.
 - 1. Bottom of water line is 18 inches above the top of sewer for a distance of 10 feet either side of crossing measured perpendicular to water line.
 - 2. Sewer shall be constructed with water main materials such as cast ductile iron pipe, Type K copper pipe, or Schedule 40 plastic pipe.
- I. Water services shall not cross below a sanitary sewer.
- J. Provide horizontal separation of least 6 feet, and preferably 10 feet, from outside wall of water service to outside wall of existing sanitary sewer.
- K. Provide horizontal separation of least 3 feet from outside wall of water service to outside wall of existing storm sewer.
- L. Locate outside wall of water service at least 6 inches, and preferably 12 inches, above or 12 inches below outside wall of existing storm or sanitary sewer.
- M. Where pipes cross, separate water main and sanitary sewer joints by at least 6 feet and water main and storm sewer joints by at least 3 feet.
- N. Where pipes have less than required horizontal separation or less than required joint separation, meet one of the following:
 - 1. Use of AWWA pressure rated pipe for pressure or gravity, storm or sanitary sewer.
 - 2. Use of welded, fused, or otherwise restrained joints on either water main or other pipe.

3. Use of watertight casing or 4 inch concrete encasement on either water main or other pipe.
- O. Where there is less than 3 feet horizontal separation or less than minimum vertical separation:
 1. Use pipe or casing pipe with impact strength of 0.25 inch ductile iron pipe or 4 inch concrete encasement for water main; or
 2. Use pipe or casing pipe with impact strength of 0.25 inch ductile iron pipe or 4 inch concrete encasement for other pipe.

3.2 NOTIFICATION

- A. Contractor, prior to any excavation work, shall notify (1) a designated locating service; (2) utilities, governmental agencies, entities, known to, or which can reasonably be assumed to have above or below ground pipe, conduit cables, structures, or similar items within limits of project; to locate and mark location of such items.
- B. In accordance with Florida Statutes Chapter 556, "Underground Facility Damage Prevention and Safety Act," every "Person" as defined in 556.102(9) shall be solely responsible to provide advance notice to "Sunshine State One-Call of Florida, Inc." (800-432-4770) not more than five nor less than two working days prior to commencement of any Excavation or Demolition, as defined in the statute, required to perform work contained in this Project, and further said "Person" shall comply with all other requirements of this Statute relative to Excavator's Work.

3.3 PROTECTION

- A. Perform excavation, backfilling and compaction in accordance with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction for protection of public and private property.
- B. Exercise care during excavation to avoid damage to existing buildings, structures, roadways, sidewalks, utilities, and survey identification markings.

3.4 INSTALLATION OF LATERAL

- A. Lay and maintain water laterals to lines and grades established by Drawings with fittings and valves at required locations.
- B. Trench preparation shall proceed in advance of lateral installation only as far as can be backfilled in same day.
- C. Contractor shall not deviate from types of excavation indicated on Drawings or in Project Manual without prior concurrence of Engineer/Architect, Owner's Representative, Construction Manager except in case of roadways, driveways, and obstructions requiring short tunnel sections that may be indicated on Drawings as open trench sections.
- D. Support tunnel sections exceeding 2 feet in length in accordance with applicable codes.
- E. Install water laterals without use of wood blocking.
- F. Lower tubing or pipe, fittings, and valves carefully into trench by means of a derrick, ropes, or other suitable tools or equipment, in a manner to prevent damage to water main materials and protect coatings and linings.

- G. Trench bottom shall be true and even in order to provide support for full length of lateral, except a slight depression may be provided to allow withdrawal of pipe slings or other lifting tackle.
- H. Remove lumped subsoil, boulders, and rock up to 1/3 cubic yard, measured by volume. Larger material will be removed under Section 31 23 18 - Rock Removal. When rock is encountered, remove to provide a clearance of at least 6 inches below and on each side of pipe, valves, and fittings for pipe sizes 24 inches or smaller, and 9 inches for pipe sizes 30 inches and larger.
- I. When excavation is complete, place a layer of appropriate bedding material on bottom of trench to depths indicated, level, and compact. Take every precaution to prevent foreign material from entering pipe while it is being placed in line.
- J. If pipe laying crew cannot put lateral into trench and in place without getting earth into it, Engineer/Architect, Owner's Representative, Construction Manager may require that before lowering pipe into trench, a heavy, tightly woven, canvas bag of suitable size be placed over each end and left there until connection is made to adjacent pipe.
- K. Take precautions to prevent foreign materials from entering joint space and carefully check joint recess for foreign material before installing gasket.
- L. Secure lateral in place with bedding material, placed by hand or equally careful means, keeping bell end open. Remove pipe and fittings that do not allow sufficient and uniform space for joints and replace with pipe and fittings of proper dimensions to insure such uniform space.
- M. Upon daily and temporary completion of lateral installation, close open ends of pipe by a water-tight plug or other means approved by Engineer/Architect, Owner's Representative, Construction Manager. This provision applies during daytime inactivity as well as overnight.
- N. If water is in trench, maintain seal in place until water level is lowered four inches below lateral invert.
- O. Whenever it becomes necessary to lay a lateral over, under, or around a known obstruction, furnish and install required fittings. Cost of such fittings will be paid for in lump sum or unit price bid for each size of lateral. No additional compensation will be paid to Contractor for any expenses incurred because of such obstruction.
- P. When an unknown underground structure interferes with Work to such an extent that an alteration of Drawings is required and alteration results in a change in cost to Contractor, Engineer/Architect, Owner's Representative, Construction Manager will issue a written order for such altered work, specifying basis of payment or credit for such altered work.
- Q. Keep interior and exterior of lateral clean and free from foreign material before installation. Provide necessary means to wipe, brush, swab, or air blast to remove any foreign material from interior of tubing or pipe as instructed by manufacturer and as directed by Engineer/Architect, Owner's Representative, Construction Manager.

3.5 TRACER WIRE INSTALLATION

- A. Lateral tracer wire originates and terminates in tracer wire access box located at right-of-way line. Install conductor tracer wire in one continuous loop.

- B. Tape conductor tracer wire to top of pipe at minimum 10-foot intervals. Wrapping conductor tracer wire around pipe is prohibited.
- C. Field test each locating wire after installation is completed.

END OF SECTION 331213

SECTION 331316 - CORROSION CONTROL – PIPE AND FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Polyethylene Sheeting.
 - 2. Polyethylene Installation – Tube Method.
 - 3. Polyethylene Installation – Sheet Method.
 - 4. Polyethylene Installation – Fitting and Appurtenances.
- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
 - 2. Section 33 05 01 – Ductile Iron Pipe and Fittings.
 - 3. Section 33 10 13 – Water Main Installation.
 - 4. Section 33 12 13 - Water Service Laterals.

1.2 REFERENCES

- A. Okaloosa County, Florida – Water/Sewer District Utilities Standards Manual – Section 2: Technical Specifications.
- B. American Water Works Association: (AWWA)
 - 1. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.
- C. ASTM International: (ASTM)
 - 1. ASTM D4976 – Specification for Polyethylene Plastics Molding and Extrusion Materials.

1.3 ENVIRONMENTAL REQUIREMENTS

- A. Due to deterioration from sunlight, minimize exposure of polyvinyl chloride and polyethylene materials prior to backfilling.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Polyethylene Sheeting: Polyethylene sheeting conforming to ASTM D4976, Type I, Class B, color black, Grade E-1, 1200 psi tensile strength, minimum thickness of 8 mil. Tube diameter or sheet width shall conform to AWWA C105. Double layer.
 - 1. Tape: 2-inch wide, black tape with rubber adhesive and minimum 9 mil polyethylene backing. Tape shall be 3M™ Preservation Sealing Tape 481 or an approved equal.
- B. Use corrosion resistant steel nuts and bolts for buried joints, fittings, and specials. Nuts and bolts shall be NSS Technologies, Inc. Cor-Blue or an approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Polyethylene encasement shall seal and prevent contact between pipe and surrounding backfill and bedding material.
- B. Remove all lumps of clay, mud, cinders, and similar materials that may have accumulated on surface of pipe during storage.

3.2 INSTALLATION - TUBE METHOD

- A. Cut polyethylene tube to a length approximately two feet longer than that of pipe section. Slip tube around pipe, centering it to provide a one-foot overlap on each adjacent pipe section, and bunching it accordion fashion lengthwise until it clears pipe ends.
- B. Lower pipe into trench and make up pipe joint with preceding section of pipe. Provide shallow bell hole at joints to facilitate installation of polyethylene tube.
- C. After assembling pipe joint, overlap pipe joint with polyethylene tube.
- D. Pull bunched polyethylene from preceding length of pipe, slip over end of new length of pipe, and secure in place.
- E. Slip end of polyethylene from new pipe section over end of first wrap until it overlaps joint at end of preceding length of pipe.
- F. Secure overlap in place. Overlaps shall be secured by use of adhesive tape capable of holding polyethylene encasement in place until backfilling operations are completed.
- G. Take up slack width to make a snug, but not tight fit along barrel of pipe, securing fold at quarter points.
- H. Repair any rips, punctures, or other damage to polyethylene with adhesive tape or with a short length of polyethylene tube cut open, wrapped around pipe, and secured in place.
- I. Proceed with installation of next section of pipe in same manner.

3.3 INSTALLATION - SHEET METHOD

- A. Cut polyethylene sheet to length approximately two feet longer than that of pipe section.
- B. Center cut length to provide one-foot overlap on each adjacent pipe section, bunching it until it clears pipe ends.
- C. Wrap polyethylene around pipe so that it circumferentially overlaps top quadrant of pipe and both portions of adjoining pipe. Tape securely.
- D. Secure cut edge of polyethylene sheet at intervals of approximately three feet.
- E. Lower wrapped pipe into trench and make up pipe joint with preceding section of pipe.

- F. Take up slack width to make snug, but not tight, fit along barrel of pipe, securing fold at quarter points.
- G. Repair any rips, punctures, or other damage to polyethylene with adhesive tape or with a short length of polyethylene tube cut open, wrapped around pipe, and secured in place. Proceed with installation of next section of pipe in same manner.

3.4 INSTALLATION - FITTING AND APPURTENANCES

- A. Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in same manner as pipe.
- B. When valves, tees, crosses, and other odd-shaped pieces cannot be wrapped practically in a tube, wrap with flat sheet or split length of polyethylene tube by passing sheet under appurtenance. Seal laps with adhesive tape.

END OF SECTION 331316

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SECTION 334013 - STORM SEWER INSTALLATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bedding.
2. Pipe Installation.
3. Preparation for Structures.
4. Structure Installation.
5. Precast Concrete Manhole and Drainage Structure Installation.
6. Frame and Grate Installation.

B. Related Sections:

1. Applicable provisions of Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
2. Section 31 05 16 – Aggregates for Earthwork.
3. Section 31 23 17 – Site Excavation, Backfill, and Compaction: Excavating for sewer system piping and structures [and detention basin.
4. Section 33 05 05 - Polyvinyl Chloride (PVC) Gravity Sewer Pipe.
5. Section 33 05 08 – High Density Polyethylene Storm Water Pipe.
6. Section 33 40 16 – Storm Sewer Laterals.
7. Section 33 42 13 - Pipe Culverts: Corrugated metal drainage pipes.

1.2 REFERENCES

A. Public Works Industry Improvement Program

1. Standard Specifications for Sewer and Water Construction in Wisconsin, Current Edition, with Addendum.

B. Okaloosa County, Florida – Water/Sewer District Utilities Standards Manual – Section 2: Technical Specifications.

C. Florida Department of Transportation

1. Standard Specifications for Road and Bridge Construction, Current Edition with latest supplements. (FDOT)

D. ASTM International (ASTM):

1. ASTM A798 – Standard Practice for Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications.
2. ASTM B788 - Standard Practice for Installing Factory-Made Corrugated Aluminum Culverts and Storm Sewer Pipe.
3. ASTM C12 - Standard Practice for Installing Vitrified Clay Pipe Lines.
4. ASTM C270 – Standard Specification for Mortar for Unit Masonry.
5. ASTM C425 - Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
6. ASTM C443 - Standard Specification for Joints for Concrete Sewer and Manholes Using Rubber Gaskets.

7. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
8. ASTM C1479 – Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations.
9. ASTM D2122 - Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.
10. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
11. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
12. ASTM F1668 - Guide for Construction Procedures for Buried Plastic Pipe.

1.3 SUBMITTALS

- A. Division 01 – General Requirements, Section 01 33 00 - Submittal Procedures, Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.
- B. Manufacturer's Installation Instructions: Submit special procedures required to install Products specified.
- C. Record horizontal location and vertical depth of pipe runs, fittings, connections, and utility structures installed.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements, Section 01 70 00 - Execution and Closeout Requirements, Section 31 02 00 – General Requirements for Sitework: Closeout procedures.
- B. Division 01 – General Requirements, Section 01 70 00 - Execution and Closeout Requirements, Section 01 78 23 - Operation and Maintenance Data, Section 31 02 00 – General Requirements for Sitework: Submit operation and maintenance data.
- C. Division 01 – General Requirements, Section 01 70 00 - Execution and Closeout Requirements, Section 01 78 39 - Project Record Documents, Section 31 02 00 – General Requirements for Sitework]: Submit Project Record Documents.
 1. Accurately record actual locations of pipe runs, connections, structures, and invert elevations.
 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 COORDINATION

- A. Division 01 – General Requirements, Section 01 30 00 - Administrative Requirements, Section 31 02 00 – General Requirements for Sitework: Coordination and project conditions.
- B. Coordinate the Work with termination of storm sewer connection outside building, trenching, connection to foundation drainage system, and municipal storm sewer system.

PART 2 - PRODUCTS

2.1 STORM SEWER PIPE MATERIALS

- A. Polyvinyl Chloride (PVC) Sewer Pipe: Shall meet requirements of Section 33 05 05 – Poly Vinyl Chloride (PVC) Gravity Sewer Pipe.
- B. Polyethylene Pipe: Shall meet requirements of Section 33 05 08 – High Density Polyethylene Storm Water Pipe.
- C. Corrugated Metal Pipe: Shall meet requirements of Section 33 42 13 – Pipe Culverts.

2.2 PIPE LOCATION MATERIALS

- A. Identification Warning Tape: Heavy plastic underground warning tape, 2-inch width. Color - Bright Green, warning message "Caution Buried STORM SEWER Below" to repeat every 30 inches.
- B. Tracer Wire: 45-mil solid copper, No. 12 HMW-PE yellow jacket coating. Installed to enable electronic locating of underground utility.

2.3 TRACER WIRE MATERIALS

- A. Mark non-conductive lateral pipes with a locating wire system.
- B. Locating wire system consists of the following:
 - 1. Tracer Wire: 45-mil solid copper, No. 12 HMW-PE yellow jacket coating. Install to enable electronic locating of underground utility.
 - 2. Tracer Wire Locating Box: 2-1/2-inch diameter, minimum, ABS pipe with 2 point terminal box and cast iron cover.
 - a. Manufacturer: Valco, Inc., Model C.P. Mini Box, or an approved equal.]

PART 3 - EXECUTION

3.1 NOTIFICATION

- A. Contractor, prior to any excavation work, shall notify (1) a designated locating service; (2) utilities, governmental agencies, entities, known to, or which can reasonably be assumed to have above or below ground pipe, conduit cables, structures, or similar items within limits of project; to locate and mark location of such items.
- B. In accordance with Florida Statute Chapter 556, "Underground Facility Damage Prevention and Safety Act," every "Person" as defined in 556.102(9) shall be solely responsible to provide advance notice to "Sunshine State One-Call of Florida, Inc. (800-432-4770) not more than five nor less than two working days prior to commencement of any excavation or demolition required to perform work contained in this Project, and further said "Person" shall comply with all other requirements of this Statute relative to Excavator's Work.

3.2 EXAMINATION

- A. Division 01 – General Requirements, Section 01 30 00 - Administrative Requirements, Section 31 02 00 – General Requirements for Sitework: Coordination and project conditions.
- B. Verify trench cut and excavation base are ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.3 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with Type A2 aggregate as specified in Section 31 05 16 – Aggregates for Earthwork.
- B. Remove large stones or other hard matter that could damage piping or impede consistent backfilling or compaction.

3.4 BEDDING AND COVER REQUIREMENTS

- A. Excavate pipe trench in accordance with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction] for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Place Type A5, A6 or A7, depending on pipe size, bedding material, as specified in Section 31 05 16 – Aggregates for Earthwork, at trench bottom.
- C. Place and shape bedding material to pipe, to a minimum depth of three inches under bell and four inches under spigot and compact to 95 percent modified Proctor density.
- D. Backfill around sides and top of pipe with bedding material to a loose lift depth of 24 inches above pipe and compact to 95 percent modified Proctor density.
- E. Maintain optimum moisture content of bedding and cover material to attain required compaction density.

3.5 PIPE INSTALLATION

- A. Install pipe, fittings, and accessories in accordance with ASTM A798, ASTM B788, ASTM C12, ASTM C1479, ASTM D2321 and ASTM F1668. Seal joints watertight.
- B. Lay pipe to slope gradients noted on drawings with maximum variation from indicated slope of 1/8-inch in 10 feet.
- C. Reference Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction] for backfilling and compacting requirements. Do not displace or damage pipe when compacting.
- D. Reference Section 33 49 00 – Storm Sewer Manholes, Catch Basins, and Inlets for manhole, [catch basin,] [and] [inlet] requirements.
- E. Connect to building collection pits, building sewer outlet through installed sleeves.

3.6 PIPE LOCATION MATERIAL INSTALLATION

- A. Install tape continuous buried 12 inches below finish grade, above pipe line; and coordinate with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction.

3.7 TRACER WIRE INSTALLATION

- A. Lateral tracer wire originates and terminates in tracer wire access box located at right-of-way line. Install conductor tracer wire in one continuous loop.
- B. Tape conductor tracer wire to top of pipe at minimum 10-foot intervals. Wrapping conductor tracer wire around pipe is prohibited.
- C. Field test each locating wire after installation is completed.

3.8 PREPARATION FOR STRUCTURES

- A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.
- B. Do not install structures where site conditions induce loads exceeding structural capacity of structures.
- C. Inspect precast concrete structures immediately prior to placement in excavation to verify structures are internally clean and free from damage. Remove and replace damaged units.

3.9 STRUCTURE INSTALLATION

- A. Excavation and Backfill:
 - 1. Excavate for manholes and drainage structures in accordance with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction in location and to depth shown.
 - 2. Provide clearance around sidewalls of structure for construction operations.
 - 3. When groundwater is encountered, prevent accumulation of water in excavations. Place manholes or drainage structures in dry trench.
 - 4. Where possibility exists of watertight structure becoming buoyant in flooded excavation, anchor structure to avoid flotation.
 - 5. Backfill excavations for manholes and drainage structures in accordance with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction.
- B. Coordinate with other sections of Work to provide correct size, shape, and location.
- C. Lift precast structures at lifting points designated by manufacturer.
- D. When lowering manholes and drainage structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and structure remains clean.
- E. Set precast structures bearing firmly and fully on crushed stone bedding, compacted in accordance with provisions of Section 31 23 16 – Utility Trench Excavation, Backfill, and

Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction or on other support system shown on Drawings.

- F. Assemble multi-section structures by lowering each section into excavation. Lower, set level, and firmly position base section before placing additional sections.
- G. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.
- H. Joint sealing materials may be installed on site or at manufacturer's plant.
- I. Verify manholes and drainage structures installed satisfy required alignment and grade.
- J. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe. Fill annular space with mortar.
- K. Cut pipe to finish flush with interior of structure.
- L. Shape inverts through manhole as shown on Drawings.

3.10 FRAME AND GRATE INSTALLATION

- A. Set frames using mortar and masonry. Install precast concrete adjustment rings or radially laid concrete brick with 1/4-inch thick vertical joints at inside perimeter.
- B. Lay precast concrete adjustment rings or concrete brick in full bed of mortar and completely fill joints. Where more than one course of concrete brick is required, stagger vertical joints.
- C. Set frame and cover 2 inches above finished grade for manholes and other structures with covers located within unpaved areas to allow area to be graded away from cover beginning 1 inch below top surface of frame.
- D. Place grate into frame after mortar has cured.
- E. Provide drainage fabric screen, under grate, to protect infiltration of debris and silt.

3.11 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements, Section 01 40 00 - Quality Requirements, Section 31 02 00 – General Requirements for Sitework: Testing and inspection services.
- B. Request inspection prior to and immediately after placing aggregate cover over pipe.
- C. Compaction and Moisture Testing: In accordance with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- E. Frequency of Tests: As determined by Engineer/Architect, Testing Agency, Owner's Representative or Construction Manager.

F. Deflection Test (PVC and Polyethylene Piping):

1. Perform deflection tests for polyvinyl chloride (PVC) [and] polyethylene (PE) pipe installations per ASTM D2122.
2. Perform deflection test using a rigid ball or mandrel without a mechanical pulling device.
3. If deflection testing occurs within 30 days of placement of final backfill, deflection shall not exceed 5 percent.
4. When deflection testing occurs more than 30 days after placement of final backfill, maximum deflection shall not exceed 7.5 percent.

3.12 PROTECTION OF FINISHED WORK

A. Division 01 – General Requirements, Section 01 70 00 - Execution Requirements, Section 31 02 00 – General Requirements for Sitework: Protecting finished Work.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is completed.

1. Take care not to damage or displace installed pipe and joints during construction of pipe supports, backfilling, testing, and other operations.
2. Repair or replace pipe that is damaged or displaced from construction operations.

END OF SECTION 334013

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SECTION 334016 - STORM SEWER LATERALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Tapping storm sewers for laterals.
2. New lateral extension.
3. Existing building lateral connection.
4. Service piping.
5. Tracer wire.

B. Related Sections:

1. Applicable provisions of Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
2. Section 31 23 17 – Site Excavation, Backfill, and Compaction.
3. Section 33 40 13 – Storm Sewer Installation.

1.2 REFERENCES

A. Public Works Industry Improvement Program

B. Okaloosa County, Florida – Water/Sewer District Utilities Standards Manual – Section 2: Technical Specifications.

C. ASTM International: (ASTM)

1. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
2. ASTM D3034 – Standard Specification for Type PSM Poly(VinylChloride) (PVC) Sewer Pipe and Fittings.
3. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
4. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
5. ASTM F1668 - Guide for Construction Procedures for Buried Plastic Pipe.

1.3 SUBMITTALS

A. Division 01 – General Requirements, Section 01 33 00 - Submittal Procedures, Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.

B. Submit operation and maintenance information.

1.4 REGULATORY REQUIREMENTS

A. Contractor shall comply with applicable rules and regulations of:

1. State of Florida Department of Environmental Protection (FDEP) and local code if more stringent for materials and installation of the Work of this Section.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Load and unload pipe, fittings, and accessories by lifting with hoists to avoid shock or damage.
- B. Under no circumstances shall material be dropped.
- C. Keep stored material free of damage.
- D. Keep interior of pipe, fittings, and other appurtenances free from dirt or foreign matter.
- E. Use timbers to separate pipe stored on ground from ground and other pipe.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Pipe shall not be laid in trenches where, in opinion of Engineer/Architect, Owner's Representative or Construction Manager, conditions are unsuitable.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Pipes, fittings, and structures shall be manufactured in the United States of America.
- B. Supply materials in accordance with:
 1. State of Florida Department of Environmental Protection (FDEP) and local code if more stringent for materials for the Work of this Section.

2.2 STORM SEWER LATERAL PIPING

- A. Poly Vinyl Chloride (PVC) Pipe: ASTM D3034, SDR 26 or 35 Polyvinyl Chloride (PVC); nominal diameter 4-inches through 15-inches, as designated on Drawings; integral gasketed joint.

2.3 FITTINGS

- A. Pipe used in fabricated fittings shall meet quality and dimensional requirements listed in standard for that pipe. Fittings shall use same joint system as pipe.
- B. Pipe used in fabricated fittings shall have a wall thickness equal to or greater than wall thickness of pipes to which fitting (or that part of fitting) will be joined.
- C. No part of spur or branch shall protrude into waterway of fitting more than 0.070-inch.
- D. Edges and joints exposed to sewage shall be rounded and free from any rough parts that could catch solids.
- E. No fitting shall have an inside diameter dimension smaller than base inside diameter for that pipe size and SDR.

2.4 JOINTS

- A. Make joints in accordance with ASTM D3212 using ASTM F477 natural or synthetic rubber gaskets or C425 for push-on joints that require no internal or external pressure to effect initial seal.
- B. Lubricant shall have composition that will in no way damage gasket or pipe due to prolonged exposure and shall not affect sealing capability of gasket.

2.5 PIPE LOCATION MATERIALS

- A. Identification Warning Tape: Heavy plastic underground warning tape, 2-inch width. Color-Bright Green, warning message "Caution Buried STORM SEWER Below" to repeat every 30 inches.
- B. Tracer Wire: 45-mil solid copper, No. 12 HMW-PE yellow jacket coating. Installed to enable electronic locating of underground utility.

2.6 TRACER WIRE MATERIALS

- A. Mark all non-conductive lateral pipes with a locating wire system.
- B. Locating wire system consists of the following:
 - 1. Tracer Wire: 45-mil solid copper, No. 12 HMW-PE yellow jacket coating. Install to enable electronic locating of underground utility.
 - 2. Tracer Wire Locating Box: 2-1/2-inch diameter, minimum, ABS pipe with 2 point terminal box and cast iron cover.
 - a. Manufacturer: Valco, Inc., Model C.P. Mini Box, or an approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install storm sewer lateral in accordance with ASTM D2321 and ASTM F1668, ASTM C12 and specified in Section 33 40 13 – Storm Sewer Installation.

3.2 WATER AND SEWER SEPARATION

- A. Install sanitary sewers at minimum required distances away from adjacent water mains and services as stipulated by:
 - 1. State of Florida Department of Environmental Protection (FDEP) and local code if more stringent for installation of the Work of this Section.

3.3 TRACER WIRE INSTALLATION

- A. Lateral tracer wire originates and terminates in tracer wire access box located at right-of-way line. Install conductor tracer wire in one continuous loop.
- B. Tape conductor tracer wire to top of pipe at minimum 10-foot intervals. Wrapping conductor tracer wire around pipe is prohibited.

- C. Field test each locating wire after installation is completed.

END OF SECTION 334016

SECTION 334100 - SITE STORM SEWER SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sewer Pipe Materials.
2. Pipe Fittings and Accessories.
3. Storm Sewer Manholes, including Frames and Covers.
4. Catch Basins and Plant Area Drains, including Frames and Grates.
5. Inlets, including Frames and Grates.

B. Related Sections:

1. Applicable provisions of Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
2. Section 31 23 17 – Site Excavation, Backfill, and Compaction: Excavating for storm sewer system piping.
3. Division 22 - Plumbing: Sump pump connection.

1.2 REFERENCES

A. State of Florida Administrative Code, Department of Community Affairs Chapter 9B and International Plumbing Code, Current Edition.

B. American Association of State Highway and Transportation Officials: (AASHTO)

1. AASHTO M36 - Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.
2. AASHTO M294 – Corrugated Polyethylene Pipe, 300- to 1200-mm Diameter.
3. AASHTO Standard Specifications for Highway Bridges.

C. American Concrete Institute: (ACI)

1. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.

D. ASTM International: (ASTM)

1. ASTM A48 – Specification for Gray Iron Castings.
2. ASTM A536 - Specification for Ductile Iron Castings.
3. ASTM A615 - Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
4. ASTM C12 - Practice for Installing Vitrified Clay Pipe Lines.
5. ASTM C14 - Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
6. ASTM C76 - Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
7. ASTM C270 - Specification for Mortar for Unit Masonry.
8. ASTM C425 - Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
9. ASTM C443 - Specification for Joints for Circular Pipe and Manholes, Using Rubber Gaskets.
10. ASTM C478 – Specification for Precast Reinforced Concrete Manhole Sections.
11. ASTM C506 – Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe.

12. ASTM C507 – Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe.
13. ASTM C700 - Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.
14. ASTM C1479 – Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations.
15. ASTM D2235 – Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
16. ASTM D2321 – Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
17. ASTM D2564 - Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
18. ASTM D2661 - Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
19. ASTM D2665 - Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent and Vent Pipe and Fittings.
20. ASTM D3034 - Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
21. ASTM D3212 - Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
22. ASTM D3350 – Specification for Polyethylene Plastics Pipe and Fitting Materials.
23. ASTM D3965 - Specification for Rigid Acrylonitrile-Butadiene-Styrene (ABS) Materials for Pipe and Fittings.
24. ASTM D4101 - Specifications for Propylene Plastic Injection and Extrusion Materials.
25. ASTM F477 – Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
26. ASTM F628 - Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core.
27. ASTM F679 - Specification for Poly(VinylChloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings.
28. ASTM F1668 - Guide for Construction Procedures for Buried Plastic Pipe.
29. ASTM F2306 - Specification for 12 to 60 in. [300 to 1500 mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications.
30. ASTM F2648 - Specification for 2 to 60 inch [50 to 1500 mm] Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications.

E. Code of Federal Regulations: (CFR)

1. Title 29, Part 1926 Safety and Health Regulations for Construction, Occupational Safety and Health Administration (OSHA), U.S. Department of Labor.

1.3 SUBMITTALS

- A. Division 01 – General Requirements, Section 01 33 00 - Submittal Procedures, Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.
- B. Product Data: Provide data indicating pipe materials, pipe fittings, and precast structures.
- C. Submit Structural Design Calculations and detailed Shop Drawings for flattop and special precast concrete manhole structures prepared and sealed by a Professional Structural Engineer licensed in the State of Florida.

- D. Design of flattop and special precast structures shall be in accordance with ACI 318 and ASTM C478.
- E. Submit concrete mix data and test reports from an approved testing laboratory certifying that concrete used in precast structures conforms to specified requirements.
- F. Manufacturer's Instructions: Indicate special procedures required to install Products specified.
- G. Certificate: Certify that Products meet or exceed specified requirements.
- H. Division 01 – General Requirements, Section 01 70 00 – Execution and Closeout Requirements, Section 01 78 39 – Project Record Documents: Project Record Drawings.
 - 1. Record actual locations of pipe runs, connections, structures, control points, and invert elevations.
 - 2. Identify, indicate, and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.4 REGULATORY REQUIREMENTS

- A. Contractor shall comply with applicable rules and regulations of
 - 1. State of Florida Department of Environmental Protection (FDEP), Department of Community Affairs (FACE), and local code if more stringent for materials and installation of the Work of this Section.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Division 01 – General Requirements, Section 01 60 00 – Product Requirements, Section 31 02 00 – General Requirements for Sitework.
- B. Deliver and store castings and gaskets in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Pipes, fittings, and structures shall be manufactured in the United States of America.
- B. Materials supplied are to be in accordance with:
 - 1. State of Florida Administrative Code, Department of Community Affairs, Fla. Admin. Code Chapter 9B and International Plumbing Code, and local code if more stringent for materials for the Work of this Section.

2.2 PIPE MATERIALS

- A. Vitrified Clay Pipe:
 - 1. Pipe: ASTM C700, extra strength, un-perforated; inside nominal diameter as shown on Drawings.
 - 2. Joint Device: Bell and spigot joint, ASTM C425, compression gasket joint.

- B. Concrete Pipe:
1. Pipe: ASTM C14, Class 1, 2 and 3; non-reinforced; inside nominal diameter as shown on Drawings.
 2. Joint Devices: Bell and spigot joint, ASTM C443, rubber compression gasket joint.
- C. Reinforced Concrete Pipe:
1. Pipe: ASTM C76, Class I, II, III, IV and V with Wall Type A, B and C; bar reinforcement; inside nominal diameter as shown on Drawings.
 2. Pipe: ASTM C506 Reinforced Concrete Arch Pipe: Pipe shall meet all requirements contained in ASTM C506.
 3. Pipe: ASTM C507 Reinforced Concrete Elliptical Pipe: Pipe shall meet all requirements contained in ASTM C507
 4. Joint Device: Bell and spigot joint, ASTM C443, rubber compression gasket joint.
- D. Polyvinyl Chloride (PVC) Pipe:
1. Pipe: ASTM D2665, polyvinyl chloride (PVC) material; inside nominal diameter as shown on Drawings.
 2. Joint Device: Bell and spigot with ASTM D2564 solvent sealed joint.
- E. Polyvinyl Chloride (PVC) Pipe:
1. Pipe: ASTM D3034, Type PSM, polyvinyl chloride (PVC) material; inside nominal diameter as shown on Drawings.
 2. Pipe: ASTM F679, polyvinyl chloride (PVC) material, PS [46] [115], nominal inside diameter as shown on Drawings.
 3. Joint Device: Bell and spigot style with ASTM F477 rubber ring sealed gasket. Joint shall conform to ASTM D3212 and ASTM D2564 solvent seal.
- F. Polyethylene Pipe:
1. Pipe: ASTM F2648 (AASHTO M294), Type S, Polyethylene Pipe, ASTM D3350 polyethylene material, inside nominal diameter as shown on Drawings.
 2. Fittings: ASTM F2306.
 3. Joint Device: ASTM D3212 bell and spigot style, with ASTM F477 gasket joint.
- G. Acrylonitrile-Butadiene-Styrene (ABS) Pipe:
1. Pipe: ASTM F628, ASTM D3965 acrylonitrile-butadiene-styrene (ABS) material; inside nominal diameter as shown on Drawings.
 2. Fittings: ASTM D2661.
 3. Joint Device: Bell and spigot style sealed joint end with solvent conforming to ASTM D2235.
- H. Corrugated Steel Pipe:
1. Pipe: AASHTO M36 Type I, II and III] nominal diameter as shown on Drawings, end joints; helical lock seam; coated inside and out with [0.050] inch thick bituminous coating.
 2. Joint Device: Galvanized steel coupling bands, 0.052 inches thick x 10 inches wide; connected with two neoprene "O" ring gaskets and two galvanized steel bolts.

2.3 PIPE FITTINGS AND ACCESSORIES

- A. Fittings and fitting joints shall be in accordance with:
 - 1. State of Florida Administrative Code, Department of Community Affairs Chapter 9B and International Plumbing Code, and local code if more stringent for materials for the Work of this Section.
- B. Fittings: Same material as pipe, molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.
- C. Mortar: ASTM C270, Type S.
- D. Filter Fabric: Non-biodegradable, nonwoven:
 - 1. Carthage Mills, HS series.
 - 2. TenCate North American Mirafi N series.
 - 3. Propex, Geotex Nonwoven series.
 - 4. US Fabrics, Medium Weight NW series.

2.4 PIPE LOCATION MATERIALS

- A. Identification Warning Tape: Heavy plastic underground warning tape, 2-inch width. Color-[Bright Green], warning message "Caution Buried STORM SEWER Below" to repeat every 30 inches.
- B. Tracer Wire: 45-mil solid copper, No. 12 HMW-PE yellow jacket coating. Installed to enable electronic locating of underground utility.

2.5 TRACER WIRE MATERIALS

- A. Mark all non-conductive lateral pipes with a locating wire system.
- B. Locating wire system consists of the following:
 - 1. Tracer Wire: 45-mil solid copper, No. 12 HMW-PE yellow jacket coating. Install to enable electronic locating of underground utility.
 - 2. Tracer Wire Locating Box: 2-1/2-inch diameter, minimum, ABS pipe with 2 point terminal box and cast iron cover.
 - a. Manufacturer: Valco, Inc., Model C.P. Mini Box, or an approved equal.]

2.6 PRECAST CONCRETE STRUCTURES INCLUDING FRAMES AND COVERS

- A. Precast Concrete Risers and Cone Sections for Manholes, Catch Basins, and Inlets: In accordance with ASTM C478, minimum wall thickness, one twelfth of internal diameter of riser or largest cone diameter plus 1 inch.
- B. Precast Concrete Base Section with Integral Floor: In accordance with ASTM C478, minimum floor thickness 6 inches for risers up to 48-inches in diameter, and 8 inches for larger diameters; bench minimum slope 1/2-inch per foot from channel to wall; cast in place pipe sleeves.
- C. Concrete Flat Slab Top: In accordance with ASTM C478 and approved Shop Drawings; Minimum thickness 6 inches for 48-inch diameter, 8 inches for larger diameters; equipped with lifting hooks.

- D. Minimum access opening in cone or top section: 24-inch diameter.
- E. Minimum compressive strength of concrete: 4000 psi.
- F. Section shall support own weight and live load equivalent to AASHTO HS-20 Highway Loading unless otherwise indicated on Drawings.
- G. Design exterior wall for a minimum equivalent fluid pressure of 90 pounds per square foot and consider additional lateral pressure from approaching truck wheels.
- H. Form and cast openings with wall sleeves in base sections as required by Drawings.
- I. Horizontal wall joints shall not be located within 18 inches of centerline of wall penetration.
- J. Section joints: Reinforced concrete base and riser sections excepting grade rings, designed and formed with tongue and groove ends to produce a continuous, uniform manhole.
- K. Identification Markings: Clearly mark on inside of each precast section indicating date of manufacture, name or trademark of manufacturer. Clearly mark on outside of each section vault identification number from Drawings.
- L. Precast concrete grade rings shall conform to ASTM C478.
- M. Mortar: ASTM C270, Type S.
- N. Reinforcement: Formed steel wire, galvanized finish.
- O. Manhole Steps:
 - 1. Steel reinforced copolymer polypropylene plastic ASTM D4101 PP0344B33534Z02; ASTM A615, Grade 60 steel reinforced 1/2 inch diameter formed; size, placement and embedment shall conform to OSHA 29 CFR 1926.1053 Ladders and ASTM C478; ends of legs tapered with fins for embedment.
 - 2. Rungs and Steps in Risers and Conical Sections: Aligned in each section to form continuous ladder with rungs equally spaced vertically in assembled manhole. Steps shall be 12 inches wide, 16 inches on center vertically, set into manhole wall as indicated on Drawings.

2.7 STRUCTURE FRAMES, COVERS, AND GRATES

2.8 MANHOLE FRAME AND COVER

- A. Manufacturers:
 - 1. Neenah Foundry Company, Neenah, WI.
 - 2. East Jordan Iron Works Inc., East Jordan, MI.
 - 3. U.S. Foundry & Manufacturing Corporation, Miami, FL.
 - 4. Substitutions: In accordance with Division 01 – General Requirements.
- B. Manhole Frame and Covers:
 - 1. Gray iron castings; ASTM A48, Class 35B or Ductile iron castings, ASTM A536, Grade 80-55-06, machined horizontal bearing surface, with concealed pickhole, gasketed, solid lid.
 - a. Neenah R-1661 or Neenah R-2502 Manhole Frame with Type A, C or D lid or grate.
- C. Catch Basin and Inlet Frame and Grate:

1. Gray iron castings; ASTM A48, Class 35B or Ductile iron castings, ASTM A536, Grade 80-55-06] machined horizontal bearing surface, with concealed pickhole, gasketed, solid lid.
 - a. Pavement: Neenah R-3210-L] or equal, with Type L vane grate.
 - b. Curb and Gutter: Neenah R-3220-L or equal, with Type L vane grate.
 - c. Lawn: Neenah R-2533 with R-1710 frame or Neenah R-2560 beehive grate, with frame.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that trench cut and excavation base are ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with Type A2 aggregate as specified in Section 31 05 16 – Aggregates for Earthwork.
- B. Remove large stones or other hard matter that could damage pipe or impede consistent backfilling or compaction.
- C. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- D. Remove scale and dirt on inside and outside before assembly.
- E. Prepare pipe connections to equipment with flanges or unions.

3.3 BEDDING

- A. Excavate pipe trench in accordance with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction for Work of this section. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Place and shape bedding material to pipe, to a minimum depth of three inches under bell and four inches under spigot and compact to 95 percent modified Proctor density.
- C. Backfill around sides and top of pipe with bedding material to a loose lift depth of 15 inches above pipe and compact to 95 percent modified Proctor density.
- D. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with manufacturer's instructions and
 1. State of Florida Administrative Code, Department of Community Affairs, Fla. Admin. Code Chapter 9B and International Plumbing Code and local code if more stringent for installation of the Work of this Section.
- B. Install concrete pipe and fittings in accordance with ASTM C1479.
- C. Install ductile iron pipe and fittings in accordance with AWWA C600.

- D. Install PVC, polyethylene and ABS pipe in accordance with ASTM D2321 and ASTM F1668.
- E. Install pipe, fittings, and accessories in accordance with manufacturer's instructions.
- F. Lay pipe to slope gradients noted on Drawings; with maximum variation from true slope of 1:1000.
- G. Backfill trench in accordance with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 - Site Excavation, Backfill, and Compaction. Do not displace or damage pipe when compacting.
- H. Connect to building storm sewer outlet and municipal sewer system, through installed sleeves.
- I. Coordinate the Work with termination of storm sewer connection outside building, connection to municipal sewer utility service, and trenching.
- J. Install colored marker tape continuous over top of pipe buried 18 inches below finish grade, above pipe line; coordinate with Section 31 23 16 - Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction.

3.5 PREPARATION FOR STRUCTURES

- A. Coordinate placement of inlet and outlet pipe sleeves required by other sections.
- B. Do not install structures where site conditions induce loads exceeding structural capacity of structures.
- C. Inspect precast concrete structures immediately prior to placement in excavation to verify structures are internally clean and free from damage. Remove and replace damaged units.

3.6 INSTALLATION - STRUCTURES

- A. Excavation and Backfill:
 - 1. Excavate for manholes and drainage structures in accordance with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction, in locations and to depth shown. Provide clearance around sidewalls of structure for construction operations.
 - 2. When groundwater is encountered, prevent accumulation of water in excavations. Place manholes or drainage structures in dry trench.
 - 3. Where possibility exists of watertight structure becoming buoyant in flooded excavation, anchor structure to avoid flotation.
 - 4. Backfill excavations for manholes and drainage structures in accordance with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 - Site Excavation, Backfill, and Compaction.
- B. Install manholes and drainage structures supported at proper grade and alignment on Type A2, A5, A6 or A7 aggregate bedding, as specified in Section 31 05 16 – Aggregates for Earthwork, to a minimum compacted thickness of 6 inches as shown on Drawings.
- C. Set base section, align pipe sleeve openings to provide straight alignment of pipe through manhole base, level and plumb sections.

- D. Set manhole at a grade to assure that no more than 8 inches of precast concrete rings would be required to bring manhole frame and cover to final grade.
- E. Lift precast structures at lifting points designated by manufacturer.
- F. When lowering manholes and drainage structures into excavations and joining pipe to units, take precautions to ensure interior of structure remains clean.
- G. Place preformed flexible joint sealant on either side of tongue portion of joint in base section to assure filling of entire joint when assembled.
- H. Set riser section on base, aligning joint prior to setting, lower riser section level and uniformly on to base to squeeze joint compound throughout tongue and groove joint, visible for inspection both interior and exterior for water tight fit.
- I. Trowel excess joint compound material flush at interior and exterior surface after placement.
- J. Repeat process for remaining riser sections and top, exercising care to align manhole ladder rungs to form uniform vertical ladder.
- K. Section shall be vertical and in true alignment with a maximum 1/4-inch tolerance per section allowed.
- L. Allow joints to set for a minimum 24-hour period before backfilling.
- M. Plug holes in section required for handling or other purposes with non-shrink grout, finished flush on inside.
- N. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe. Fill annular space with mortar.
- O. Cut pipe to finish flush with interior of structure.
- P. Provide concrete flowline at bottom of lowest structure section to achieve sloped drainage from entering pipe to exiting pipe. Trowel smooth. Perform backfilling carefully, bringing fill up evenly on all sides.
- Q. Compact fill around vault with a mechanical hand operated wacker.

3.7 INSTALLATION - FRAME AND COVER

- A. Set frames using mortar and precast concrete adjustment rings as required.
- B. Place precast concrete rings in full bed of mortar with completely fill joints. Verify maximum height of adjustment rings allowed by code prior to installing.
- C. Plaster adjustment rings on both inside and outside of ring cylinder with mortar.
- D. Place flexible joint sealant on centerline circumference of slab top or concrete ring with mortar bed placed on interior and exterior of sealant to full width of frame or ring area.

- E. In non-pavement areas set frame and cover two inches above finished grade for manholes and other structures with covers to allow area to be graded away from cover beginning 1-inch below top surface of frame.

3.8 TRACER WIRE INSTALLATION

- A. Originate and terminate lateral tracer wire in wire access box located at right-of-way line. Install conductor tracer wire in one continuous loop.
- B. Tape conductor tracer wire to top of pipe at minimum 10-foot intervals. Wrapping conductor tracer wire around pipe is prohibited.
- C. Field test each locating wire after completing installation.

3.9 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements, Section 01 40 00 - Quality Requirements, Section 31 02 00 – General Requirements for Sitework: Field inspection and testing.
- B. Perform compaction and moisture content testing in accordance with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 - Site Excavation, Backfill, and Compaction.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- D. Frequency of Tests: As determined Engineer/Architect, Owner’s Representative, Construction Manager or Testing Agency.
- E. Deflection Test: Deflection tests shall be performed for all polyvinyl chloride (PVC) and polyethylene pipe installations.
 - 1. Deflection test shall be performed using a rigid ball or mandrel without a mechanical pulling device.
 - 2. If deflection testing occurs within 30 days of placement of final backfill, deflection shall not exceed 5 percent.
 - 3. When deflection testing occurs more than 30 days after placement of final backfill, maximum deflection shall not exceed 7.5 percent.

3.10 PROTECTION OF FINISHED WORK

- A. Division 01 – General Requirements, Section 01 70 00 - Execution and Closeout Requirements, Section 31 02 00 – General Requirements for Sitework: Protecting installed work.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is completed.

END OF SECTION 334100

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SECTION 334213 - PIPE CULVERTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Corrugated Steel Pipe Culvert.
2. Concrete Pipe Culvert.
3. Polyethylene Pipe Culvert.
4. Pipe Culvert Joints.
5. Flared End Sections.
6. Accessories.

B. Related Sections:

1. Applicable provisions of Division 01 – General Requirements, Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
2. Section 31 05 16 – Aggregates for Earthwork.
3. Section 31 23 17 - Site Excavation, Backfill, and Compaction: Excavating and backfilling for culvert piping.

1.2 REFERENCES

A. Florida Department of Transportation:

1. Standard Specifications for Road and Bridge Construction, Current Edition with latest supplements. (FDOT)

B. American Association of State Highway and Transportation Officials: (AASHTO)

1. AASHTO M36 - Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.
2. AASHTO M170 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
3. AASHTO M294 - Specification for Corrugated Polyethylene Pipe, (12 - Inch to 36 - Inch Diameter).

C. ASTM International: (ASTM)

1. ASTM A760 – Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.
2. ASTM A798 - Practice for Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications.
3. ASTM A929 - Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe.
4. ASTM B745 – Specification for Corrugated Aluminum Pipe for Sewers and Drains.
5. ASTM B788 – Practice for Installing Factory-Made Corrugated Aluminum Culverts and Storm Sewer Pipe.
6. ASTM C14 - Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
7. ASTM C33 - Specification for Concrete Aggregates.
8. ASTM C76 - Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
9. ASTM C150 - Specification for Portland Cement.
10. ASTM C443 - Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

11. ASTM C506 - Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe.
12. ASTM C507 - Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe.
13. ASTM C655 - Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe.
14. ASTM C985 - Specification for Nonreinforced Concrete Specified Strength Culvert, Storm Drain, and Sewer Pipe.
15. ASTM C1479 - Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations.
16. ASTM D2321 – Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
17. ASTM F677 - Specification for Large Diameter Corrugated Polyethylene Pipe and Fittings.
18. ASTM F1668 - Guide for Construction Procedures for Buried Plastic Pipe.

1.3 SUBMITTALS

- A. Division 01 – General Requirements, Section 01 33 00 - Submittal Procedures, Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.
- B. Product Data: Submit data on pipe, fittings and accessories.
- C. Manufacturer's Installation Instructions: Submit procedures required to install Products specified.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements, Section 01 70 00 - Execution and Closeout Requirements Section 31 02 00 – General Requirements for Sitework: Closeout procedures.
- B. Division 01 – General Requirements, Section 01 70 00 - Execution and Closeout Requirements Section 01 78 39 – Project Record Documents, Section 31 02 00 – General Requirements for Sitework: Project Record Documents:
 1. Accurately record actual locations of pipe runs, connections, and invert elevations.
 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- C. Division 01 – General Requirements, Section 01 70 00 - Execution and Closeout Requirements, Section 01 78 23 – Operation and Maintenance Data, Section 31 02 00 – General Requirements for Sitework: Operation and maintenance Data.

1.5 PRE-INSTALLATION MEETING

- A. Division 01 – General Requirements, Section 01 30 00 - Administrative Requirements, Section 31 02 00 – General Requirements for Sitework: Pre-installation meeting.
- B. Convene one week prior to commencing Work of this section.

PART 2 - PRODUCTS

2.1 CONCRETE CULVERT PIPE

- A. Concrete Pipe: ASTM C14, Class 1, 2, or 3; non-reinforced:
 - 1. Bell and spigot or plain end joints.
 - 2. Shape: Circular with nominal diameter as shown on Drawings.
- B. Reinforced Circular Concrete Pipe: ASTM C76, Class I, II, III, IV, V with Wall Type A, B, or C; bar] reinforcement [AASHTO M170, Class I, II, III, IV, V; Type R-4[bell and spigot end joints:
 - 1. Shape: Circular with nominal diameter as shown on Drawings.
- C. Arched and Elliptical Pipe
 - 1. Reinforced Arch Pipe: ASTM C506, Class A-II, A-III, A-IV.
 - 2. Reinforced Horizontal Elliptical Pipe: ASTM C507, Class HE-A, HE-I, HE-II, HE-III, HE-IV.
 - 3. Reinforced Vertical Elliptical Pipe: ASTM C507, Class VE-II, VE-III, VE-IV, VE-V, VE-VI.
- D. Reinforced Concrete Pipe Joint Device: ASTM C443, rubber compression gasket joint. Use Bureau of Reclamation Type R-4 joint.
- E. Flared Ends: Same material and joints as pipe
- F. Reinforced Circular Concrete Pipe: FDOT Section 449.
- G. Reinforced Arched and Elliptical Concrete Pipe:
 - 1. Reinforced Horizontal Elliptical Pipe: FDOT Section 449.

2.2 POLYETHYLENE CULVERT PIPE

- A. Polyethylene Culvert Pipe: AASHTO M294, Type S.
 - 1. Shape: Circular with nominal diameter as shown on Drawings.
 - 2. Joints: AASHTO M294, corrugated to match pipe.
 - 3. Joints: Polyethylene sleeve with gasket.
- B. Polyethylene Culvert Pipe: DOT Section 948.

2.3 BEDDING AND COVER MATERIALS

- A. Bedding: Fill Type A6 or A7 specified in Section 31 05 16 – Aggregates for Earthwork.
- B. Cover: Fill Type A6 or A7, as specified in Section 31 05 16 – Aggregates for Earthwork loose lift to 24 inches above top of pipe.

2.4 ACCESSORIES

- A. Filter Fabric: Non-biodegradable, woven manufactured by Mirafi division of TenCate Geosynthetics North America.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements, Section 01 30 00 - Administrative Requirements, Section 31 02 00 – General Requirements for Sitework: Coordination and project conditions.
- B. Verify trench cut or excavation base is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Remove large stones or other hard matter that could damage piping or impede consistent backfilling or compaction.

3.3 EXCAVATION AND BEDDING.

- A. Excavate culvert trench to 12 inches below pipe invert, in accordance with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction] for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Place bedding material at trench bottom, level fill materials in one continuous 4-inch compacted depth layer, compact to 95 percent Modified Proctor density.
- C. Place filter fabric over compacted fill.
- D. Backfill around sides and to 12-inch compacted depth over top of pipe with cover material, tamped in place and compacted to 95 percent Modified Proctor density.
- E. Maintain optimum moisture content of bedding material to attain required compaction density.
- F. Place fabric over compacted bedding.
- G. Conform to FDOT Section 430.

3.4 INSTALLATION - PIPE

- A. Install concrete pipe in accordance with ASTM C1479.
- B. Install polyethylene pipe in accordance with ASTM D2321 and ASTM F1668.
- C. Lift or roll pipe into position. Do not drop or drag pipe over prepared bedding.
- D. Shore pipe to required position; retain in place until after compaction of adjacent fills. Ensure pipe remains in correct position and to required slope.
- E. Repair surface damage to pipe protective coating with two coats of compatible bituminous paint coating.
- F. Install aggregate at sides and over top of pipe. Install top cover to minimum compacted thickness of 12 inches.

- G. Place filter fabric over compacted fill.
- H. Install culvert end gratings.
- I. Refer to Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction for backfilling and compacting requirements. Do not displace or damage pipe when compacting.
- J. Conform to FDOT Section 430.

3.5 PIPE ENDS

- A. Conform to FDOT Section 430.
- B. Place fill at pipe ends, at embankment slopes, at concrete aprons, [to adjacent construction, as indicated on Drawings.

3.6 ERECTION TOLERANCES

- A. Division 01 – General Requirements, Section 01 40 00 - Quality Requirements, Section 31 02 00 – General Requirements for Sitework: Tolerances.
- B. Lay pipe to alignment and slope gradients noted on Drawings; with maximum variation from indicated slope of 1/8-inch in 10 feet.
- C. Maximum Variation from Intended Elevation of Culvert Invert: 1/2-inch.
- D. Maximum Offset of Pipe from Indicated Alignment: 1-inch.
- E. Maximum Variation in Profile of Structure from Intended Position: 1 percent.

3.7 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements, Section 01 40 00 - Quality Requirements, Section 31 02 00 – General Requirements for Sitework: Testing and inspection services.
- B. Division 01 – General Requirements, Section 01 70 00 - Execution and Closeout Requirements, Section 31 02 00 – General Requirements for Sitework: Testing, adjusting, and balancing.
- C. Request inspection prior to and immediately after placing aggregate cover over pipe.
- D. Compaction Testing: In accordance with Section 31 23 16 – Utility Trench Excavation, Backfill, and Compaction, Section 31 23 17 – Site Excavation, Backfill, and Compaction.
- E. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.
- F. Frequency of Tests: As determined by Engineer/Architect, Owner’s Representative, Construction Manager or Testing Agency.

3.8 PROTECTION OF INSTALLED CONSTRUCTION

- A. Division 01 – General Requirements, Section 01 70 00 - Execution and Closeout Requirements, Section 31 02 00 – General Requirements for Sitework: Protecting installed construction.
- B. Protect pipe and bedding from damage or displacement until backfilling operation is completed.

END OF SECTION 334213

SECTION 347739 – CHECKED BAGGAGE INSPECTION SYSTEM

PART 1 – GENERAL

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1.02 ABBREVIATIONS & DEFINITIONS

A. Abbreviations

The following abbreviations and acronyms may be used throughout this document. Not all abbreviations may apply to this specification.

AHJ	Authority Having Jurisdiction
AL	Alarm Line
ALCL	Alarm Line Cleared Line
AOA	Air Operations Area
ATO	Airline Ticketing Offices
ATR	Automatic Tag Reader
AWG	American Wire Gauge
BAIT	Baggage Auto-ID Transfer
BDR	Baggage Data Register
BHS	Baggage Handling System
BHSC	Baggage Handling System Contractor
BHSO	Baggage Handling System Oversized Baggage
BIT	Baggage Inspection Table
BMA	Baggage Measuring Array
BPH	Bags per Hour

BPM	Bags per Minute
BRP	Baggage Removal Point
BSM	Baggage Source Message
BSM	Baggage System Management
BVS	Baggage Viewing Station
CBIS	Checked Baggage Inspection System
CBRA	Checked Baggage Resolution Area
CCTV	Closed Circuit Television
CL	Clear Line
CM(AR)	Construction Manager (at Risk)
CPU	Computer Processing Unit
CS	Control Station
CTX	Computed Tomography X-ray
CUSS	Common Use Self Service
CUTE	Common Use Terminal Equipment
dBA	Decibel "A" Weighted
DHS	Department of Homeland Security
EDS	Explosives Detection System
EMC	Electromagnetic Compatibility
EMT	Electrical Metallic Tubing
ETD	Explosives Trace Detection
FAT	Factory Acceptance Test
FF&E	Furniture, Fixtures, and Equipment
FIDS	Flight Information Display System
FIO	For Information Only
FIS	Federal Inspection Station
FLA	Full Load Amps
FPM	Feet per Minute
FR	Fire Resistant
GC	General Contractor
GFI	Ground Fault Interrupter
HMI	Human Machine Interface
HMWPE	High Molecular Weight Polyethylene
HOA	Hand/Off/Auto
HP	Horse Power
HSD	High Speed Diverter
Hz	Hertz
I/O	Input/output
IATA	International Air Transport Association
ID	Identification
IMC	Intermediate Metal Conduit
IRD	Interface Requirements Document
ISAT	Integrated Site Acceptance Test
ISO	International Organization for Standardization
KPI	Key Performance Indicator
KVM	Kernel-based Virtual Machine
LAN	Local Area Network
LBS	Pounds
LCD	Liquid Crystal Display

LED	Light Emitting Diode
LEO	Law Enforcement Officer
MCC	Motor Control Center
MCP	Motor Control Panel
MDP	Main Power Distribution Panel
MDS	Maintenance Diagnostic System
MES	Manual Encoding Station
MICE	Mechanical, Ingress, Climatic/Chemical and Electromagnetic
MS	Millisecond
MSP	Motor Starter Panel
NP	Node Panel
NSA	National Security Agency
NTP	Notice to Proceed
O&M	Operations & Maintenance
OEM	Original Equipment Manufacturer
OG or OOG	Out-of-Gauge
OS	Oversize
OSR	On-Screen Resolution
OSRCL	On-Screen Resolution Cleared Line
OSRL	On-Screen Resolution Line
OTK	Operation Test Kit
P/PB	Push/Pull Button
PB	Push Button
PC	Personal Computer
PDP	Power Distribution Panel
PE	Photoeye
PFD	Power Face Diverter
PLC	Programmable Logic Controller
PVC	Polyvinyl Chloride
QC	Quality Control
QCR	Quality Control Report
QD	Quick Disconnect
QLR	Quick Look Report
RCDD	Registered Communications Distribution Designer
RFD	Request for Deviation
RFI	Request for Information
RFID	Radio Frequency Identification
RFP	Request for Proposal
RFS	Request for Substitution
RL	Re-Induction Line
RPI	Requested Package Interval
RPM	Revolutions per Minute
SAC	Sort Allocation Controller
SAE	Society of Automotive Engineers
SAT	Site Acceptance Test
SCCR	Short Circuit Current Rating
SE	Shaft Encoder
SPB	Start/Reset Pushbutton
SS	Security Shunt (shunt exit)

SSI	Sensitive Security Information
SSTP	Site Specific Test Plan
SVGA	Super Video Graphics Display
SVS	Secondary Viewing Station
TEFC	Totally Enclosed Fan-cooled Motor
THHN	Thermoplastic Insulated Cable, Heat Resistant and Can Withstand Higher Temperatures, Nylon Coating
THHW	Thermoplastic Insulated Cable, Heat Resistant and Can Withstand Higher Temperatures, Approved for Use in Damp and Wet Locations
TIR	Total Indicated Runout
TOB	Top of Bed
TRR	Test Readiness Review
TSO	Transportation Security Officer
TSR	Test Summary Report
UPS	Uninterrupted Power Supply
USB	Universal Serial Bus
VAC	Volts Alternating Current
VDC	Volts Direct Current
VFD	Variable Frequency Drive
VLAN	Virtual Local Area Network
VPN	Virtual Private Network
VSU	Vertical Sortation Unit
VTC	Vic Thompson Company

B. Definitions

1. Baggage Handling System (BHS): All project content, including equipment, installation materials, interfaces, components, hardware, software, installation, coordination, and construction supervision of computers, PLC, controls, and control hardware and software, management and support services required to implement the work and supply a fully functioning system as described by the Contract Documents.
2. BHS Contractor (BHSC): Equipment Contractor, Equipment Supplier, Baggage Contractor, Baggage Handling System Contractor Supplier, and Contractor, and will mean the firm or company that is responsible for the design, engineering, manufacture, modification, installation, testing, warranty and technical support of the conveyor equipment and systems required to implement the work and supply a fully functional system as described by the Contract Documents.
3. Contract Plans: The Proposal Plans referred to in these written Specifications or the Contract. The Owner may, from time to time, supply modifications or revisions of such plans and other plans to the Contractor for the purposes of the Contract.
4. Request for Proposal (RFP): A formal written request from the Owner to qualified bidders or the BHSC for a proposal on the BHS defined by the Specifications and plans.
5. Request for Information (RFI): A formal written request to Owner from a bidder or BHSC requesting additional information or clarifications to the Specifications or plans.
6. Request for Substitution (RFS): A formal written request to the Owner from a bidder or BHSC requesting permission to substitute an approved equal product, component, service or action from one called out in the Specifications.
7. Notice to Proceed (NTP): A written notice given by the Owner to the BHSC setting the date on which the contract time will commence, and upon which the BHSC's obligations under the contract documents begins.

8. **Substantial Completion:** Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. Only minor corrective work will be allowed to be considered as punch list work. Upon receipt of written notice of substantial completion from the BHSC, the Owner, VTC, and BHSC will create a list of items to be completed or corrected (punch list) before Final Acceptance and Final Payment. The BHSC must provide the level of effort and resources necessary to complete the defects or deficiencies (punch list) within thirty (30) days of issuance of such list. For phased projects, each phase may have a unique Substantial Completion date agreed upon by the Owner and BHSC.
9. **Final Completion:** The date of Final Completion of the Project or portion thereof will be the date of issuance of the Certificate of Final Completion. The certificate will be issued when all project-related start-up, commissioning, testing, training, etc. has been completed and accepted by the Owner; close-out documentation has been reviewed by VTC and accepted by Owner to include, but not limited to: as-built documentation, O&M manuals, warranty information, spare parts list, notice of system compliance, all test results, PLC documentation, and software source code files; all changes orders have been processed; the AHJ has issued Certificate of Occupancy (if required); final release of Lien has been submitted; and final request for payment to BHSC has been submitted.
10. **As-Built:** A comprehensive set of documents identifying the complete and final condition of the system.

C. Project Team Definitions

1. Owner: Okaloosa County
2. BHS Designer: VTC
3. Design Team: VTC, Corgan, Graef
4. BHS Contractor (BHSC): Refers to the BHS contractor
5. General Contractor (GC) or Construction Manager (CM): Refers to the building and facility contractor
6. TSA: Refers to the TSA or the firms that are contracted to perform services by and on behalf of the TSA

1.03 DOCUMENT PRECEDENCE AND CONTROL

A. Document Precedence

The Specifications, Plans, Addendum, and contract all constitute the Contract Documents for the Project. If there are any discrepancies between any related documents, including specifications, plans, codes and regulations that conflict with each other, the BHS Contractor (BHSC) must notify VTC of the discrepancy in writing. VTC will consult with the Owner, and will then advise the BHSC as to which document will govern. Until the conflict is resolved, the most stringent resolution must be followed.

B. Document Control

Certain information relating to the CBIS performance and operations are considered Security Sensitive Information (SSI). Such information shall be controlled, managed and marked in accordance with 49 CFR Parts 15 and 1520, including but not limited to the following:

1. System detection and decision logic and associated software.
2. Methodology of CBIS use, bag screening/clearing procedures and alarm resolution.
3. Technical specifications of screening equipment and system equipment parameters.

4. Threat images and descriptions.
5. Performance data from screening systems, including the testing of the screening systems.

C. Project Plans

Refer to Index Sheet for list of all applicable plans.

D. Project Coordination

BHSC must coordinate the work with work by others as identified by the Owner.

1.04 REFERENCES

A. Reference Codes

Comply with the requirements of the reference standards stated herein, except where more stringent requirements are required by the Authority Having Jurisdiction (AHJ). Reference to the codes and standards form part of this specification to the same extent as if bound herein.

1. All work must be in accordance with the latest applicable national, state and municipal building codes.
 - a. Florida Building Code
 - b. Fort Walton Beach Building Code
 - c. Florida Plumbing Code
 - d. Florida Mechanical Code
 - e. National Electrical Code (NEC) (NFPA 70) - 2017
 - f. Standard for the Installation of Sprinkler Systems (NFPA 13) - 2016

B. Reference Standards

1. Transportation Security Administration (TSA)
 - a. Planning Guidelines and Design Standards (PGDS) for Checked Baggage Inspection Systems (CBIS), Version 6.0.
 - b. Checked Baggage Inspection System (CBIS) Interface Requirements Document (IRD), v1.08a, dated December 8, 2009.
2. L3 eXaminer 3DX Integration Guide (EDS to Baggage Handling System)
3. American Gear Manufacturers Association (AGMA) www.agma.org
 - a. AGMA 6013-A06, Standard for Industrial Enclosed Gear Drives
 - b. AGMA 6034-B92, Practice for Enclosed Cylindrical Worm Gear Speed Reducers and Gear Motors
4. American Ladder Institute (ALI) www.americanladderinstitute.org
 - a. A14.3, Fixed Ladders
5. American Society of Mechanical Engineers (ASME) www.asme.org
 - a. ASME B20.1-2012, Safety Standard for Conveyors and Related Equipment
 - b. ASME B29.1, Precision Power Transmission Roller Chains, Attachments, and Sprockets
 - c. ASME B29.100-2011, Double Pitch Roller Chains, Attachments and Sprockets
6. American Society of Safety Engineers (ASSE) www.asse.org
 - a. A1264.1, Safety Requirements for Workplace Walking/Working Surfaces and Their Access; Workplace Floor, Wall and Roof Openings; Stairs and Guardrails Systems

7. ASTM International (ASTM) www.astm.org
 - a. ASTM A36, Standard Specification for Carbon Structural Steel
 - b. ASTM A240/A240M-14, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
 - c. ASTM A307-12, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod
 - d. ASTM A325-10e1, Standard Specification for Structural Bolts
 - e. ASTM A1011, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low Alloy and High-Strength Low Alloy with Improved Formability
 - f. ASTM D378-10, Standard Test Methods for Rubber (Elastomeric) Belting, Flat Type
8. American Welding Society (AWS) www.aws.org
 - a. AWS A5.1, Specifications for Carbon Steel Electrodes for Shielded Metal Arc Welding
 - b. AWS C1.1M, Recommended Practices for Resistance Welding
 - c. AWS C1.4M, Specification for Resistance Welding of Carbon and Low-Alloy Steels
 - d. AWS C1.5, Specifications for the Qualifications of Resistance Welding Technician
 - e. AWS D1.1, Structural Welding Code Steel
9. Conveyor Equipment Manufacturers Association (CEMA) www.cemanet.org
 - a. CEMA 401, Roller Conveyors – Non-Powered
 - b. CEMA 402, Belt Conveyors
 - c. CEMA B105.1, Specifications for Welded Steel Conveyor Pulleys with Compression Type Hubs
 - d. CEMA SBP-001, Design and Safe Application of Conveyor Crossovers for Unit Handling Conveyors
10. Industrial Automation Open Networking Alliance (IAONA) www.iaona.de
 - a. Industrial Ethernet Planning and Installation Guide
11. Institute of Electrical and Electronic Engineers (IEEE) www.ieee.org
 - a. 802.1, Wired and Wireless Communications Standards
 - 1) 802.1Q-2014: Bridged Networks
 - 2) 802.1X-2010: Port Based Network Access Control
 - 3) 802.1AB-2009: Station and Media Access Control Connectivity Discovery
 - 4) 802.1AC: MAC Services Definition
 - 5) 802.1AE-2006: MAC Security
 - 6) 802.1AEbn: Galois Counter Mode-Advanced Encryption Standard-256
 - 7) 802.1AR-2009: Security Device Identity
 - 8) 802.1AS-2011: Timing and Synchronization for Time-Sensitive Applications in Bridged Local Area Networks
 - 9) 802.1AX-2014: Link Aggregation
 - 10) 802.1BA-2011: AVB Systems
 - 11) 802.1BR-2012: Bridge Port Extension VN-Tag
 - b. 802.3, Standard for Ethernet
12. International Air Transport Association (IATA) www.iata.org
 - a. Passenger Services Resolutions Manual, RP 1745 – *Baggage Information Messages*
13. International Electrotechnical Commission (IEC) www.iec.ch
 - a. 62443, Industrial Communications Network – Network and System Security

- b. 24702, Information Technology, Generic Cabling, Industrial Premises – Mechanical, Ingress, Climatic/Chemical, and Electromagnetic (MICE) Table
- 14. Internet Engineering Task Force (IETF) www.ietf.org
 - a. Request for Comments Documents Series
- 15. National Association of Architectural Metal Manufacturers (NAAMM) www.naamm.org
 - a. MBG 531-09, Metal Bar Grating Material
 - b. MBG 534-12, Metal Bar Grating Engineering Design Manual
- 16. National Electric Manufacturers Association (NEMA) www.nema.org
 - a. ICS 1, Industrial Controls and Systems: General Requirements
 - b. ICS 2, Industrial Control and Systems: Controllers, Contactors and Overload Relays
 - c. ICS 2.3, Industrial Control Systems: Instructions for the Handling, Installation, Operation and Maintenance of Motor Control Centers Rated not More than 600 Volts
 - d. MG 1, Motors and Generators
 - e. Z535.1, American National Standard for Safety Color
- 17. National Fire Protection Association (NFPA) www.nfpa.org
 - a. NFPA 70E, Standard for Electrical Safety in the Workplace
 - b. NFPA 80, Standards for Fire Doors and Other Opening Protectives
- 18. National Institute of Standards and Technology (NIST) www.nist.gov
 - a. SP 800-40 Revision 3, Guide to Enterprise Patch Management Technologies
 - b. SP 800-41 Revision 1, Guidelines on Firewalls and Firewall Policy
 - c. SP 800-61 Revision 2, Computer Security Incident Handling Guide
 - d. SP 800-82 Revision 2, Guide to Industrial Control Systems (ICS) Security
 - e. SP 800-153 Guidelines for Securing Wireless Local Area Networks (WLANs)
- 19. National Security Agency (NSA) www.nsa.gov
 - a. “A Framework for Assessing and Improving the Security Posture of Industrial Control Systems (ICS)” Version 1.1, by the Systems and Network Analysis Center of the NSA
- 20. Occupational Safety and Health Administration (OSHA) www.osha.gov
 - a. 29 CFR Part 1910, Occupational Safety and Health Standards
 - b. 29 CFR Part 1926, Safety and Health Regulations for Construction
- 21. Open DeviceNet Vendors Association (ODVA) www.odva.org
 - a. Ethernet/IP Media Planning and Installation Manual
- 22. “Recommended Practice: Improving Industrial Control Systems Cybersecurity with Defense-In-Depth Strategies”, by the US Department of Homeland Security
- 23. Underwriters Laboratory (UL) www.ul.com
 - a. UL 62, Flexible Cords and Cables
 - b. UL 845, Motor Control Centers

1.05 PERMITS

BHSC is responsible for securing and paying for all permits pertaining to the BHS installation, and to provide copies of such permits and inspections to the related designers and Owner for their records.

1.06 WORK HOURS

Work hours to be “determined” every day of the week, while the CBIS is in operation. Working hours and access when temporary screening solutions allow access to non-operational CBIS must be coordinated with Owner.

1.07 SYSTEM OVERVIEW

A. Existing Outbound Checked Baggage Inspection System/BHS (if applicable)

The existing baggage screening system at VPS consists of 2 (two) L3 6700 units integrated into two separate mini-inline systems. The two systems are connected by a pair of diverters placed in tandem on the TC1 and TC2 lines. Each of the 2 (Two) ticket counter lines feed 1 (one) of the L3 6700 EDS machine. Clear bags are placed back onto the conveyor after processing and sent to a dedicated flat plate make up carousel for that system.

B. New Outbound Checked Baggage Inspection System/BHS

VPS will have a single, fully automated CBIS with two integrated L3 6700 ES EDS machines. A Third shunt line will be installed as an OOG line and can be used for future expansion and addition of a third L3 6700 ES EDS machine. Additionally, the t-merges at the security boundary on the existing ticket counter lines will be replaced with standard power turns. New OSR and CBRA rooms will be added and clear bags will be sent to one of two slope plate make up devices located within a new structure to be built to the west of the existing terminal building.

C. Project Overview

The extent of the work shown on the plans and as specified herein is defined to include all labor, materials, equipment, and supervision required for the design, fabrication, installation, and testing of the particular baggage handling system. Descriptions and requirements indicated by the Contract Documents establish basic arrangements, visual concepts, dimensions and modules of units, profiles and sightlines of members, performance, function and operation. Within these limitations, the BHSC must construct the Work to meet arrangements, visual concepts, design criteria and like requirements indicated by the Contract Documents and include components not indicated but necessary for performance, function, operation and to be considered a permanent and safe operating system.

D. Mechanical, Electrical, and Controls Field Survey

1. BHSC must perform a complete mechanical and electrical field survey prior to preparation of Shop Drawings and must identify all conflicts created by or resulting from existing conditions or work by others. BHSC must propose adjustments to horizontal and vertical conveyor dimensions as needed to accommodate such conflicts and/or to meet the requirements of the Contract Documents.
2. BHSC must perform a complete inspection and evaluation of all existing conveyors and controls and notify VTC and Owner of any operating discrepancies. BHSC must supply a completely integrated and operable CBIS/BHS. All existing conveyor control systems must be incorporated into the new CBIS/BHS control system.

E. Installation

BHSC must furnish and install all necessary equipment to provide a complete, operable and maintainable system including but not limited to: conveyor bed sections, drives, take-ups, sideguards, shrouding, floor supports, ceiling hangers and headers, stainless steel panels and

conveyor trim, fire/security doors, draft curtains, catwalks, platforms, access ladders, guard rails, control panels, conduit and wiring, all controls including interface with all baggage-related equipment and screening equipment and any other materials or equipment required to provide a complete, operable and maintainable system in complete compliance with this specification.

F. Standardization

When multiple manufacturers are listed for a specific component within this specification, the BHSC must use one specified manufacturer for a specific component throughout the project.

G. Demolition of Existing Conveyors

1. BHSC must demolish all required existing conveyors as identified within the plans and all temporary conveyors, including; all conveyor bed sections, drives, take-ups, sideguards, shrouding, floor supports, ceiling hangers and headers, stainless steel panels and conveyor trim, fire/security doors, draft curtains, catwalks, platforms, access ladders, guard rails, control panels, conduit and wiring, all controls (back to source) to return the facility back to its original condition.
2. The Owner will have first right of refusal on all existing conveyor equipment to be removed. Any removed conveyor equipment remaining will become property of the BHSC and must be removed from the site in a timely manner. At no time will conveyor equipment to be removed remain on site in excess of 48 hours without written approval from the Owner.

H. Coordination

1. BHSC must coordinate with the TSA’s designated suppliers for the installation, integration, and commissioning of all TSA-furnished equipment integrated into the BHS. BHSC is responsible for coordinating the work for all wiring, conduit and communication between the TSA-furnished equipment and the BHS as outlined below to provide an operable system as described herein.
2. The table below identifies coordination items and the responsible party for completing the work and providing a complete and operable BHS.

Item	Description	Contractor	TSA
1.0	EDS Equipment		
1.0.a	EDS shipment from warehouse		√
1.0.b	EDS rigging unload and place on site		√
1.0.c	EDS communication voice and data raceway/conduit from network room to EDS	√	
1.0.d	EDS test receptacle adjacent to each or each pair of EDSs	√	
1.0.e	EDS spare parts storage area	√	
1.0.f	EDS area CCTV monitors power and cable	√	
1.0.g	EDS Site Acceptance Test (SAT)		√
1.0.h	EDS maintenance		√
1.1	UPS Equipment		
1.1.a	UPS unload and place on site		√
1.1.b	Building power to power panel for UPS	√	
1.1.c	Power panel for UPS and power to UPS	√	
1.1.d	UPS raceway/conduit from UPS to EDS with disconnect	√	
1.1.e	UPS electrical connection (conductor) to EDS		√
1.2	OSR Room		
1.2.a	OSR workstations (PVS), monitors, keyboard, printer		√

Item	Description	Contractor	TSA
1.2.b	OSR FF&E		√
1.2.c	OSR communication voice and data raceway/conduit and cabling from network room to PVS	√	
1.2.d	OSR – BHS passive display, BHS workstation	√	
1.3	EDS – Multiplexing		
1.3.a	CPU, server, rack, router, monitor and other equipment, including terminations and testing		√
1.3.b	EDS patch panel	√	
1.3.c	Network cabling from network room to PVS, SVS, , UPS, EDS	√	
1.3.d	EDS control station , CPU, monitor, keyboard		√
1.4	CBRA		
1.4.a	Furnish and install ETD equipment		√
1.4.b	ETD electrical power at each ETD table	√	
1.4.c	Furnish and install ETD tables	√	
1.4.d	Furnish and install search workstations (SVS)		√
1.4.f	BHS Bag ID displays (BSD)/printer/reader	√	
1.4.g	Passive EDS displays	√	
1.4.h	Handheld barcode reader for manual encode	√	
1.4.i	EDS image/report printer		√
1.4.j	Furnish and install CBRA CCTV		√
1.4.i	ETD maintenance		√
1.5	TCU/Passenger Viewing Area		
1.5.a	TCU equipment		√
1.5.b	Passenger Viewing Area	√	
1.6	TSA Support Areas		
1.6.a	TSA Supervisor area	√	
1.6.b	TSA Supervisor area FF&E		√
1.6.c	TSA Break Room	√	
1.6.d	TSA Break Room FF&E		√
1.7	BHS		
1.7.a	BHS Control Room telephone, power and communications	√	
1.7.b	CBIS/BHS design, fabrication, installation, testing	√	
1.7.c	BHS integration with EDS	√	
1.7.d	CBIS/BHS training	√	
1.7.e	BHS maintenance	√	

Table 1: Responsibility Matrix

1.08 REQUESTS FOR INFORMATION (RFIS)

A. Requests for Information

1. If the BHSC needs clarification on items relating to the Contract Documents, the BHSC must submit a RFI for each item to VTC and the Owner in writing.
2. The RFI must reference an activity on the Progress Schedule and must note time criticality of the RFI, indicating time within which a response is required and priority when more than one RFI is submitted at the same time.
3. If the BHSC is satisfied with the clarification and does not request a change in Contract Sum or Contract Time, then the clarification will be executed without a change.

4. If the BHSC believes that the clarification results in a change in Contract Sum or Contract Time, then the BHSC must notify VTC and the Owner who may then deny the request for change or issue a RFP.
5. The BHSC must not contract, purchase, or cause to be delivered any articles, devices, or material relating to the RFI prior to obtaining the written response from the Owner.
6. RFIs are not to be used to request deviations or substitutions.

1.09 SUBSTITUTIONS AND DESIGN DEVIATIONS

A. Substitutions

1. Whenever an article or any class of articles, devices or materials is specified by the trade name or by the name of any particular patentee, manufacturer, dealer, or by reference to the catalog of any such patentee, manufacturer or dealer, it will be understood to mean the articles, devices, or materials specified and none other.
2. If BHSC desires to use any articles or materials that it believes are equal in quality, finish and durability and equally suitable for the purpose intended as the particular articles, devices, or materials specified, BHSC must submit a written Request for Substitution (RFS) for each item to VTC and the Owner for approval.
3. RFS will be received and considered only when extensive revisions to the Contract Documents are not required, changes are in keeping with general intent of the Contract Documents, when timely, fully documented and properly submitted, and when one or more of the following conditions are satisfied, all as judged by the Owner:
 - a. Where required product, material, or method cannot be provided within Contract Time, but not as a result of Contractor's failure to pursue the work promptly or coordinate various activities properly.
 - b. Where required product, material, or method cannot be provided in a manner which is compatible with other materials of the work, or cannot be properly coordinated therewith.
 - c. Where required product cannot be used without adversely affecting the Owner's insurance coverage on completed work.
 - d. Where required product, material, or method cannot receive required approval by a governing authority, and requested substitution can be so approved.
 - e. Where substantial advantage is offered to the Owner, in terms of cost and/or time, or other valuable considerations. This includes the cost of future maintenance and spare parts if different than what is specified.
4. The RFS must include product identification, manufacturer's literature, samples (as applicable), information of similar projects on which product has been used, including date of installation, contact information of manufacturer's representative, detailed description of proposed method, and drawings illustrating methods.
5. Include accurate cost data comparing proposed substitution with product and amount of net change in Contract price, including design fees and other related costs under the contract.
6. All variations of the proposed substitute from that specified must be identified in the RFS and available maintenance, repair, and replacement service must be indicated.
7. The articles, devices and materials specified must not be changed except with the recommendation of VTC and the written consent of the Owner.
8. BHSC must not contract, purchase, or cause to be delivered any substitute articles, devices, or materials prior to obtaining such written approval from the Owner.
9. BHSC waives claims for additional costs caused by substitution which may subsequently become apparent.

10. BHSC must submit a statement of how substitution will affect schedule of work and Contract Time. If specified material cannot be furnished by specified manufacturer, documentation from the manufacturer that the specified material cannot be manufactured, supplied, and/or accelerated to meet the work days must be submitted with the BHSC's schedule.
11. Certification by BHSC to the effect that, in its opinion and after its thorough evaluation, proposed substitution will result in total work which is equal to or better than the work originally required by Contract Documents, in every respect of significance except as specifically stated in certification. Certify that substitution will perform adequately in application indicated, regardless of equality and exceptions thereto.
12. BHSC to include in certification BHSC's waiver of rights to additional payment and time which may subsequently be necessitated by failure of substitution to perform adequately, and for required work to make corrections thereof.
13. After execution of Contract, substitutions will not be considered for acceptance when:
 - a. They are indicated or implied on shop drawings or product data submittals without a formal request from BHSC.
 - b. They are requested directly by a subcontractor or supplier.
14. All accepted substitutions will be added to the Contract Documents by Change Order.

B. Design Deviations

1. If BHSC desires to deviate from the design, BHSC must submit a Request for Deviation (RFD) for each item to VTC in writing for review and approval from the Owner.
2. The RFD must include all information relevant to the reason for the deviation to the design.
3. Changes to the design as specified must not be made except with the written consent of VTC and the Owner.
4. BHSC must not contract, purchase, or cause to be delivered any substitute articles, devices, or materials relating to the deviation to the design prior to obtaining such written approval from the Owner.

C. Non-Compliance of Substitutions and Design Deviations

1. If at any time the approved substitution or deviation does not perform to the standards and publications submitted for the item in question, the BHSC will bear sole responsibility of the replacement, and any associated costs with the implementation of the replacement, of the item as originally designed per this Specification.
2. The BHSC must also be responsible for any liquidated damages that may occur due to scheduling delays associated with the substitution or deviation.

1.10 SUBMITTALS

A. General

1. The BHSC must submit a Schedule to VTC for review and Owner approval, 15 days from NTP. BHSC shall maintain accurate schedule updates and provide current schedule each week as required herein.
2. Each submittal must have a transmittal form that identifies the project, the BHSC, subcontractor, major supplier, pertinent drawing sheet and detail number, submittal number and specification section number as appropriate.
3. Upon Owner's approval, certain Submittals may be delivered electronically.
4. The BHSC must stamp the submittal attesting the contents of the submittal have been coordinated with the field conditions, trades, and disciplines and meets the contract requirements. Submittals without the BHSC's stamp of approval will be rejected without

- review. If the BHSC is a subcontractor, the submittal must be reviewed, commented, and stamped by the General Contractor (GC) or Construction Manager (CM). If GC or CM stamp is missing, the submittal will be rejected without review.
5. All drawings submitted must have the appropriate title, date of the original drawing and revision number and date.
 6. VTC will review, comment and transmit all comments in writing on each required submittal within 10 business days upon receipt of the complete submittal.
 7. Partial submittals are not acceptable and will be rejected without review.
 8. Attend Electrical/Controls review meetings to ascertain that the project specifications and requirements are properly reflected in the BHSC submittal documents. The review meetings consist of the following sessions. Frequency of the meetings may vary depending on the project size and complexity. Required attendees are representatives from BHSC, Owner, and VTC.
 - a. Meeting 1 – Date and location to be determined

The main focus of this meeting is to gain a clear understanding of the project specifications and requirements. Attendees will discuss the following items. This will be held after NTP and BHSC Site Survey and prior to BHSC initiating design.

 - 1) Design considerations in technical specifications and requirements (Electrical and Controls)
 - 2) Project phasing
 - 3) Project process and coordination
 - 4) Findings and concerns from BHSC Site Survey
 - b. Meeting 2 - Date and location to be determined

This meeting is to review the critical components of the primary submittals from the BHSC. BHSC must submit the following materials a week prior to this meeting. The discussion items are shown below.

 - 1) PLC/MCP Breakout
 - 2) Lower Level and Upper Level Network Architecture
 - 3) Electrical/Controls Phasing Plan
 - 4) BHS Control Room or/and Server Room Requirements
 - 5) Power Requirements including UPS and MCP size
 - 6) Redundancy Requirements for Servers, PLCs, and Network
 - 7) Device Layout and E-stop Zones
 - c. Meeting 3 – date and location to be determined

This meeting is to review the BHSC submittals mostly related to the system functionalities and operations. BHSC must provide review materials a week prior to this meeting. The discussion items are shown below.

 - 1) Update to previous meeting
 - 2) System Functionalities for Lower Level such as start-up, e-stop, doors, faults, etc.
 - 3) System Functionalities for Upper Level such as reporting, MDS, sortation, etc.
 - 4) PGDS Requirements including Report, Tracking, and Failsafe
 - 5) BHS Interface Requirements
 - 6) EDS Requirements including Phasing, Cabling, and Interfaces
 - 7) Sortation Requirements such as BSM/BPM interfaces

B. Required Submittals

BHSC shall make the following Submittals, and any others required to provide confirmation of compliance with the requirements of the Contract Documents.

1. Detailed Project Schedule

Submit a detailed project schedule that includes start dates and durations of each task and includes milestone dates. The schedule should be able to indicate percent complete on tasks. The detailed project schedule must be in .pdf format and updated monthly. The detailed project schedule must be in CPM format and include, at a minimum, the following tasks:

- a. Notice to Proceed (NTP)
- b. Detailed Submittal Schedule
- c. Mechanical and Electrical Site Survey
- d. Mechanical Design
- e. Electrical Design
- f. Mechanical Fabrication
- g. Electrical Fabrication
- h. Mechanical Shipments
- i. Electrical Shipments
- j. Demolition Activities
- k. Mechanical Installation
- l. Electrical Installation
- m. Factory Acceptance Test (FAT)
- n. Controls Installation/Programming
- o. EDS Equipment Installation and Testing
- p. System Tie-ins
- q. BHSC Testing
- r. Spare Parts Delivery
- s. Owner Pre-Integrated Site Acceptance Test (P-ISAT)
- t. Test Readiness Review (TRR)
- u. Integrated Site Acceptance Test (ISAT)
- v. Punch List
- w. Run-In Period/Beneficial Use of System
- x. Operation and Maintenance Training
- y. Final Acceptance

2. Mechanical, Electrical, and Controls Field Survey Report

- a. BHSC must submit a report detailing the results of the field survey identifying areas of conflict or concern which may impact construction and installation, and any issues regarding operating discrepancies. Items not identified on the field survey report are assumed to be resolved or coordinated by the Contractor to meet the intent of the Contract Documents.

3. System Layout Drawings

- a. Show the overall mechanical system layout including dimensioned plans, elevations, sections, building structure and interferences, building penetrations or modifications, motor locations, catwalks, crossovers and clearances. Clearly identify any building interferences and design deviations.
- b. All drawings submitted must have the appropriate title, date of the original drawing, revision number and date, and submitted in .pdf format

4. System Installation Phasing Plan

Submit a detailed installation phasing plan that coordinates with the project phasing plans in .pdf format which identifies operational impacts.

- a. Provide the least amount of operational impact and utilize an overnight tie-in during non-operational hours wherever and whenever possible.
- b. In the event an overnight tie-in cannot be accomplished, include temporary measures, including bag porters, that will diminish impacts or be completed in an overnight tie-in.
- c. Show any potential impacts to the Owner, BHS O&M Staff, TSA, and airlines.

5. Tie-in Plans

- a. Provide a tie-in plan in .pdf format a minimum of five business days prior to each tie-in.
- b. The tie-in plan must consist of the scope of the tie-in, detailed hour-by-hour schedule for the tie-in, mechanical drawings, electrical drawings, manpower list, test plan, and contingency plan.
- c. Include provisions in the tie-in plan for meetings. Each tie-in plan must include a meeting, held two business days prior to the tie-in. The attendees will include the BHSC, VTC, the Owner, and all parties affected by the tie-in.

6. Motor and Equipment Schedule

Submit a detailed motor schedule in .pdf format for both the new and the modified conveyor systems. The motor schedule must include the equipment ID, equipment type (i.e. transport conveyor, HSU, power turn, etc.), conveyor centerline length (if applicable), conveyor width, conveyor speed, motor horsepower, motor type, VFD/Brake (if applicable), voltage, nameplate amperage, source of power feed, circuit breaker size, wire and/or cable size selected to be used.

7. Structural Details

Submit structural and seismic attachment and support detail drawings and related design calculations of all structural supports and structural attachments for the new and modified portions of the BHS and associated catwalks and platforms. A Professional Structural Engineer registered in the state of Florida must sign and seal the submittal.

- a. Include the design and location of all structural attachment points and types, including the equipment load of where the equipment is to be supported by the building structure.
- b. Include a vibration isolation drawing package that shows the isolation type, method of installation, and where used.
- c. Structural attachment details must be submitted in ACAD (.dwg) and .pdf format.

8. Mechanical Shop Drawings

- a. A Professional Mechanical Engineer registered in the state of Florida must sign and seal the submittals for mechanical drawings, and calculations.
- b. Use approved mechanical shop drawings for application and approval of any required permits for mechanical installation work.
- c. Mechanical shop drawings must include, but not necessarily be limited to: system layout drawing, details and dimensions of all equipment (plan, elevation, and sections), clearances both horizontal and vertical as related to the building structure, interferences, dimensions and details of any required building preparations or modifications, and location and dimensions of conveyor drives. Also include cut sheets of all mechanical components used in the BHS.
- d. Mounting details must include, but not necessarily be limited to: photo eyes, debris pans, drip pans, shaft encoders, VFDs, HOAs, etc.

- e. Mechanical shop drawings must be submitted in ACAD (.dwg) and .pdf format, and one hard-copy.
9. Conveyor and Related Structure Paint Chips
- Submit to VTC for review and Owner approval.
10. Electrical and Controls Shop Drawings
- a. A Professional Electrical Engineer registered in the state of Florida must sign and seal the submittals for new or modified BHS motor control panel (MCP) load calculations.
 - b. Use approved electrical and controls shop drawings for application and approval of any required permits for electrical and controls installation work.
 - c. Electrical and controls shop drawings must include, but not necessarily be limited to:
 - 1) PLC and MCP/NP (if applicable) Breakout
 - 2) Electrical panel layouts showing size and field location.
 - 3) Schematics showing master power panel and power distribution panels, field wiring and power consumption requirements, conduit diagrams showing location of all controls and power conduit, conduit sizes, and wire sizes and numbers.
 - 4) Controls Network Topology drawings for both upper and lower levels.
 - 5) Controls upper level hardware configuration and network cabinet layouts.
 - 6) Hardware and software design configuration of Maintenance Diagnostic System (MDS).
 - 7) Control Room hardware configuration and cabinet layouts.
 - 8) Interior and front panel layout of control panels, conveyor layouts with device locations (PEs, Control Stations, Shaft Encoders, VFDs, etc.). Layouts must be identified by either designated control panel, or by individual conveyor subsystem.
 - 9) Where applicable, locations of all existing MCPs to be re-controlled or modified.
 - 10) Color-coded drawings showing the conveyors and their associated E-Stop zones and E-Stop pushbutton locations.
 - d. Electrical and controls shop drawings must be submitted in ACAD (.dwg) and .pdf format, and one hard copy.
11. Mechanical, Electrical, and Controls Product Data and Cut Sheets
- Submit catalog and manufacturer cut sheet for all components to be installed. Cut sheets must be legible, reproducible, and directly relevant to the specific items as used in the system. Each individual item must be clearly identified by the inclusion of a highlighted/shaded arrow immediately adjacent to the item. Product data and cut sheets must be categorized, identified, and separated for clarity.
12. Spare Parts List
- Submit a Spare Parts List as outlined in Exhibit D and described in Section 1.11 Spare Parts.
13. Description of Operations
- a. The System Description of Operations
 - b. Sequence of Operations
 - c. Functional Specifications
 - d. Screens/Menus of all Human Machine Interfaces (HMI)
 - e. Sortation Rules Methodology
14. Two Week Look-Ahead Report
- Submit a two week look-ahead schedule each week in .pdf format. The two week look-ahead schedule must include, but not necessarily be limited to, the following information:

- a. Submittal Schedule update
- b. Mechanical activities by day
- c. Electrical activities by day
- d. Controls and programming activities by day
- e. Testing activities by day
- f. Dates and times of all tie-in/cut-over meetings
- g. Dates and times of all shift change coordination meetings

15. Monthly Status Report

Submit a Monthly Status Report in .pdf format that reports work progress during the calendar month just completed. The monthly status report will be the basis for evaluating job progress, payment requests, and time extension requests. The monthly status report must include, but not necessarily be limited to, the following information:

- a. Status of major project components (percent complete, amount of time ahead or behind schedule) and an explanation of how project will be brought back on schedule if delays have occurred. Major project components include, but are not necessarily limited to:
 - 1) Mechanical, electrical, and controls software engineering
 - 2) Fabrication
 - 3) Mechanical, electrical, and controls installation
 - 4) Testing completed
- b. Progress made on critical activities indicated on each schedule, including inspections
- c. Explanations for any lack of work on critical path activities planned to be performed during the month
- d. Explanations for any schedule changes, including changes to logic, activity durations, and manpower loading
- e. Status of major material and equipment delivery
- f. System design and coordination issues
- g. List of critical activities scheduled for the upcoming month
- h. Status of proposed and accepted change orders

16. Welding Reports

Submit copies of all welding reports for structural welds as observed by a certified welding inspector as per Section 3.01B.

17. Safety Signs and Graphics

Submit examples of all graphic signs as per Section 3.01R.

18. System Reports & Format

Refer to Section 4.05.

19. TSA Coordination Documents

Submit TSA Coordination Documents including the following:

- a. Full-size plans to include Conveyor IDs
- b. Description of Operations
- c. Completed SSTP checklist and reference documentation

20. Factory Acceptance Test (FAT) Agenda

The FAT Agenda must provide enough detail to adequately describe what the BHSC will be demonstrating during the FAT.

The following is a representative list of the items that are to be validated, at a minimum:

- a. Security testing in accordance with the PGDS
 - b. Controls logic
 - c. System graphics
 - d. System reports
 - e. Bag tracking
 - f. System faults
 - g. Sortation
 - h. Upper level architecture
 - i. Lower level architecture
 - j. Redundancy (hot-backup) for the upper level servers
 - k. Redundancy (warm-backup) for PLCs
21. Static, Dynamic, Functional, and Load Test Plan and Test Results
- a. BHSC must meet all the requirements of the contract documents.
 - b. The test plan must be submitted to the Owner and VTC for review and approval at least 45 days prior to the operation start-up date for the BHS(s). Testing must include static and dynamic electric, static and dynamic mechanical, functional testing and load test and related procedures.
 - c. The test plans must identify and demonstrate all system performance criteria.
 - d. Submit reports for VTC and Owner approval detailing the results of the successful testing as outlined in the approved Test Plan no later than five business days prior to the start of Owner's testing. These reports shall be certified as to accuracy and compliance with the Test Plan.
22. Security Testing Plan and Test Results
- a. BHSC must meet all the requirements of the CBIS SSTP, TSA PGDS, and contract documents.
 - b. The test plan for each test performed must include all required personnel, test luggage counts and types (how many Clear, Alarm, and Out-Of-Gauge bags inducted), induction points, induction rate, additional materials or tools, reports used for documentation of the test, and pass/fail criteria of each test.
 - c. Submit testing reports detailing the results of the security testing as outlined in the approved SSTP, noting any deficiencies and the remedies of such.
23. Notice of System Compliance
- BHSC must submit written Notice of System Compliance detailing dates of testing and completion to VTC and the Owner.
24. Training Plan
- BHSC must provide a Detailed Training Plan to include, but not limited to, the following:
- a. Course Outline(s)
 - b. Course Material(s)
 - c. Course Proposed Schedule(s)
 - d. Course Intended Audience
25. Draft and Final Operation and Maintenance (O&M) Manuals
- a. Submit one hard copy DRAFT O&M Manual to VTC and the Owner for review and approval at least 15 days prior to BHSC conducted training.
 - b. O&M Manuals to include, but not limited to, the following subjects:

- 1) System description and operation
 - 2) Operating instructions
 - 3) Preventative maintenance
 - 4) Troubleshooting
 - 5) Removal and installation procedures
 - 6) Parts list
 - 7) Manufacturer's literature
 - 8) Warranty procedure
 - 9) List of provided applicable software and licenses
- c. Upon approval, provide final O&M Manuals in electronic format and in hard copy bound in three-ring binders in a number requested by the Owner.

26. As-Built Documentation

- a. Submit four sets of full size mechanical and electrical drawings showing the "As-Built" condition of the system(s) to VTC and the Owner for review and approval. Submit bound drawings with all reference files in ACAD (.dwg) format on medium as specified by the Owner.
- b. Upon correction of any deficiencies noted, BHSC must provide four hard copies of full size drawings and in ACAD (.dwg) format. Provide one copy on medium as specified by the Owner.
- c. Submit six sets of approved as-built plans on bond paper of the same drawings reduced to 11" x 17" size to be bound in 3-ring binders of the Final O&M Manuals.
- d. Submit support documents in .pdf format.
- e. Support documents must include 3D AutoCAD model in ".dwg" format.
- f. Submit PLC documentation and software source code files in editable format.
- g. Provide application software and its licenses to the Owner such that the maintenance personnel can monitor source codes for trouble shooting purposes after the system is handed over to the Owner. The application software and its licenses include, but are not limited to: PLC software source codes (programming, network communication, etc.), and HMIs (BIT, BRP, IQT, system status displays, etc.). This applies to both lower level and upper level systems.

27. Punch List Completion Notice

BHSC must provide completed, signed punch list to VTC and the Owner.

28. Notice of Final Completion

Submit written notice to VTC for review and to Owner for acceptance that BHSC has inspected work for compliance with the Contract Documents, that deficiencies listed with the Certificate of Substantial Completion (punch list) have been corrected, and that all equipment and systems have been tested in accordance with the Contract Documents.

1.11 SPARE PARTS

A. General

1. The BHSC must include in their price, as a separate line item, an allowance as listed in the Bid Documents.
2. Spare parts will subsequently be procured against the Final Spare Parts List prepared in conjunction with the Draft Operations and Maintenance Manuals (reference Exhibit A) and as modified and accepted by the Owner.

3. The pricing for spare parts shall be based on actual vendor invoices furnished by the BHSC, plus overhead and profit markup allowed by the Contract.
4. Shipping cost must be included in the pricing and invoices furnished to the Owner.
5. The BHSC's handling and coordination cost must be included in the overhead markup allowed by the Contract.
6. All spares must be new and identical to the parts furnished on the original equipment.
7. All spare parts must be packed and cushioned to prevent damage during transport and long-term storage.
8. The spare parts must be preserved and packed in such a manner to prevent corrosion and any other kind of degradation during transport and long-term storage.

B. Classification

1. BHSC must perform a complete mechanical and electrical field survey of the existing BHS conveyor equipment and maintain consistency, in terms of supplier, with the existing components. This requirement applies to items such as motors, gearboxes, bearings, belting, field control components, MCP controls components, and PLCs, to simplify spare parts inventory and maintenance familiarity of system components.
2. BHSC must perform a comprehensive analysis of installed products as the basis for evaluating the actual requirements of a reliable and cost-saving supply of spare parts.
3. BHSC will classify the spare parts based on the following characteristics:

a. Capital Spares

Capital Spares are vital spares for critical equipment that may have substantial impact on operations, and are dependent upon how long the products will still be available; which products are no longer available; and if the item is obsolete or likely to be obsolete in 6 months' time.

b. Insurance Spares

An insurance item is a spare part that will be used to replace a failed identical part in operating equipment whose penalty cost for downtime is very high. Hence, by definition, it is an insurance against such failures for which the down time costs are very high, and parts which have long lead times. They do not become obsolete until the parent equipment is retired from service no matter if they do not move for many years.

c. Overhaul Spares

Spare parts which must be replaced every time the equipment is disassembled and re-assembled, and are dependent upon how long the products will still be available; which products are no longer available; and if the item is obsolete or likely to be obsolete in 6 months' time.

d. Wear and Tear Spares

Spare parts which have regular wear and tear in the course of operation of the equipment and need to be replaced after definite number of hours of equipment operation or deteriorating condition; how long the current delivery times are; can the asset in service be repaired in an acceptable lead time (repair rather than replace); and when required, can the item be delivered by a vendor in an acceptable lead time (quick/local delivery).

e. Consumable Spares and Commercial Off the Shelf (COTS)

These are regularly used items such as lubrication, fasteners, seals, bearings, etc. and can be purchased locally.

C. Quantities

1. BHSC will quantify the spare parts based on the following characteristics:
 - a. The quantity of Capital, Insurance, and Overhaul Spares must be a minimum of two per type of equipment (i.e. two merge belts or power turn belts per each size of merge or power turn unit, two gear boxes or motors for each drive train), up to 10% of the total quantity.
 - b. The quantity of Wear and Tear Spares must be 5% of the total quantity of equipment.
 - c. The quantity of Consumable Spares and COTS must be 1% of the total quantity of equipment.

1.12 SAFETY

A. System

BHSC shall affirm that their system(s) and related components satisfy all legal safety requirements required by all governing codes.

B. Life Safety

The BHSC is responsible for the coordination of egress routes with VTC and the responsible authorities. The BHSC must supply all necessary crossovers, catwalks, etc. to satisfy all life safety requirements.

C. Personnel

1. All safety measures must protect the working staff of the BHS from injuries. This includes work platforms and tug & dolly ram protection as well as all other areas of the BHS where only the maintenance staff has access and is working.
2. Provide foam padding, safety tape, or threaded rod end caps at all points of the conveying system and support structure subject to maintenance or personnel access which can be classified as a "head knocker", or impose injury.
3. All safety measures must be in accordance with and follow federal as well as local OSHA and other safety regulations. BHSC must investigate and incorporate into their design any additional safety features and requirements which may be required.

1.13 WARRANTIES

BHSC represents and warrants that it is and will be at all times fully qualified and capable of performing the work and to complete the work in accordance with the terms of the Contract Documents. BHSC warrants that all work is/was performed in accordance with generally accepted professional standards of good and sound practices and all requirements of the Contract Documents. BHSC warrants that the work, including but not limited to, each item of materials and equipment provided by BHSC incorporated therein, must be new, must be of suitable grade of its respective kind for its intended use unless such grade is specified in the Contract Documents, must be free from defects in design, engineering, materials, construction, and workmanship, and must conform in all respects with all applicable requirements of federal, state, and local laws, licenses, and permits, the Contract Documents and all descriptions set forth therein, applicable construction codes and standards, functionality and technical requirements specified, and all other requirements of the Contract Documents.

In the event that these warranty provisions conflict with other required warranties within the overall project documents and specifications, the more stringent, as determined by the Owner, must apply.

Warranties are effective from the Substantial Completion date for each phase as agreed upon by the Owner and BHSC.

A. Warranty Items

1. BHSC must warrant the BHS equipment for one year against defective parts and labor.
2. BHSC must warrant all BHS equipment for five years against defective design.
3. BHSC must transfer all warranties for materials and equipment received from subcontractors and suppliers.
4. BHSC must warrant against defective parts and labor for all relocated/reused and refurbished BHS equipment for one year.
5. The design warranty must guarantee that the design application and overall system integration of the BHS components, sub-components, assemblies, sub-assemblies and parts utilized are free from faults, patent infringements and defects in design, application and/or integration.
6. Excessive wear will be considered a defect within these provisions.
7. If, within the warranty period described in the general warranty terms, from the effective date of the warranty, the work or the system or any equipment or material is found in any respect to not conform to the warranty set forth herein, Owner or designee will notify BHSC. The BHSC shall acknowledge and propose timely corrective action within one business day of notification of non-conformance.
8. Parts for warranty work must be shipped freight pre-paid to the location specified by the Owner. If requested by the BHSC, failed/malfunctioning parts may be returned to the BHSC. FOB, within 10 days of notification of detection of such failed/malfunctioning parts.
9. Parts taken from spare parts inventory to complete warranty service work must be replaced by the BHSC within two weeks of removal notification.
10. Owner may choose to perform the normal warranty labor repair work with its maintenance staff at the BHSC's expense. BHSC must provide labor for work related to design deficiencies.

B. Technical Support

BHSC must provide on-site mechanical and electrical, and on-call technical, PLC and software support (with the ability to remotely connect to and monitor the system), during normal operational hours for a period of 60 days starting on the date of live operations, and on-call technical support for a period of 30 days thereafter.

1.14 GENERAL MECHANICAL

A. Baggage Characteristics

The types of baggage which the systems may encounter are classified as follows:

1. Normal

Normal baggage is defined as items which can be transported by the Baggage Handling System (BHS) and processed by the project-specific EDS equipment without special handling as indicated in Table 2.

BHS	Length (Inches)	Width (Inches)	Height (Inches)	Weight (pounds)
Minimum	12	12	3	5
Maximum	54	31	36	120
BMA Settings	60	29.5	23.8	n/a

Table 2: Normal Baggage Characteristics

The BHS must handle items safely and securely while traveling through the system without causing interruption to the systems' operation. The system must be able to process tubbed articles such as: car seats, garment bags, soft-sided bags, as well as items with loose straps, strings, ropes, or hooks.

2. Out-Of-Gauge (OOG)

OOG baggage is defined as items which can be transported by the BHS but are too large to be processed by the project-specific EDS.

3. Oversize (OS)

Items that do not fall within the normal characteristics described above, or are of a nature that cannot be handled properly by the system (animal cages, skis, fishing poles, etc.) are considered oversize and will be handled according to the system-specific operating policy.

B. Clearances

1. The BHSC must conduct a field survey of all conveyor paths prior to the submission of installation drawings.

2. Bag Clearances

- a. A minimum of 36" of vertical clearance for normal bags from the conveying surface to the underside of any building members or utilities must be maintained.
- b. If conditions exist where this clearance cannot be maintained, BHSC must notify VTC and the Owner in writing as soon as possible for any clearance deviations.

3. Conveyor Clearances

- a. Where conveyors must cross over baggage cart ways or work stations, a minimum clearance of 8'-0" must be maintained to the lowest portion of the conveyor or its support structure, unless otherwise noted in the drawing package.
- b. A minimum of 12" clearance must be maintained from motors, drive units and bearing to fixed obstructions such as walls, beams and columns.
- c. A minimum of 24" clearance between conveyor guards for adjacent conveyors.

4. EDS Maintenance Access Clearance

- a. BHSC must maintain the manufacturer's recommended clearance for access and maintenance for the machine as outlined in their respective integration guidelines.

C. Baggage Transport

1. The BHSC must provide a system to transport the baggage smoothly and effectively through the system.

2. Consideration and care must be used, particularly in the fabrication of all projections, welds, surfaces, and transfer points between conveyors to eliminate damage to various types of bundles, handbags, suitcases, and trunks encountered.
3. Bottom glides on cases, strings, tags, straps, bag handles, destination tags, etc. must be protected against damage from sideguards, transfer points and all other surfaces against which baggage may come into contact during baggage handling.
4. Maximum Incline/Decline Angles
 - a. The maximum angle on inclines and declines must not exceed 18° from the horizontal; 15° or less must be maintained as a design objective for non-tracked conveyor lines.
 - b. Incline and decline angles must be 12° or less in tracked zones.
 - c. The BHSC must promptly notify VTC and the Owner if conditions exist that exceeds these requirements.

D. Equipment Loads

1. Input Load conveyors must be sized for a live load of 60 lbs/ft.
2. All other conveyors must be sized for live loads based on the following formula and Table 3.

$$Live\ Load = 40 \frac{lbs}{ft} \times \left(\frac{90\ fpm}{actual\ fpm} \right) \times \left(\frac{Throughput\ (BPM)}{20\ BPM} \right)$$

Subsystem	Maximum (BPM)
Input Conveyor Lines (Ticket Counters and Curbside)	20
Main Transport Conveyor Lines (delivering to or receiving bags from the screening matrix)	40
Each EDS Line (receiving from or delivering to individual EDSs)	OEM specified
Make-Up Feed Conveyor Lines	20

Table 3: System Throughput Rates

3. All conveyor drives must be sized so that multiple (0.5 second) time intervals between start and stop can be made under full design load conditions for a minimum duration of 30 seconds.
4. The system must be optimized to deliver bags to the EDSs with a minimum 12” gap between bags.

E. Conveyor Design Speed

1. Individual component speeds with and without VFDs
 - a. Any component with a VFD must operate within 2 percent of design speed.
 - b. Any component without a VFD must operate within 5 percent of design speed.
 - c. If conditions exist where this design speed cannot be obtained, BHSC must notify VTC and the Owner in writing as soon as possible for any design deviations.

F. Performance and Dependability

1. General Requirements

- a. The BHS must be capable of continuous operation, 20 hours per day, 365 days per year during normal operating hours, with provisions for routine preventive maintenance as specified in the maintenance manual.
 - b. The system must operate reliably and be reasonably free of breakdowns.
 - c. Major components of the system must be pre-tested so that life expectancy under the design operating conditions is known prior to installation.
 - d. Design of the components comprising the system must provide for ease of maintenance, replacement accessibility, and service requirements.
2. Breakdowns

The system breakdowns must be limited to the following repair times:

Breakdowns	Repair Time (Minutes)
90.00%	< 15
5.00%	< 30
4.90%	< 120
0.10%	< 24 Hours

Table 4: Repair Time Requirements

3. Availability

The weekly system availability as a whole (excluding EDSs) must be 99%. The system availability must be calculated as follows:

$$SA = \frac{OH - RT}{OH}$$

Where: SA = System Availability

OH = Operational Hours

RT = Repair Time

G. Operating Conditions

1. Normal operations will be considered to be 20 hours per day, 365 days per year.
2. All mechanical components must operate satisfactorily within a temperature range of 20°F to +140°F, with a relative humidity of 0 to 100 percent (non-condensing on optical surfaces).

H. Accessibility

1. Equipment components requiring inspection and servicing must be readily accessible.
2. Suitable doors or removable enclosures must be provided.
3. Access holes in frames or guards are acceptable but must be held to a minimum number and size, and must not create protrusions or discontinuities detrimental to the baggage being conveyed.
4. All components and assemblies must be easily disconnected and removed from the equipment without requiring extensive disassembly.

I. Vibration Control

1. All parts of the conveyor system, including catwalk, supported from structural elements or hangers must be on vibration isolators to eliminate such vibrations from being transmitted to the building. Vibration must not be noticeable in public or office spaces.
2. Surface-mounted conveyors and other associated components, including catwalk, using header steel connected to building elements and mezzanines must not transmit any vibration to these structures and must be fitted with vibration isolators.

J. Seismic Bracing

1. The BHSC must comply with all applicable codes regarding seismic bracing for the project.

K. Noise Levels

1. Noise measurements will be made under free field conditions according to DIN 45635/ISO 3744, no closer than three feet from the sound source. The dBA values do not include the noise due to baggage.
2. BHSC must measure noise levels with a calibrated A-weighted sound level meter at slow response or a calibrated 1/3 band octave analyzer and converted to A-weighted sound pressure levels.
3. BHSC must conduct baseline noise level readings during peak and non-peak operating hours prior to any work done on the system. The BHSC must record the time, location and the noise level for each reading.
4. BHSC must conduct noise level readings after work is complete on the system at the same locations for the same peak operating period.
5. Noise must be limited throughout the system to the following levels:

	Public Areas	Equipment Areas
Maximum	70 dBA	80 dBA

Table 5: Noise Level Requirements

L. Materials

1. General

- a. Steel used in the fabrication of the equipment must be free from rust, rust pits, kinks, and sharp bends.
- b. Methods used to form the material must not fracture or otherwise damage the metal.
- c. Burrs, sharp edges, and sharp corners must be removed. All parts must be formed and cut properly to assure uniformity.
- d. All joints must be smooth and all corners rounded.
- e. Holes for photoeye beams must be punched into metal sideguards and tapered from the inside (wide) to the outside (narrow). Burning will not be allowed.
- f. Joints between sections of conveyor bed must be chamfered to ensure that there is no step-up condition between bed sections.

2. Plate

- a. Structural steel plates and shapes must conform to ASTM A36/A36M-12, Standard Specification for Carbon Structural Steel.
- b. Hot-rolled sheets and coils must conform to ASTM A-569.
- c. General procedure and qualification of welders must be in accordance with AWS D.1.1/D1.1M:2006, Structural Welding Code - Steel.

- d. All welding electrodes must conform to AWS A.5.1/A5.1M:2012, Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
3. Fasteners
 - a. All fasteners at a minimum must conform to ASTM A325, Type 1, or SAE Grade 5, Class 2A thread fit for bolts and Class 2B thread fit for nuts.
 - b. All fasteners must be zinc-plated, cadmium plated or stainless steel.
 - c. Jam nuts must not be used for structural connections.

1.15 GENERAL ELECTRICAL

All equipment must be the current version of manufacture at time of bid. When any product has available factory upgrades or modifications, such upgrades and modifications must be fully implemented at the factory and receive full factory testing and certification.

A. Electrical Clearances

1. Electrical clearance for safety and maintenance must meet the requirements of NFPA 70 National Electric Code (NEC) article 110.26 , state, and local Electrical Codes for Personnel and Other Protective Equipment.
2. If conditions exist where this clearance cannot be maintained, BHSC must notify VTC and the Owner in writing as soon as possible for any clearance deviations.

B. Radio Frequency Interference

1. The equipment provided must not cause interference with communications within the airport or between the airport and aircraft or ground vehicles.
2. All electrical and electronic equipment, including interconnecting wires and cables, must be designed to operate without malfunction in the presence of normal electromagnetic emissions generated by other equipment installed or used at the airport.
 - a. The normal airport environment includes the aircraft communications bands and high power radar systems. It also includes various electrical motors and controls, power tools (including welders), automotive vehicles, etc.

C. System Power Provisions

1. Source for Systems
 - a. Airport or building power originates from main switchgear and is distributed to areas within the building using building panel boards or Main Distribution Panels (MDPs). Building panel boards or MDPs feed Power Distribution Panels (PDPs), or Motor Control Panels (MCPs).
 - b. Distributed drives contain motor starters, Variable Frequency Drives (VFDs) and controls within a single drive package mounted on the conveying system adjacent to the drive motor and powered from PDPs.
 - c. 480 Volts Alternating Current (VAC), three-phase, 60 Hz power will be furnished by the General Contractor (GC) or Construction Manager (CM) to a disconnect located near the PDP.
 - d. Building MDP must function as the main power source panel for the BHS. The panel is the distribution point for service to each PDP.
 - e. The PDP must function as the distributed power source for the motors in the system. The PDP must be the distribution point (14 three pole circuit breaker) of 30A service to groups of motors within the system.

2. EDS Power
 - a. The GC or CM will be responsible for providing power from the building source disconnect to the UPS serving the EDS machines.
 - b. The BHSC is responsible for secondary power distribution to each EDS machine. This includes terminating wires at the appropriate locations, EDS and UPS, as well as providing a power disconnect near each EDS.
3. Distribution for Systems
 - a. BHSC must provide all power distribution equipment from the building MDP to all BHS/BHS equipment. This includes the following:
 - 1) Furnish and install all services, feeder, and fused disconnects for branch circuits from the MDP each disconnect to each PDP as specified.
 - 2) Approximate Locations of the PDP power panels are as shown on the plans. The BHSC is responsible for coordinating the final location of the PDP panels with VTC and the Owner.
 - 3) Coordinate the location and distance between the MDPs, PDPs or MCPs and the field devices so that the voltage drop does not exceed two percent.
 - 4) Furnish and install all panel boxes, wire ways, conduits, conductors, transformers, fuses, equipment and materials required to complete the electrical power distribution for the operation of the system.
 - 5) Indicate the full load amperage of each PDP fuse or breaker size on shop drawings.
 - 6) Furnish and install transformer for all 120 VAC, single-phase power required for the system controls equipment (PLC cabinet) and power for the control room equipment.
 - b. Motor and control power for parallel conveyor lines must not be on a single circuit. The loss of either 480V or 120V power on a single circuit must not stop parallel conveyor lines.
 - c. BHSC must show on its shop drawings the electrical power requirements (amperage) of each MCP main circuit breaker.
 - d. BHSC must validate harmonic distortion induced by the BHS and correct if it does not meet the acceptable limits. The acceptable limits on total harmonic distortion (THD) is at 5% and any single harmonic is at 3% as recommended by IEEE std 519.

1.16 GENERAL CONTROLS

A. General Controls Requirements

1. A complete BHS control system must be supplied as part of the work required under this contract. The control system must interface and/or control, at a minimum, the following equipment and all functionalities relevant to the equipment:
 - a. Automatic Tag Reader (ATR)
 - b. Baggage Measuring Array (BMA)
 - c. Horizontal Sorters
 - d. EDS Machines
 - e. Operator Displays
 - f. Operator Interfaces
 - g. Merges/Reverse Merge
 - h. Queue/Gapping Conveyor Belts
 - i. Vertical Sorters
2. BHSC must program each system to function as specified herein.

3. During startup and testing, the functionality of the conveying system, devices, control, and reporting must be demonstrated through the integrated BHS system.
4. Erroneous code must be removed prior to commissioning and final testing.
5. The BHSC is responsible for providing Controls system which is compatible with the existing system.
6. The BHS control system must interface with the fire/security system.
7. The hardware, software, and firmware must comply with state of the art technologies and represent current industrial standards. The components must be compatible and tested product families to provide continuity. The components must be readily available.
8. All field components used within the system must be suitable for use under harsh environmental conditions (e.g. temperature, soiling, electrically contaminated environments, vibrations, shocks, high humidity, and various climate temperatures). Refer also to section 1.14G, Operating Conditions.
9. All field network components must meet the environment class specified in the MICE table (ISO/IEC/TR 29106).
10. The system components must permit easy and rapid servicing and replacement.
11. Proprietary hardware, software, or firmware is prohibited within this project. Software must be off-the-shelf or open source, and be the most recent version
12. The computer system hardware must be comprised of standard, off-the-shelf components. No custom built hardware or interface devices are to be used.
13. The computers used must be open-standard non-proprietary computers and the latest technology at the time of bid submittal.
14. All new industrial computer equipment must be available for two years.
15. All new PLC components must be available for three years.
16. The system controls must be capable of functioning for 10 years.
17. If the BHSC cannot comply with the availabilities of equipment, they must indicate alternative source(s) of supply.
18. The functionality and compatibility of spare parts from alternative source(s) of supply must be identified by the BHSC.
19. The control equipment for the system must be designed to control and monitor the baggage from the time the bag is inducted into the system until it reaches its destination.
20. The control system must be designed to meet the specific functional requirements of the BHS.
21. The control system must include the ability for an operator to take any diverter out of automatic, and manually control diverters for desired routing scheme from the Control Room.
22. The loss of a single power circuit or controls must not disable more than one conveyor line.

B. BHS Network

1. Network Standard Compliance
 - a. The network system must be based on the IEEE 802.3 Ethernet standards. A modification of Ethernet protocol that creates incompatibility with commercial off-the-shelf Ethernet products is prohibited.
 - b. The network system must use standard unmodified TCP, UDP and IP protocols for Ethernet frame encapsulation and transport across the network per Internet Engineering Task Force (IETF) Requests for Comments (RFC) documents.
 - c. The network system must communicate with the enterprise network equipment using open-standard non-proprietary protocols.
 - d. The network system must be able to integrate into other parts of the airport network, if required.

2. Network Segmentation

- a. Controls system consists of defined zones and segmentation in order to place applications and devices in the logical framework based on the requirements.

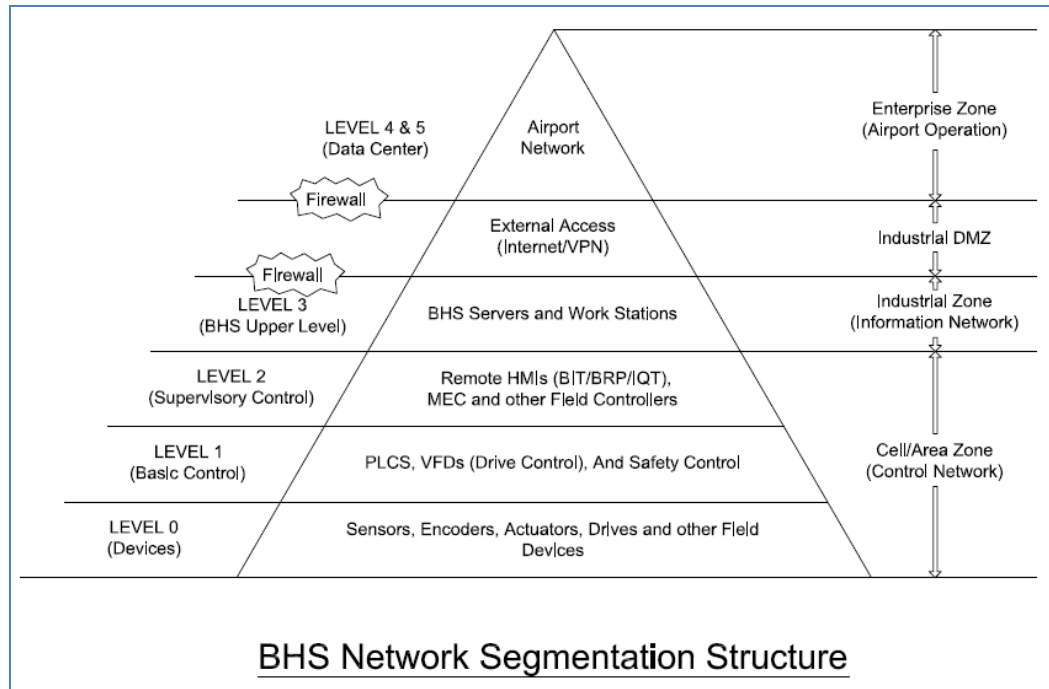


Figure 1: Typical Network Segmentation

b. Lower Level Network

- 1) EtherNet/IP must be used as a primary network between the PLC and field devices.
- 2) The lower level network must consist of the layer-2 network with multiple VLAN.
- 3) The PLCs must interface with field devices via EtherNet/IP network.
- 4) The system field devices must be incorporated into the EtherNet/IP network. Any field devices not specified as EtherNet/IP product must be connected via gateway, point I/Os, or I/O blocks that are compatible to EtherNet/IP.
- 5) BHSC must finalize optimal PLC breakout and network topologies with consideration of equipment availabilities, ease of maintenance, and avoiding a single point of failure.

c. Upper Level Network

- 1) Upper Level Network must utilize Ethernet TCP/IP to connect PLCs as well as external access.
- 2) Coordinate with the airport and the airline Information Technology (IT) personnel to ascertain that BHS interface to the airport network (if any) satisfies IT infrastructure.
- 3) Upper Level Equipment must synchronize time with the Network Time Protocol server. BHSC must coordinate with the Owner to define the clock source.

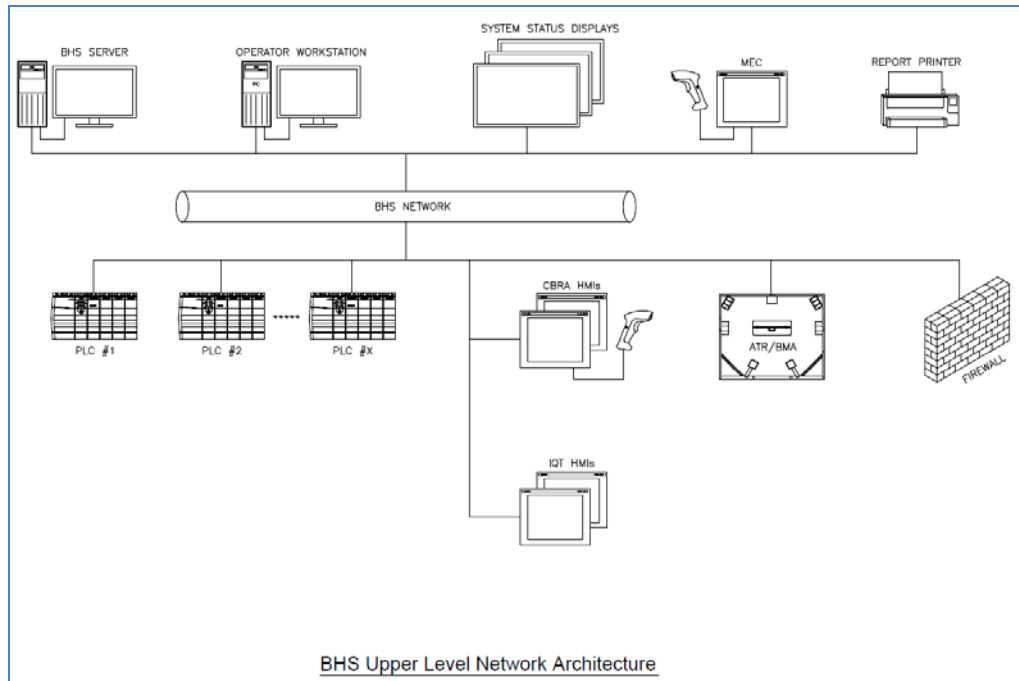


Figure 2: Typical Upper Level Network

3. Network Architecture

- a. The different topologies and network redundancy must be applied with the consideration of the physical conveyor layout and level of equipment accessibility.
- b. Linear/Star Topology
 - 1) This topology is applicable where a single point of network failure has minimum impact on the bag flow (for example, the physical conveyor layout allows having an alternative route(s) to transfer baggage to the destination).
- c. Device Level Ring (DLR)
 - 1) This topology must be used for the critical areas where a single point of network failure affects bag flow.
 - 2) DLR must have two supervisors, if possible.
 - 3) The supervisors must be either Ethernet modules (e.g., EN2TR) or E-Taps.
- d. VLAN must be zoned properly per each cell zone or each PLC control zone. An example of the IP Address breakout is:

Cell/PLC Zone	IP Address
Cell/PLC 1	192.168.1.yy
Cell/PLC 2	192.168.2.yy
Cell/PLC x	192.168.x.yy
PLCs to Upper Level System	192.168.9.yy

Table 6: Example of IP Address

1.17 SYSTEM

A. System Description of Operations

- 1. The BHS is divided into three areas with multiple zones based upon the functionality of the conveyors. The three areas are:

- a. Area 1 – Input Conveyors
 - b. Area 2 – BHS Matrix
 - c. Area 3 – Cleared Baggage Conveyors
- B. Area 1, Zone 1 – Input Conveyor Subsystem
1. The Input Conveyor Subsystem consists of ticket counter conveyors.
 2. The bags are placed onto one of these load conveyors with the carrier’s bag tag. The bags are merged onto a main transport line which transports the bags to the EDS Matrix for screening.
 3. Reinsertion Conveyors
 - a. Baggage that arrives at the Checked Bag Resolution Area (CBRA) with an ‘Error/Unknown’ status, or cannot be resolved from the image database, may be transported to the Reinsertion Conveyor via carts provided by the airport.
- C. Area 1, Zone 2 – BHS Oversize Subsystem (BHSO)
1. Baggage that is classified as oversize must be manually transported to the manual screening areas located at the west end of the ticket lobby.
- D. Area 2 – BHS Matrix
1. This area must maintain security tracking and system performance required by PGDS.
- E. Area 2, Zone 1 – Baggage Identification Subsystem
1. Bag Measuring Array (BMA)
 - a. All bags pass through the BMA.
 - b. Each bag will be measured for height, width, and length to detect EDS OOG bags.
 - c. The BMA must be set to the most restrictive height, width, and length of the EDS capability being employed for this project (see Table 2).
 2. The BMA must have a combination Automatic Tag Reader (ATR).
 3. Once a bag enters this zone, a BHS Tracking ID must be assigned and logged into the BDR. It must be tracked through all zones in this area, utilizing time and shaft encoders, until the bag is diverted to a clear baggage conveyor line (Area 3). The 10-digit IATA Tag ID numbers must be passed to EDSs. In case of a lost bag, Pseudo IDs must be used as alternative.
- F. Area 2, Zone 2 –Out-Of-Gauge Subsystem
1. OOG bags must be diverted to the OOG line.
 2. Bags without dimension information or bags lost in track between the BMA and OOG divert point must be diverted to the first EDS shunt line.
 3. OOG bags diverted onto the OOG bypass line must be tracked and logged into the BDR as ‘Out-Of-Gauge’ bags.
 4. When the bag reaches the CBRA, it must be staged inline until released by the TSO. As TSO releases the bag, the BDR must be updated, to include the workstation ID. The non-EDS screened inspection protocol must be used for OOG baggage.
 - a. After screening the bag, the TSO will “Alarm” or “Clear” the bag.
 - b. Alarmed bags will be processed in accordance with the local Law Enforcement Officer (LEO) protocol.
 - c. Once the bag is cleared, it will be placed on the clear baggage conveyor for transport to the bag make-up unit.

G. Area 2, Zone 3 – EDS Delivery Subsystem

1. Matrix bag distribution
 - a. To utilize even machine run time, a Round Robin method will be applied to distribute bags to the EDS machines.
2. BHSC must provide the option to select the primary EDS. This option must consist of both a manual selection and an automatic selection that will automatically rotate the primary EDS per a planned daily, weekly, or monthly sequence.
3. Stop feeding bags to the machine when any fault condition occurs at area 2, zones 4 and 5 as well as associated OSR/CL lines..
4. Staggered static deflectors on the queues prior to the gapping queues must be used to position the bags for entrance into the EDS.
5. Static guides on both sides of the EDS entrance queue conveyors must be used to prevent bags from jamming at the transition from the BHS entrance queue to the EDS entrance tunnel.
6. The first queue prior to the EDS must be installed with casters and quick disconnects for EDS repair, or replacement.

H. Area 2, Zone 4 – EDSs

1. Level 1 – Screening (EDSs) – All EDS In-Gauge bags must continue to the EDSs for screening. Each bag must be tracked through each specific area and recorded in the BDR.
 - a. The BHS PLC must transfer the unique bag tracking number to each EDS. The ID must follow the format required by IRD and PGDS.
 - b. Bags that become ‘Lost-In-Track’ in this zone must be assigned a new BHS Tracking ID when acquired at the next tracking photoeye.
 - c. Communication between the EDS and the BHS must be per the IRD, as required for the EDS interface.
 - d. The EDS provides Level 1 ‘Bag Disposition’ to the BHS PLC of a bag exiting the exit tunnel of the machine, and be logged as such in the BDR:
 - 1) ‘Machine Cleared’ – Indicates the bag was cleared by the EDS.
 - 2) ‘Machine Alarmed’ – Indicates a suspect bag.
 - 3) ‘Error’ – Indicates an error in the EDS.
 - e. If the EDS does not give the BHS PLC a signal within the time period specified, or the machine decision is still pending, then the bag must be given an ‘Error’ status and be handed off for Level 2 – Screening (OSR).
 - f. EDS Cleared bags must have the bag tracking ID number and the EDS ID reconciled in the BDR as a ‘Machine Cleared’ bag.
 - g. EDS Errored bags and the EDS ID must be logged in the BDR as an ‘Error’ bag.

I. Area 2, Zone 5 – Level 1 Decision Subsystem

1. The Level 1 decision conveyors are defined from the exit tunnel of the EDS to the Level 1 divert point where the BHS must either divert the bag to the Clear Line or to On Screen Resolution Line (OSR)Level 2 – Screening.
 - a. Bags identified by the EDS as ‘Machine Cleared’ must be diverted to the Clear Line and transported directly to the baggage make-up area.
 - b. Bags identified by the EDS as ‘Machine Alarmed’ bag must be diverted to the Level 2 – Screening (OSR) line and tracked into the CBRA.

- c. Bags identified by the EDS as 'Error/Unknown' must be diverted to the Level 2 – Screening (OSR) line, diverted to the Alarm Line, and tracked into the CBRA.
 - d. Bags that become 'Lost-In-Track' in this zone must be assigned a new BHS Tracking ID when acquired at the next tracking photoeye, logged in the BDR as a 'Lost-In-Track' bag, and diverted to the Level 2 – Screening OSR line, diverted to the Alarm Line, and tracked into the CBRA for resolution.
2. Fail-safe functionality must be programmed at all Level 1 decision points to prevent non-cleared bags from being diverted to a clear line.
 3. In the event of fail-safe or a fault condition on the Level 1 Clear Line subsystem conveyors, past the Vertical Sortation Unit (VSU), and the VSU is either in or can be cycled to the OSR line, all bags prior to the Level 1 decision point, regardless of status, must be directed to the OSR line to allow for those bags that are either Machine or OSR Cleared to be directed to the clear line at the Level 2 decision point.
 4. The first Level 1 decision conveyor must be installed with casters and quick disconnects for repair or replacement of the EDSs.
- J. Area 2, Zone 6 – On Screen Resolution (OSR)
1. Level 2 – OSR Screening: The time for OSR must be no less than 45 seconds, as defined as the travel time from the exit tunnel of the EDS to the decision point at which the BHS either diverts the bag to the clear line or to Level 3 – Screening.
 2. The BHS must receive bag disposition from the EDS per IRD requirements. Until the OSR resolution has been made, the bag disposition must be tracked and logged in the BDR as 'Decision Pending'. The bag status can be transmitted any time after the bag data is handed off from the EDS to the OSR Operators until the bag reaches the photoeye prior to the Level 2 - OSR decision point for diverting clear bags. The bag's status will then be updated in the BDR as:
 - a. Operator Cleared
 - b. Operator Alarmed
 - c. Timed Out
 3. Bags cleared by Level 2 – OSR Screening must be diverted to the OSR Clear Line and transported directly to the baggage make-up area.
 4. Once cleared, the bag identification number, status, and OSR station ID must be reconciled in the BDR as an 'Operator Cleared' bag.
 5. Bags Alarmed by Level 2 – OSR Screening must be reconciled in the BDR as an 'Operator Alarmed' bag, along with the OSR Station ID, and continue to Level 3 – ETD Screening for resolution.
 6. Bags that reach the Level 2 decision point without resolution from the OSR Operator, and after the defined OSR Time, must be logged in the BDR as a 'Timed Out' bag, along with the OSR Station ID, and continue to Level 3 – ETD Screening for resolution.
 7. Bags that become 'Lost-In-Track' in this zone must be assigned a new BHS Tracking ID when acquired at the next tracking photoeye, logged in the BDR as a 'Lost-In-Track' bag, along with the PE ID associated to where the bag was reacquired, and diverted to the CBRA for resolution.
 8. A fail-safe feature must be programmed at all Level 2 decision points to prevent non-cleared bags from being diverted to a clear line.
 9. Fail-safe activations must be less than 0.5% of the total daily bag volume, measured by the number of individual bags tripping the fail-safe.

K. Area 2, Zone 7 – CBRA

1. Level 3 – Explosive Trace Detection (ETD) Screening: All Alarmed, Error, Lost-In-Track, missed divers, OOG bags, and unresolved OSR bags, must be transported to the CBRA.
2. Bags must be delivered to the CBRA utilizing queues. CBRA queuing method must follow functionalities described in PGDS.
3. Bags must be tracked on the alarm line queues arriving at the designated search work stations. Bags arriving on the queue may display an “unknown” status on the Bag Removal Point (BRP) HMI.
4. Bags with “unknown” status will be carted to transport baggage from CBRA to reinsert belt.
5. Sequence of CBRA operation must meet procedures described in PGDS.
6. After screening the bag, the TSO will either “Alarm” or “Clear” the bag.
 - a. Alarmed Bags must be processed in accordance with the local Law Enforcement Officer (LEO) procedures.
 - b. Cleared Bags must be placed on the ALCL conveyor for transport to the baggage make-up area. The bag must be logged in the BDR as an “ETD Cleared” bag, along with the Workstation ID.

L. Area 3 – Cleared Baggage Subsystem

1. The Cleared Baggage Subsystem consists of:
 - a. Level 1 (EDS) Clear Decision Point to Make-up Area
 - b. Level 2 (OSR) Clear Decision Point to Make-up Area
 - c. Level 3 (ETD) Clear Lines to Make-up Area
2. Primary sortation ATR through secondary sortation to individual make-up or sort pier devices.
 - a. The primary sortation system consists of an ATR identifying the sort destination via the IATA bar code utilized on the bag tag.
 - b. Cleared bags which read correctly are directed to a divert point to be transported to the appropriate make-up device or sort pier.
 - c. In the event of a no-read by the ATR, the bag must be identified as no-read in the BDR, and sent to the manual encode station, the default make-up device, or the sort pier.

PART 2 - PRODUCTS

2.01 MECHANICAL

A. Drives

1. Motors
 - a. All motors as manufactured by:
Lenze 8400 Motec
 - b. General
 - 1) The conveyors must be driven by AC induction motors that conform to NEMA standards.
 - 2) Conveyors designed to be utilized as queues or in high cycle applications must have high efficiency motors.
 - 3) All other conveyors must have premium efficiency motors.

- 4) Motors must be sized for maximum load and belt speed requirements under continuous operation (minimum of 2 Horse Power (HP)) and, where applicable, must be capable of withstanding shock caused by frequent starting and stopping under load conditions.
- 5) Motors must also be of the constant speed (nominal 1800 Revolutions Per Minute (RPM)), continuous service, and ball-bearing type with a minimum of class "F" insulation.
- 6) All motors must be copper-wound, Totally Enclosed Fan Cooled (TEFC) construction, with a NEMA T-frame, and must be provided with overload protection in the control panel.
- 7) The service factor for motors must be a minimum of 1.15.
- 8) On inclines and declines 10 degrees or greater, motors must be equipped with automatically applied mechanical brakes to prevent overrun after the motors are de-energized.

2. Reducers

- a. All reducers as manufactured by:
 - 1) Lenze, G500 gearbox
- b. Reducers must be right-angle helical bevel, shaft mounted, and with integral or C-Faced motors. All reducers must be mounted with concentric taper-lock type hub or manufacturer's approved concentric locking device.
- c. All reducers must be sized for Class II application.
- d. All shaft mounted reducers must be capable of being installed in the A and B position (left hand/right hand).
- e. All reducers must be equipped with drip pans that are constructed as:
 - 1) A minimum 14 gauge sheet metal with a minimum depth of $\frac{3}{4}$ ".
 - 2) Drip pan must be fitted with a non-leaking drain plug.
 - 3) Drip pan must be painted to match conveyor color.
 - 4) Drip pan must be sized to match drive and catch all dripping fluids.

B. Pulley Assemblies

1. General

- a. All pulleys must be equipped with taper lock type hubs, and 1-7/16" minimum diameter AISI 1045 TG&P shafts mounted in precision and ground flange type ball bearing units.
- b. All pulleys must be single piece steel construction and have steel end discs attached to the rim by continuous welding. Welding of shafts to end discs is not permitted.
- c. All pulley and shaft assemblies must have a maximum concentricity tolerance of 0.060".
- d. The shaft run out of each assembly must not exceed 0.004" TIR (Total Indicated Runout)/inch of shaft length measured from the pulley hub.
- e. All pulleys must be dynamically balanced for a minimum speed of 400 fpm.
- f. All exposed rotating shafts must be covered with caps or collars.

2. Head and Tail Pulleys

- a. All non-powered head and tail pulleys must be trapezoidal crown faced, with 1-7/16" minimum diameter shafts.
- b. All head and tail pulleys must be minimum 6" diameter x 10-gauge wall.
- c. Slider bed must be arranged to keep the gap between the bed section and the end pulley to a nominal dimension of 1" +/- 3/8".

- d. All belt tracking must be accomplished through adjustments to snub rollers. If snub rollers cannot be installed, head and tail pulleys must be equipped with jacking bolts and lock nuts to facilitate tracking adjustment.
 - e. All other head and tail pulleys for units not covered above must be the same as described under drive pulleys, specified below.
3. Drive Pulleys
 - a. General
 - 1) All drive pulleys must be lagged with a minimum 3/8" thick vulcanized lagging per belting manufacturers' recommendation.
 - 2) Provide a minimum 210° belt wrap around the drive pulley.
 - 3) Drive pulleys for intermediate/center type drives must be flat faced.
 - 4) Drive pulleys must not be driven by chain.
 - b. Non-Motorized Pulleys
 - 1) Drive pulley and shaft sizes are determined by maximum belt pull as follows:
 - a) Light Duty (250 pounds maximum belt pull) must be 6-3/4" minimum diameter, trapezoidal crown faced or a V-guide groove, with a 1-7/16" minimum diameter shafts.
 - b) Normal duty (500 pounds maximum belt pull) consists of an 8-3/4" minimum diameter drive pulley with a 1-11/16" minimum diameter shaft.
 - c) Intermediate duty (1,000 pounds maximum belt pull) consists of a 10-3/4" minimum diameter drive pulley with a 1-15/16" minimum diameter shaft.
 - d) Heavy duty (1,500 pounds maximum belt pull) consists of a 12-3/4" minimum diameter drive pulley with a 2-3/16" minimum diameter shaft.
 - c. Motorized Pulleys
 - 1) All motorized pulleys as manufactured by:
 - a) Sparks
 - b) Van Der Graaf
 - 2) Motorized pulleys may only be used in applications such as ticket counter conveyors or queue conveyors where physical space is limited, or wherever space precludes a shaft mounted reducer, inline helical bevel gear reducers with integral or C-faced motors.
 4. Snub Pulleys
 - a. All snub pulleys must be a minimum of 4" in diameter and flat faced.
 - b. All snub pulleys must be used for belt tracking and equipped with jacking bolts to facilitate adjustment.
 5. Take-Up Pulleys
 - a. All take-up pulleys must be a minimum of 4" in diameter and flat faced.
 - b. Take-Up Pulleys must be mounted on threaded take-up devices with steel guides for the bearings. The devices must be linked together so that when adjusted, both sides travel together.
- C. Return Idler Rollers
1. The return idler rollers must be a minimum of 2-1/2" diameter, 12-gauge steel equipped with an 11/16" hex axle for belt speeds less than 150 fpm and a minimum of 3-1/2" diameter with an 11/16" hex axle for belt speeds from 150 to 300 fpm.

2. All hex shaft return idler rollers must be equipped with sealed, permanently lubricated, caged, precision type ball bearings.

D. Bearings

1. All bearings as manufactured by:
 - a. Link-Belt Series – FC3
 - b. Dodge GT or SXR Series
 - c. Sealmaster MH-T Series
2. All bearings must be pre-lubricated, plugged instead of grease fitting, self-aligning, anti-friction, and sealed.
3. All bearings must have a minimum L-10 life of 30,000 hours based on service and loading of conveyors and on the manufacturer's published data showing load rating of each bearing used.

E. Slider Bed Sections

1. Conveyor bed sections must be a minimum of 12-gauge hot-rolled steel, formed in one piece and reinforced to be strong and well braced with 1-1/4" x 1-1/4" x 3/16" angle stiffeners on a maximum of 3'-4" centers on transport conveyors and 2'-6" centers on load conveyors.
2. Butt coupling joints must be provided. Conveyor beds must be provided with the following between-guard width dimensions:

Conveyor Type	BG (Inches)
Ticket Counter Load	39
Transport (Standard)	39
Transport (Oversize)	45

Table 7: Conveyor between Guard Dimensions

F. Radius Break Overs

1. For transitions from incline to horizontal or horizontal to decline, the radius break over must be constructed in the same manner as the slider bed construction.
2. The bed must have a 10'-0" radius break over slider bed as a design objective, unless otherwise noted.
3. For return belt idling, vertical bends must be equipped with a snub pulley.

G. Shrouding

1. The shrouding in public areas must be formed stainless steel, minimum 12-gauge, Type 304 with No. 4 brushed finish. All other shrouding must be minimum 12-gauge Hot Rolled Steel with finish to match conveyor color.
2. The shrouding in CBRA must be formed A36 steel, minimum 12-gauge, powder coated finish.
3. Skirts must be 14-gauge or heavier sheet metal approximately 6" deep with toe space.

H. Sideguards

1. Sideguards must be a minimum of 12-gauge hot-rolled steel with a formed 90° edge turned away from the conveyor and a formed 90° edge turned down to eliminate sharp edges.
2. Sideguards must be reinforced with 1-1/4" x 1-1/4" x 3/16" vertical angle stiffeners on not more than 3'-4" centers on transport conveyors and not more than 2'-6" centers on load conveyors. The OTK sideguard must be equipped with a 45-degree transition to blend OTK sideguard height with adjacent conveyor sideguard height on both sides of OTK sideguard.
3. Stainless steel shrouding is considered to be a sideguard and thus requires stiffeners.
4. Unless otherwise noted, sideguard height in inches must be as follows:

Function	Front Guard	Back Guard
Ticket Counter/Curbside	0"	21"
OTK Queues	4"	12"
Transport	12"	12"
Roller Top	0"	0"

Table 8: Sideguard Heights

I. Spill Plates

1. Spill plates must be constructed of 12-gauge stainless steel Type 304 with a #4 brush finish.

J. Protective Guarding

1. Guarding must be provided on the underside of belt conveyors where the underside flange/lip is greater than 1'-6" but less than 7'-6" above finished floor elevation.
2. All conveyor end pulleys, drives, take-ups, return rollers and snub pulleys where the belt changes direction 7'-6" or less from the floor or working level must be so guarded so that their entire sides and bottom are covered.
3. The guard must extend such a distance that a person cannot reach behind it and become caught in the nip point between the belt and pulley (at least 36").
4. Acceptable guarding is:
 - a. Quick release or hinged metal guarding
 - b. Quick release expanded metal guarding
 - c. Quick release nylon mesh
5. Provide quick release hinged solid metal guarding along the underside of the conveyor over personnel work areas.

K. Gap Debris Pans

1. Provide protection from falling objects in work areas, aisles or personal access areas located beneath overhead portions of the system with gap debris pans between conveyor sections.
 - a. Gap debris pans must be provided and installed on all conveyor-to-conveyor junction points or transfer locations, where there is a likelihood of small objects falling.
 - b. Gap debris pans must be 12-gauge minimum sheet metal and painted to match conveyor color with 2" minimum raised sides and be the width of the conveyor and minimum 8" long.

L. Floor Supports and Ceiling Attachments

1. All floor supports must be of a Standard "H" type design with vertical adjustment. Floor support vertical members must be, at a minimum, constructed of 10-gauge hot-rolled formed steel channel with 10-gauge, hot-rolled universal foot and head plates with height adjustability.
2. Ceiling attachments must be 3/4" diameter threaded rod vertical hangers with not less than 2" x 2" x 1/4" angle horizontal members.
3. Hanger configuration must be failsafe.
4. Where bridge-type supporting structures are required in lieu of vertical hanger rods, such structures must be provided by the BHSC.
5. Vibration isolators for ceiling attachments as manufactured by:
 - a. Mason industries (Series 30N)
 - b. VMC (HRSA Series)
6. All vibration isolators must be supplied by the same manufacturer.
7. Vibration isolators must be selected in accordance with the weight distribution, so as to produce reasonably uniform deflections.

M. Belting

1. All belting as manufactured by:
 - a. Ammeraal
 - b. Siegling

Belting must be applied as follows:

Application	Forbo Siegling	Ammeraal Beltech
Transport Conveyors, up to 9°	E12/2 0/V1 M FR TXGD6 (Green) [907193]	EX 10/2 0+00 BLK AS FR IR [576610] EX 10/2 0+00 BLK AS FR (514065)
Case 1: Standard Queues (does not include Case 2 Queues)	E8/2 UO/V15 LG FR Black [906434]	EX 10/2 0+A32 BLK AS FR (A578812)
Case 2: ETD Queues and 54" Queues with Static Deflectors	E12/2 UO/V/VO SE BLK [999903]	EX 10/2 0+00 BLK AS FR (514065)
Case 3: Pre-EDS/EDS Gapping and Entrance Queues (Case 3 takes precedence over Case 2)	E8/2 UO/V15 LG FR Black [906434]	EX 10/2 0+A32 BLK AS FR (A578812)
Inclines/Declines > 9°	E12/2 V1/V10 LG FR Black [907143] E12/2 0/V10 LG FR TXGD6 (Green) [907194]	EX 10/2 0+A32 BLK AS FR IR (576652) EX 10/2 0+A32 BLK AS FR (A578812)
Conveyors at Plow-Type Merges & HSUs	PHR3-200 TW BBXBB FR [908209]	Fabric X/EP 19/3 0+0 (SBR) BLK AS FR (560100)

Belting in Public Areas	E12/2 0/V1 M FR TXGD6 (Black) [907182]	EX 10/2 0+00 BLK AS FR (514065) EX 10/2 0+05 BLK M2 AS FR IR (576601)
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Note: Value in brackets [] is manufacturer's article number

Table 9: Belting Application Types

2. The width of all belts must be equal to the between guard dimension of the respective conveyor minus three inches maximum, except for edge V-guided belts.
3. Belts for the following equipment must be as furnished by the approved, original equipment manufacturer:
 - a. Merges (Induction, Take-Away/Reverse)
 - b. Power Turns
 - c. Vertical Merge Units
 - d. Vertical Sortation Units
4. V-guides must be hot vulcanized to the belt. Cold bonded V-guides are not acceptable.
5. All conveyors less than 10 feet and all queues must have belting equipped with V-guides.

N. Vertical Sortation Unit (VSU)/Vertical Merge Unit (VMU)

1. Vertical Sorter Units as manufactured by:
 - a. G & S Airport Conveyor
 - b. Glidepath
 - c. Jervis B. Webb
 - d. Siemens
 - e. Vanderlande Industries, Inc.
2. The vertical sorter must be capable of diverting a minimum of 28 BPM. This is defined as one complete cycle per bag.
3. All motors in VSU/VMU must be controlled by VFDs.
4. VSU/VMU must have a panel with the following features, if panel does not contain features BHSC to provide auxiliary controls station to provide that functionality:
 - a. E-Stop
 - b. HOA
 - c. Lockable disconnect
 - d. A selector switch to operate the diverter in the maintenance mode
 - e. Safety cage around VSU/VMU, equipped with switches and sensors wired in series with unit E-Stop circuit
 - f. All VSU/VMU Faults must be reported to BHS PLC control system

O. Horizontal Sortation Unit (HSU)

1. Horizontal Sortation Units as manufactured by:
 - a. Siemens
2. Each HSU must be of proven standard 40 BPM throughput design with demonstrated expansion capability to 60 BPM. Throughput is calculated on diverting every other bag. The diverter must be designed to minimize the potential for baggage jams and damage.
3. For parallel and 45 degree takeaway divert arrangements, the vertical belt speed (paddle belt) must be set to 1.41 times faster than the mainline belt speed.

4. For a 90 degree take-away, the belt speed of the HSU vertical paddle speed and the take-away belt speed must be set at 1.15 times the speed of the mainline belt speed.
5. The diverter unit must consist of a rigid structural steel support frame to reduce vibration and beam deflection. The surface contacting the bag must be smooth and continuous to transport the bag across the mainline/transport conveyor and onto the take-away conveyor or device. In the extended position, the full face of the paddle must extend sufficiently to push baggage off the mainline/transport conveyor. When retracted, the face must completely clear the belt path. The diverter drive must have a smooth, controlled acceleration and deceleration at each end of the stroke.
6. For safety, the diverter's sensing controls and diverter drive mechanism must be disarmed whenever the mainline has stopped for any reason.
7. All motors in HSU must be controlled by VFDs.
8. HSUs must have a panel with the following features, if panel does not contain features BHSC to provide auxiliary controls station to provide that functionality:
 - a. E-Stop
 - b. HOA
 - c. Lockable disconnect
 - d. A selector switch to operate the diverter in the maintenance mode
 - e. All HSU Faults must be reported to BHS PLC control system

P. Horizontal and Spiral Conveyor Turns (Power Turns)

1. Power turns as manufactured by:
 - a. Flow-Turn
 - b. Portec, Inc.
 - c. Transnorm System, Inc.
2. Standard transport power turns must have an outside radius of 87" (Model Type "C"), power turns at the ticket counters must have an outside radius of 59" (Model Type "B"), and oversize power turns must have a 60" inside radius, unless otherwise noted.
3. The maximum angle of any single powered turn must be 180°.
4. Drives for power turns must meet the requirements listed in section 2.01A "Drives" of this specification.
5. To facilitate parts procurement, a copy of the packing list which accompanies each power turn must be included in the spare parts section of the Operations and Maintenance Manual.
6. Power turn belt speeds must be adjusted so as to not cause bag skewing when receiving and delivering bags from adjacent conveyors.
7. All power turns in tracked zones must be equipped with VFDs.

Q. Queue Conveyors

1. General
 - a. All queue conveyors must be supplied with V-Guided belts for belt tracking.
 - b. All queue conveyors must be equipped with VFDs.
 - c. Belting for all queue conveyors must be based on the specific queue functionality identified in Section 2.01M Belting.
 - d. All queue conveyors must be a minimum of 54' in length except where noted otherwise on the plans.
2. OTK Queue Conveyors

- a. The first 54" queue conveyor upstream of the three 36" pre-EDS queue conveyors, and the first conveyor downstream of the EDS must incorporate an OTK sideguard for TSA IQ Testing.
- R. 45° Merge
1. 45° merges as manufactured by:
 - a. Portec, Inc.
 - b. Transnorm System, Inc.
 2. Where a 45° merge is used, its construction must be typical slider bed construction as described in Section 2.01E "Slider Bed Sections" with the drive/take-up unit at 90° to the flow of baggage.
 3. All merges must have a centerline length of 5', unless otherwise noted.
 4. All merges must have a filler brush located at the discharge end.
 5. All merges must be equipped with VFDs with dynamic braking.
- S. Static Deflectors and Static Guides
1. Static deflectors as manufactured by:
 - a. Globe Composite Solutions, LTD.
 2. The static deflector must be installed ½" above the photoeye's field of view so that the gap created below the static deflector is self-clearing.
 3. Static deflectors must be molded composite
 4. The static deflector must be snag-free.
 5. The static deflectors must be installed staggered whereas the start of each taper must be offset by the length of the queue.
 6. Welding of the static deflector/frame to the sideguard is not permitted.
- T. Make up Devices
1. Slope Plate Devices
 - a. Slope Plate Devices as manufactured by:
 - 1) G & S Airport Conveyor
 - 2) Glidepath
 - 3) Horsley
 - 4) Jervis B. Webb
 - 5) Siemens
 - 6) Vanderlande
 - b. General
 - 1) Slope plate devices must be constructed of articulating contoured pallets or flights forming a continuous, rotating, sloped surface.
 - 2) Slope plate units must be provided with a deck guard made of formed angle, 12-gauge hot rolled steel.
 - 3) The deck guard must be nominally 7" by 2" and located at the top of the make-up unit.
 - 4) Overall outside device dimensions must be as shown on the plans.
 - c. Design Data
 - 1) Load Rating

- a) The device must be rated at 50 pounds per square foot or 125 pounds per peripheral foot live load.
- 2) Frame and Track
 - a) The frame must consist of standard modular assemblies bolted together to form a support structure and guide for the flight assemblies.
 - b) The track must be of rolled or formed structural steel. Structural supports for the tracks are to be spaced on a maximum of 4' centers.
- 3) Flight Assemblies
 - a) Each flight assembly must consist of a steel support assembly with upper support wheel, a flight (cover pan) and a segmented, molded rubber bumper at the lower end.
 - b) Each module must be connected at its lower end to a continuous drive linkage which incorporates the lower support wheels.
 - c) Upper and lower support wheels must have polyurethane treads for quiet operation of the device.
 - d) Flights must be 14-gauge stainless steel with Teflon tape rub stripping applied to the underside of each flight at the trailing edge.
2. Drive
 - a. The drive must consist of a heavy-duty, double-pitch roller chain with hardened drive blocks driven by a motor through a helical gear reducer and drive sprocket sized for AGMA Class II.
 - b. The unit must be must be operated continuously at 90 fpm.
 - c. The roller chain must engage at least two modular flight assemblies at all times.
 - d. Each unit must have overload protection and be provided with mechanical soft start device (s) or VFD(s).
 - e. A redundant drive must be installed on make-up units that only require a single drive. The redundant drive is to run simultaneously with the primary drive to allow continuous operation in the case primary drive failure.
 - f. All drives must be synchronized.
 - g. The drive must be designed for operation at 480 VAC, 3-phase, 60 Hz power source.
 - h. The drive must be sized to permit start-up under full load conditions.
3. Electrical Maintenance Outlet
 - a. One 120 VAC, single-phase 60 Hz duplex outlet must be provided in the general vicinity of each drive assembly by BHSC.
 - b. Outlet must be GFI protected and enclosed in a weather-proof enclosure.

U. Sliding Top Inspection Tables

1. Sliding Top Inspection Tables as manufactured by:
 - a. Lucasey
 - b. Or approved equal
2. Tables using a sliding configuration must have a 48" of slide movement with +/- one inch extension adjustable and stops at both ends. Slide portion of table to automatically retract.
3. Inspection table with full 48" movable top constructed of 18gauge brushed #304 stainless steel. Base plates for anchoring must not extend outside of the table leg supports. Table is 60" long by 30" wide with a stainless steel back guard. Top of sliding table must be no more than 30" above finished floor.

4. Table top to have 48" full extension slide capable of supporting a baggage load of 100 lbs. minimum in addition to the table top weight. Installed and pitched one degree +/- to allow table top to automatically retract. Stop underneath table must allow top to slide and provide a positive stop above the frame. Pinch points between the alarm line conveyor and table top must be protected with padding. Extension length of table must be adjustable +/- one inch with stops at both ends.
5. Table top to have release mechanism providing positive stop at normal (non-extended) position. The BHSC may provide an electric release solenoid in lieu of the mechanical handle release. The electric release must not restrict the table from returning to the normal locked position.
6. Tables to have two drawers (large and small) adjacent to the alarm line, an open area for storage, and a paper towel dispenser.
7. Tables must be constructed in mirror form for back-to-back application between a pre-wired center console backsplash.
8. Provide a center console backsplash 42" tall by 6" wide minimum between the two moveable table tops where tables are back-to-back.
9. Table configuration and center console backsplash/knee wall must have the EDS-specific components for integrated mounting of the ETD machine, HMI panel and Search Viewing Station (SVS) monitor.
10. Backsplash to be 18-gauge brushed #304 stainless steel on 3/4" FR plywood or a 5" x 3" x 1/4" steel tube frame support. Anchor to floor. Stainless steel to wrap all exposed surfaces, weld, and grind smooth.
11. Backsplash to include openings in the stainless steel and frame with 2-1/2" diameter grommets and cable sleeve to provide the power, data, and fiber connections to the equipment mounted above the backsplash.
12. Provide one flush mounted quad outlet along the vertical face of the backsplash and provide a second quad outlet inside the backsplash for connecting the ETD, BVS, and HMI. Provide a data quad box for data and fiber connections inside the backsplash. Provide access panels under the table top in the backsplash for access to the data and power connections.

V. Baggage Tubs

1. Baggage Tubs as manufactured by:
 - a. Geo Tex, Inc.
2. Provide 500 low profile plastic tubs 36"x24"x5" HMWPE with ASL bottom, ASL insert and drain hole.

W. Curbing and Guard Rails

1. Unless otherwise agreed to, protection for baggage handling system equipment and master control panels must be in the form of concrete and core drilled, concrete filled bollards, which must be provided by the General Contractor.
2. As a minimum, flange-mounted steel tube guardrail posts for protection of such equipment must be 4" X 4" square with 1/4" wall thickness with steel channel cross members.

X. Catwalks and Platforms

1. BHSC is responsible for design, fabrication, and installation of all catwalks, crossovers and platforms, associated access ladders / stairs and railings for the baggage systems where shown on the drawings, and as additionally required for the operation and maintenance of the system. These locations include, at a minimum, all potential jam locations (such as merges, diverts, power turns), locations where maintenance cannot be performed in a safe manner,

- and Fail-Safe locations. BHS Contractor to coordinate with the Owner, the Owner's representative, and the Architect to confirm the final location and quantities for catwalks, crossovers, platforms, and their associated equipment.
2. Specifications for suspending the catwalks will be the same as that for conveyors as described in Section 2.01L, "Floor Supports and Ceiling Attachments". The catwalk uniform working live load must be 40 pounds per square foot or a concentrated load at a location producing the maximum load effects of 300 pounds in 6.25 square feet (2.5 feet x 2.5 feet), whichever produces the greater effect. The maintenance platform uniform working live load must be 60 pounds per square foot with structural member deflection no greater than L/360. Supports must be located so that there is no unsupported ends, such as where two catwalk sections meet or catwalk terminates.
 3. Catwalks, and crossovers (step-overs and bridges) must be constructed with a walking surface of minimum 10 gauge formed steel. Toe boards and walking surface must be a one piece, continuous u-shape (4" high toe board). Walking surfaces must be reinforced to limit deflections to under 1/4".
 4. The minimum walking surface width must be nominally 36" with a 7" gap between the outside surface of the toe kick and the conveyor. Widths may be increased to meet NEC 110.26 working clearances.
 5. Handrails must be installed on all catwalks, crossovers, and platforms except where adjacent to conveyors.
 6. Nosing required for exposed ends of grating at elevation changes and at the top of ladders /stairs.
 7. Personnel protection must be included for all catwalk, crossovers, and platforms to minimize potential injuries. This includes removing all sharp edges, corners, and welds, deburring surfaces, padding and safety tape, and any other measures as necessary.
 8. Openings at the top of ladders/stairs must be protected by a self-closing gate.

Y. Fire/Security Doors/Shutters

1. Fire/Security doors/shutters as manufactured by:
 - a. Airport Equipment Specialists, Inc.
 - b. Vigneaux
2. Fire doors/shutters must be rolling shutter, slat-type, interior-face-mounted doors with electric operators, UL-labeled for three hour rating with Class A firewalls, and supplied with a fusible link or thermocouple.
3. Fire/security doors/shutters must be designed for continuous operation with a Life Cycle Expectancy of 22,000 cycles, at a maximum 4 cycles per 20 minute period.
4. No intermittent type doors allowed.
5. Fire/Security doors/shutters must be supplied with self-closing coils which will cause the door to close in the event of system power loss.
6. Fire door to fit between 2" conveyor-to-conveyor transfer gap.
7. Fire/security doors must provide a set of dry contacts for external monitoring of door status to be used by the Owner's security system, and faults for maintenance use

Z. Draft Curtains

1. Draft curtains as manufactured by:
 - a. Chase Economax
 - b. NECOR Corporation

2. Draft curtains must be two staggered layers of black or color specified by Owner, 8" wide x 1/16" thick strips.

2.02 ELECTRICAL

A. Power Panels

1. Furnish and install appropriately sized circuit breakers for all branch motor circuits and control power circuits within the baggage handling system.
2. All power panels must be minimum 14KAIC rated.

B. Relays

1. Relays as manufactured by:
 - a. Allen-Bradley 700 Type N or P
 - b. Siemens, SIRIUS series
2. E-Stop Relays as manufactured by:
 - a. Allen-Bradley 440R-N23132
 - b. Allen-Bradley Minotaur MSR127T
 - c. Allen-Bradley 700S-P or 700S-CF
 - d. Wieland, Configurable Safety Controller, samos PRO

C. Control Transformers

1. Control Transformers as manufactured by:
 - a. ACME, T series
 - b. Eaton, NEMA Premium
 - c. Sola Corporation, CVS series (conditioned power)
 - d. Sola Corporation, HS series (non-conditioned power)
2. Programmable controllers or sortation controllers must be equipped with the appropriate number and size of power regulators to ensure that the power is properly conditioned.
3. Power supplies for remote I/Os must be conditioned.

D. Circuit Breakers

1. Circuit breakers as manufactured by:
 - a. Eaton
 - b. General Electric (GE)
 - c. Siemens
 - d. Allen Bradley

E. DC24V Power Supply

1. DC24V Power Supplies as manufactured by:
 - a. Allen-Bradley
 - b. PULS
 - c. SOLA
 - d. Balluff
2. DC24V Power Supplies must be din-rail mounted.
3. DC24V Power Supplies must be operational within the temperature range of 14F to 140F.

4. DC24V Power Supplies must meet efficiency of 89% or higher.
5. If DC24V power supply is used for remote Ethernet switches, it must be DC-UPS, a battery, or a combination.

F. Conduits, Wireways, and Cable Trays

1. Rigid Metal Conduit (RMC)
 - a. The minimum size of RMC must be ¾”.
 - b. All fittings must be electro-galvanized.
 - c. All fittings must be of malleable steel threaded; and include gasket and covers.
2. Electrical Metal Tubing (EMT)
 - a. The minimum size of EMT must be ¾”.
 - b. Connectors of EMT must be with insulated throats with steel lock nuts or rings.
3. Liquid-tight Flexible Metal Conduit (LFMC)
 - a. Liquid-tight flexible conduit as manufactured by:
 - 1) Anaconda
 - 2) EF liquid-tight
 - 3) Sealtite
 - b. The minimum size of LFMC must be ½”.
4. Intermediate Metal Conduit (IMC) is not acceptable.
5. All fittings must be the water tight type.
6. Wireways
 - a. Wireways must be 4” x 4” divided metal and the minimum size is 18-gauge.
 - b. Wireways must have hinged covers and insulating pads on the inside radius of internal bends at all elevation and horizontal changes.
 - c. The design and installation of wireways must be of the “lay-in” type to avoid the need to thread wires through wireway end and transition connectors.
7. Cable Trays
 - a. Cable Trays must be U shaped wire mesh metal with equal height sidewalls.

G. Conductors

1. Power conductors must be a minimum of No. 12 AWG, 600 volt; Type THHW/THWN insulated stranded copper wire.
2. All control wires from terminal blocks to the field devices except for wires in quick disconnect cables must be a minimum of No. 14 AWG, type THHW/THHN stranded copper conductor, rated at 600 volts, and not less than 194F.
3. All control wires from terminal blocks to PLC input/output modules (inside panels) must be a minimum of No. 16 AWG.
4. Electronic circuit wiring must have a minimum of No. 22 AWG.

H. Enclosures

1. Industrial enclosures as manufactured by:
 - a. Hoffman
 - b. Rittal
 - c. Saginaw Control & Engineering (SCE)

2. Industrial enclosures must be NEMA Type 12.
3. Enclosures exposed to direct rain must be NEMA Type 4 weatherproof.
4. The PLC cabinet must be free-standing ventilated UL Type 12 with see-through front door.
 - a. OTK Enclosure
 - 1) Must be slanted top enclosures
 - b. CBRA BSD Enclosure
 - 1) Must be no greater than 4.5" deep
 - 2) CBRA BSD Enclosure to be no greater than 20" wide x 14" high

I. Pull Boxes, J-boxes

1. Junction boxes must conform to NEMA code requirements.

J. Motor Starters (Distributed Controls)

1. Motor starters as manufactured by:
 - a. Non-reversing
 - 1) Allen-Bradley 190 Series (IEC type)
 - b. Reversing
 - 1) Allen-Bradley 190 Series (IEC type)
2. Starters must incorporate thermal overload protection in all phases.
3. Minimum starter size must be NEMA size "O" (or IEC equivalent).
4. Motor starters must be equipped with an integral or separate HOA switch. The hand mode must bypass the control circuit and provide local power to the motor for maintenance operation.
5. Non-reversing motor starters must consist of three-pole, single-throw, magnetic across-the-line contactors, each with a holding contact and auxiliary contacts as required.
6. Non-reversing motor starters must have three manual reset, thermal overload relays.
7. Reversing motor starters must have electrical and mechanical interlocks.

K. Variable Frequency Drives (VFDs)

1. VFDs/VFD components as manufactured by:
 - a. Lenze
2. Power separation for VFDs is required to facilitate the installation of harmonic filters, if the filters are required.
3. VFDs must have the dynamic braking option and dynamic braking resistors.
4. VFDs must be EtherNet/IP compatible and must incorporate diagnostic and reporting functions over the EtherNet/IP network.
5. VFDs must have compatibility and connectivity to fulfill required network topology by itself or with an additional device such as an E-Taps.

L. Motor Safety Disconnects

1. If available, utilize VFD manufacture's built-in MSD
2. Motor safety disconnects as manufactured by:
 - a. Allen-Bradley, 194E
 - b. Square D, MD series
 - c. Turck, A9669

3. Motor safety disconnects must be 3-pole OFF/ON rotary switch type.
4. Motor safety disconnects must come with at least one auxiliary contact (N.O.) to monitor OFF/ON condition on Graphics and Report.
5. Enclosures must be IP65 rated or higher.
6. Motor safety disconnect must be lockable on Off position.
7. Motor safety disconnects must meet the requirements specified by the drive manufacturer.

M. Line Reactors

1. Line reactors as manufactured by:
 - a. MTE Corporation
2. VFDs that are located over 50 feet from their respective motor must have 5% line reactors installed on the output side of the VFD.

N. Power Cable

1. Power cables consist of the cables from the conduits/wireways to VFDs/motor starters/motors.
2. VFD cables if used must meet VFD manufacturers' requirements.
3. Power cables must be shielded and 600V rated.

O. Electrical Surge Protector Device

1. Electrical Surge Protector Devices (SPD) are required for the following areas.
 - a. On the line side of all 480VAC 3-phase power in PDPs, MCPs, and NPs
 - b. On the line side of 120VAC 1-phase power in NPs and Control Panels,
 - c. 120VAC 1-phase power feeding to UPSs installed for PLCs and servers
2. SPD as manufactured by:
 - a. Eaton
 - b. Surge Suppression Inc., CTM series or S-SP series
3. SPD for 480VAC must meet the following requirements:
 - a. Include discrete protection in all available modes as recommended by ANSI/IEEE Std. 1100-2005
 - b. Demonstrate frequency attenuation relative to ANSI/IEEE C62.41 Category A testing in all available modes
 - c. Be listed UL-1449 4th Edition
 - d. Include circuit board integrated current fusing and component integrated thermal fusing for maximum safety and protection
 - e. Include thermal stress reducing encapsulation for maximum durability and longevity
 - f. SPD for panel board mounted must have a Short Circuit Current Rating (SCCR) of 200k AIC
4. SPD for 120VAC must meet the following requirements:
 - a. Include only solid-state clamping components consisting of a multi-stage hybrid design
 - b. Bi-directional and encapsulated in a UL listed/recognized high dielectric compound
 - c. Have frequency responsive circuitry (Sine wave tracking) for each mode of protection
 - d. Designed to protect all dedicated circuits for PLC and field control panels
5. SPD must have LED to show the status of power.

P. Quick Disconnect Cable for non-EtherNet/IP Devices

1. Field devices such as photoeyes and control stations must be connected to an I/O block through a quick disconnect cord set.
2. All cord sets as manufactured by:
 - a. Belden/Lumberg
 - b. IFM
 - c. Turck
3. The cord set must have the temperature range of 14°F to 140°F .
4. All cord sets must be equipped with 90 degree connectors except for the connections orientated vertically down position.

Q. Photoeyes (PE)

1. Photoeyes as manufactured by:
 - a. Allen-Bradley Photoswitch 9000 series
 - b. Banner World-Beam Q45 series
 - c. IFM 06 series
 - d. Pepperl+Fuchs, OBR7500
2. Photoeyes used for jam detection, over height bag detection, change in length, etc., must be retro-reflective type devices.
3. Photoeyes must have quick-disconnect cabling.
4. Photoeyes must be unaffected by reflective bags.
5. Status indicator lights on the device must be Light Emitting Diode (LED) type.

R. Light Curtain Assemblies

1. Light curtain assemblies as manufactured by:
 - a. Banner – EZ-Array series
 - b. SICK MLG series
2. The light curtain assemblies must have quick disconnect cables.
3. The light curtain assemblies must be able to detect a height of 0.5” to 24”.

S. Push Button Control Stations

1. Push button(PB) Control Stations(CS) as manufactured by:
 - a. Allen-Bradley Type 800T/30.5mm operators
 - b. Eaton Cutler Hammer
 - c. Schneider Electric
2. Control station enclosures must be NEMA 12 and yellow in color.
3. Control stations in public view, at ticket counters, and at claim areas must have stainless steel plate covers.
 - a. All E-Stop push button applications must be of the maintained-contact, push-to-stop, red illuminated mushroom-head type.
 - b. Other push button switches must be momentary-contact type.
4. Illuminated push buttons lights must be LED type.
5. Control and E-Stop wiring connections to push button stations must be quick disconnecting type.

6. Control Types and descriptions of push button functionality are as follows (see detailed drawings):
 - a. Type 1A - Primary CS at input conveyors with security system integration
 - b. Type 1B - Primary CS at input conveyors for reversible sub-system
 - c. Type 2 - Inbound /Transfer CS
 - d. Type 3 - Secondary CS at input conveyors/secondary CS at make-up units/manual input.
 - e. Type 4 - Maintenance CS at make-up units
 - f. Type 5 - Fire/Security Door Maintenance Interface
 - g. Type 6 - No-Read Station
 - h. Type 7 - Horizontal Sortation Unit Interface
 - i. Type 8 - Hand/Off/Auto (HOA)
 - j. Type 9 - E-Stop/Jam/Start Reset
 - k. Type 10 - Vertical Sorter Interface
 - l. Type 11 – MCP Door Interface
 - m. Type 12A - Master Emergency Stop
 - n. Type 12B - Emergency Stop
 - o. Type 13 - Emergency Stop Lanyard
 - p. Type 14 - Reserved
 - q. Type 15 - Reserved
7. Control Station Components
 - a. EMERGENCY STOP (E-Stop)
 - 1) Must be a lockable, two-position, maintained contact, red illuminated, push to stop, mushroom head type, non-plastic, push-pull button.
 - b. START/RESET Push button (SPB)
 - 1) Ticket Counter CSSPB
 - a) Must be green, extended head, illuminated with guard, momentary contact push button.
 - 2) Other CS SPB
 - a) Must be green, flush-head, non-illuminated, momentary contact push button.
 - c. Conveyor or Device STOP Push Button
 - 1) Must be red, flush-head, non-illuminated, momentary contact push button.
 - d. Jam Indicator
 - 1) Must be amber, extended head, illuminated, pilot.
 - e. Start-Up Warning
 - 1) Must be an audible alarm that sounds as a warning whenever the subsystem is starting.
 - f. RESET Push Button
 - 1) Must be black, flush-head, non-illuminated, momentary contact push button.
 - g. ENABLE/DISABLE Keyed Switch
 - 1) Must be a two-position, maintained contact keyed switch.
 - h. ADVANCE Push Button
 - 1) Must be yellow, flush-head, non-illuminated, momentary contact push button.
 - i. AUTO/MAINTENANCE Keyed Switch
 - 1) Must be a two-position, maintained contact keyed switch.
 - 2) The key must be removable in both the MAINTENANCE and AUTO positions.

- j. HAND/OFF/AUTO (HOA) Selector Switch
 - 1) Must be a three-position, maintained contact selector switch.
 - k. JOG Push Button
 - 1) Must be yellow, flush-head, non-illuminated, momentary contact push button.
 - l. REVERSE Push Button
 - 1) Must be white, extended-head, illuminated, momentary contact push button
 - m. Door OPEN Push Button
 - 1) Must be black, flush-head, non-illuminated, momentary contact push button.
 - n. Door CLOSE Push Button
 - 1) Must be black, flush-head, non-illuminated, momentary contact push button.
 - o. System Ready Indicator (LTG)
 - 1) Must be green, flush-head, illuminated
 - p. Lamp Test Push Button (TPB)
 - 1) Must be gray, flush-head, non-illuminated, momentary contact push button
 - q. Alarm Silence Push Button (APB)
 - 1) Must be yellow, flush-head, non-illuminated, momentary contact push button
 - r. Motor Fault Indicator (LTB)
 - 1) Must be blue, extended-head, illuminated
 - s. System Fault Indicator (LTA)
 - 1) Must be amber, extended-head, illuminated
- T. Emergency Stop Lanyards
- 1. Emergency Stop lanyard assemblies as manufactured by:
 - a. Allen Bradley (Lifeline 4 series)
 - 2. Lanyard cables must be red.
- U. Selector Switches
- 1. Selector switches as manufactured by:
 - a. Allen Bradley 800T
 - b. Eaton Cutler Hammer
 - c. Schneider Electric
 - 2. Selector switches must be of the multiple, rotary, heavy duty industrial type generally known as instrument, control auxiliary, or transfer.
- V. Audible Warning System
- 1. Audible Warning System as manufactured by:
 - a. Allen-Bradley 800T
 - b. Mallory Company Sonalert
 - 2. System must be tower light devices with audible alarms.
 - 3. System must have audible devices producing 15 to 20 dBA above ambient noise level.

W. Stack Light or Rotating Beacon

1. Stack lights as manufactured by:
 - a. Allen-Bradley 855T tower lights
 - b. Banner TL70 modular tower light
2. Rotating beacons as manufactured by:
 - a. Eaton Cutler Hammer
 - b. Edwards Signaling Company horn/beacon Cat. #105XBR
 - c. Schneider Electric
3. Illuminated indicators, warning, and stack lights must be supplied with LED bulbs.
4. Stack lights and rotating beacons must have quick disconnect cables.
5. Stack Light Types
 - a. Type SL-1
 - 1) Must be Clear, Green, Red indication without horn.
 - b. Type SL-2
 - 1) Must be Red, Amber indication with horn.
 - c. Type SL-3
 - 1) Must be Blue indication with horn.
 - d. Type SL-4
 - 1) Must be Red indication with horn
 - e. Type SL-5
 - 1) Must be Amber indication with horn.

X. Shaft Encoders (SE)

1. Shaft encoders as manufactured by:
 - a. Allen-Bradley
 - b. SICK AFM60/AFS60
 - c. Turck RM-94SA1R
2. Shaft encoders must be EtherNet/IP absolute encoders.
3. The shaft encoders must be absolute type to minimize baggage tracking loss due to communication failure/delay.
4. The shaft encoders must be set to have a pulse-per-revolution that equates to a resolution of 2" or less of travel per pulse (or less) on the conveyor bed for effective baggage tracking.
5. Shaft encoders must incorporate all diagnostic and reporting functions over the EtherNet/IP network.
6. Status indicator lights on the device must be LED type.

Y. I/O Block

1. I/O blocks as manufactured by:
 - a. Allen-Bradley
 - b. Belden/Hirschmann
 - c. Pepperl+Fuchs
 - d. Turck
 - e. Weidmuller

2. I/O blocks must be EtherNet/IP compatible.
3. I/O block must have compatibility and connectivity to fulfill required network topology (for example DLR) by itself.
4. Digital output must have galvanic isolation.
5. I/O block must be rugged modules with M12 D code LAN connector.
6. Operation temperature must be 14°F to 140°F.
7. I/O block must have LED as diagnostic indicators.

Z. EtherNet/IP Taps (E-Taps)

1. E-Taps as manufactured by:
 - a. Allen-Bradley
2. E-Taps must be used for devices to be compatible with a require network topology, or a maintenance port (if applicable).

2.03 CONTROLS

A. Programmable Logic Controller (PLC)

1. PLCs as manufactured by:
 - a. Allen-Bradley
2. PLCs must be hot-backup with ControlLogix L7x series or equal. The firmware for the redundancy modules must be version 19 or later.
3. Communication modules must consist with the fastest speed and the most connections (TCP/IP or/and other network connections) available on the market.

B. Uninterruptible Power Supply (UPS) for BHS System

1. UPS(s) as manufactured by:
 - a. American Power Conversion (APC)
 - b. Eaton 9130 Series
2. UPS(s) to provide a minimum of 30 minutes of power at 100% capacity to PLCs and to all redundant server computers, monitors, and Ethernet switches during a power outage, prior to emergency power activation.
3. Minimum of 1500 VA must be sized for up to 4 PLC racks.
4. UPS must be true on-line double conversion.
5. Unit must have a network connection for supervision of the UPSs on-line health, including any fault conditions.
6. Inbound or stand-alone PLCs do not require UPS.

C. Automatic Tag Reader (Optical ATR)

1. ATR as manufactured by:
 - a. Cognex
2. The optical scanners shall be capable of determining the bag's sort code at a rate of not less than 2100 bags per hour for tags as herein defined.
3. The optical scanner array should be designed to automatically scan airline bar-coded baggage tags attached to a wide variety of checked baggage.

The optical scanner array must consist of a minimum of 12 camera scanners (scanner heads) physically arranged to provide baggage tag reading on all 6 sides of a bag. One IP camera overhead upstream for image capture only.

4. Environmental

- a. ATR must operate without malfunction within a temperature range of 32° F to 122° F (0-50°C) with a relative humidity of 0 to 99% non-condensing.
- b. If the scanner array or components cannot operate within this range, enclosures must be provided with the proper environmental control devices such as but not limited to: heating, cooling, ventilation, and filtering of airborne contaminants, to provide an operating environment that will conform to the manufacturer's electrical and mechanical requirements.

5. Scanner Array Controller (Redundant Operation)

- a. Each scanner array controller must have an independent link to the baggage sortation system.
- b. Connectivity to the baggage sortation system must be serial RS232, RS422, or RS485 interface, or Ethernet Network interface with TCP/IP protocol or EtherNet/IP.
- c. Each scanner array controller shall provide a network connection to the laser scanner array. Each independent network interface from each laser scanner head is networked together and connected to its appropriate scanner array controller.
- d. Each scanner array controller shall provide field connections for an independent photoelectric scanning zone sensor and direct-coupled tachometers.
- e. Each scanner array controller shall send only one message for each bag detected in the scanning zone.
- f. The scanner array controller will detect when a scanner head, network interface, power supply, photoelectric scanning zone sensor or direct-coupled tachometer failure occurs. The primary scanner array controller will enunciate the fault condition at the scanner array by means of its light tree indicator pole as well as a status message to the diagnostic software system located remotely in the control room.
- g. Upon any failure affecting the primary scanner array controller or those components interfaced to the primary scanner array controller, the secondary scanner array controller will automatically take over laser scanner array operation.
- h. Each scanner array controller shall have a 4-color light tree indicator pole. The lights are designated as follows:
 - 1) Green: Controller/Scanner Array Active
 - 2) Red: Controller/Scanner Array Failure
 - 3) Yellow: Controller in Stand-By Mode
 - 4) Blue: Good Read
- i. Provide an access point to monitor each scanner controller.

6. Read Rates

- a. The minimum monthly read rate for the laser scanner array for originating baggage must be at least 97% during normal operation for all IATA 10-digit license plate baggage tags, IATA 10-digit fallback tags, and 4-digit city code tags. This percentage does not apply to handwritten tags or noncompliant tags that will negatively impact actual read rates.
- b. Each camera scanner array shall achieve a minimum read rate of 99% during controlled testing.
- c. Each scanner array shall not exceed an error rate (misread rate) of 0.1%.

7. Diagnostic Software System

- a. The diagnostic software system running on a PC and located in the control room is Web-based and designed to provide maintenance data and statistical information about the scanner array's performance.
 - b. Each scanner array controller will interface to the diagnostic software system by means of an Ethernet interface with TCP/IP protocol.
 - c. For remote maintenance servicing, the diagnostic software system can be accessed remotely by means of a PC modem connection enabling a qualified service technician to help evaluate and diagnose laser scanner array problems down to the individual scanning head.
 - d. The diagnostic software system enables the remote monitoring and download of log files. The diagnostic software system includes the following:
 - 1) System List: Screen displays the System ID, System Name and IP address (array designation), Device ID, and current day read rates.
 - 2) Long Term Read Rate Data: Screen displays of Long Term Read Rate Overview (total log period by array) and Long Term Read Rate Detail (by day, by array).
 - 3) Daily Statistics: Screen displays daily statistics (by day, by array, by scanner head) and daily statistics by selected scanner head groups (by day, by array, by group).
 - 4) Exclusive Scanner Read Rate: Screen display of the frequency of when only ONE scanner head read the baggage tag during the scanning zone (by array, by head).
 - 5) Daily Course: Screen displays hourly read rates (by hour, by array).
 - 6) Histograms: Screen displays of object length, object gap, multiple read occurrences, and X/Y/Z positions of the baggage tags read.
 - 7) System Info: System documentation screens.
 - 8) Download Page: Screen containing raw data files (by day, by array).
 - 9) Alarm Settings: Specific screens enabling the maintenance group user programmability to preset alarm conditions for laser scanner array failures or declining scanner head performance.
 - e. Employing the diagnostic software system in the airport design must enable the implementation of optional Web-based touch-screen displays for viewing the diagnostic software system screens locally at the scanner arrays.
8. Scanner Requirements: Installation of the scanners must be compatible with BHSC's control system. The optical tag reader must meet the following requirements:
- a. Scanners meeting the requirements of this Specification are anticipated to have effective reading capability (depth of field), as follows provided the tag is oriented within the limits described below.
 - b. Each optical scanner shall have an imaging capability of a minimum of 3 MP with an image capture rate of up to 40 Hz.
 - c. Depth-of-field (measured from the front surface of the scanner's exit window) shall be nominally 46 inches or less.
 - d. Full reading capability shall be provided within the ranges shown above.
 - e. Each scanner shall be equipped with advanced recognition technology (OCR) software for partial scan reconstruction, and for automatic detection and recognition of printed symbols, machine print and handwriting.
 - f. Modularly designed so scanner replacement is "plug and play" with no optical alignment regardless of its location within the array.
 - g. The scanner array shall be physically arranged to provide baggage tag reading on all 6 sides of a bag.
 - h. The arrangement of the scanner cameras within the optical scanner array will be positioned as follows:

- 1) The scanner array shall be designed for 100% redundant operation.
 - 2) No single point of failure will cause a total scanner array shut down.
 - i. Each scanner array will contain 2 scanner array controllers, 2 photoelectric scanning zone sensors, and 2 direct-coupled tachometers for redundant operation.
 - j. Scanner array shall be capable of decoding a minimum of 2100 baggage tags per hour being conveyed at speeds of up to 400 fpm with a minimum bag separation of 6" between bags.
- D. Baggage Measuring Array (BMA)
1. BMA as manufactured by:
 - a. SICK, Model Number BDS200 dimensioning system
 2. The BMA must include the following (at a minimum):
 - a. Two Dimensioning Heads
 - b. One Controller Unit with Dimension Software
 - c. One installed tachometer (shaft-driven)
 - d. BDS Local Web Browser Diagnostic Display One Display Assembly with Serial Cable
 - e. Required Frames for installation
 3. The BMA must measure each bag for height, width and length to detect EDS Out-Of-Gauge bags.
 4. The BMA must be set to the most restrictive height, width and length of the EDS being employed.
 5. The BMA must not hinder the continuous flow and transport of baggage.
 6. The BMA must communicate with the BHS PLC(s) as to the "Go/No-Go" size of the bag.
- E. BHS Servers
1. Servers as manufactured by:
 - a. HP Proliant DL series
 2. The servers must consist of redundant architecture with fault tolerant redundancy (hot-backup) and data recovery. Redundancy must be achieved without compromising performance.
 3. The servers must support the use of virtualization.
 4. BHSC must install levels of security access, firewalls, and antivirus protection on all servers.
 5. Minimum one year storage capacity must be available within the computer, for all data collected and used in generating system reports and system events.
- F. Operator Workstation
1. Operator Workstation as manufactured by:
 - a. HPz200 series
 2. The operator workstation must consist of a tower PC with multiple monitors attached to a multiport video adapter.
 3. The monitors must be standard SVGA LCD monitors and meet the following requirements (at a minimum):
 - a. Minimum size of 24" and 16:9 ratio 1920 x 1080 pixels resolution.
 - b. Designed to operate satisfactorily within the temperature range of 32 degrees to 120 degrees F (0-50 degrees C) with a relative humidity (non-condensing) of 5% to 95%.

- c. Scanning frequencies must be compatible with the output signals from the video adapter used.
- d. A minimum of two monitors per workstation must be provided. The quantity of monitors depends on the final size and configuration of the baggage handling control system.

G. Printers

1. Printers as manufactured by:
 - a. HP CP2025 series
2. A minimum of two color printers must be provided.

H. Ethernet Switches

1. Upper Level System

- a. The Ethernet Switch for the Upper Level System as manufactured by:
 - 1) Allen Bradley, Stratix 8300
 - 2) Belden/Hirschmann
 - 3) Cisco, Catalyst
- b. The Ethernet Switch for the Upper Level System must be a managed Layer 3 switch.
- c. The Layer 3 switch must perform all VLAN routing for the BHS system and must be capable of the following:
 - 1) Up to 256 VLANs to manage per switch
 - 2) IEEE 802.1q VLAN tagging
 - 3) Internet Group Management Protocol (IGMP) snooping and querying
 - 4) Simple Network Management Protocol (SNMP) V2/V3 along with robust port statistics and configuration
 - 5) Support for standard IT convergence protocols such as Resilient Ethernet Protocol (REP), Multiple instances of Rapid Spanning Tree Protocol (RSTP), Multiple Spanning Tree Protocol (MSTP), and Media Redundancy Protocol (MRP)
- d. The Ethernet Switch must be configured to avoid a single point of failure with either redundancy or stacking.

2. Lower Level System

- a. The Ethernet Switch for the Lower Level System as manufactured by:
 - 1) Allen Bradley, Stratix 5700
 - 2) Belden/Hirschmann, RS20 series
- b. The Ethernet Switch for the Lower Level System must be a managed Layer 2 switch.
- c. The power source for the Ethernet Switch for the Lower Level System must be either a UPS or a battery in order to mitigate switch recovery time.
- d. The Layer 2 switch must act as the edge device connection points and must be capable of the following:
 - 1) VLAN capable if isolation is desired at the edge
 - 2) Extended temperature ranges
 - 3) No moving parts
 - 4) A fault contact to be able to monitor via PLC
 - 5) Powered from 24VDC
 - 6) External backup media to be able to store configuration of the switch
 - 7) IGMP snooping

- 8) Diagnostics such as LEDs, log file, remote monitoring, port mirroring, topology discovery, address conflict detection, network error detection, duplex mismatch detection, and trap for configuration saving and changing
 - 9) Port control and security such as port security with multiple addresses, SNMP V3, authentication, multi-client authentication, guest VLAN and unauthenticated VLAN, port based radius VLAN assignment, Access Control List (ACL), and login banner.
 - 10) Quality of Service (QoS) support
 - 11) Differentiated Services Code Point (DSCP) support
 - 12) VLAN support
 - 13) Support for standard IT convergence protocols (REP, RSTP, MSTP, MRP) and standard industrial convergence protocols
 - 14) MAC filtering and address notification
3. Ethernet hubs must not be used within the BHS network.
 4. BHSC must configure and optimize the Ethernet Switches within the BHS network.
 5. The Ethernet Switches must be configured to be all “auto-negotiate” or all “full-duplex” and to be full switching fabric.
 6. BHSC must optimize the Ethernet Switches for industrial multi-ports automation products or automation products.
 7. BHSC must provide any additional switch configurations required by the selected network protocols such as REP, STP.
 8. Ethernet Switches must maintain at least 20% of the spare ports for future expansion.
 9. Patch panels must be used to maintain system, to accommodate network changes, and the ease of maintenance.

I. Ethernet Network Cable

1. Ethernet Cable as manufactured by:
 - a. Belden/Hirschmann
 - b. Turck
2. Cord sets must be pre-assembled by manufacturers and used to connect the field devices.
3. The cord set must be:
 - a. Right angled to maintain low profile
 - b. IP68 rated against moisture and temperature range must be -40°F to 167°F
 - c. Meet ODVA EtherNet/IP standards
4. Cable segments must be as short as possible. The service loop must not exceed 12 inches in the open environment and 4 inches inside a cabinet/enclosure. Do not exceed the manufacturer’s requirements for bend radius and pull strength.
5. The type and the length of cables must be determined based from the location of field devices, distance of each segment, and environment. The Ethernet cables must be selected with consideration of the environment defined in the MICE table. Refer to the ODVA and IEEE guidelines. The categories for the cable justification are:
 - a. The Channel bandwidth requirements such as channel class or category
 - b. Cable type (copper/fiber)
 - c. Connector type (RJ45, M12, ST, SC, LC)
 - d. Electrical attributes and noise types and levels described per MICE table
 - e. Two-pair/four-pair cabling
 - f. MICE severity levels where the cables will be installed
 - g. Additional attributes such as IP67 or/and high flex

6. Bulkhead feed-throughs must be used when connectivity through an enclosure is required.
7. Shielded, bonded twisted-pair (STP/ScTP) cables and IP65/67 rated connectors must be used within the environment per MICE table.
8. RJ45 connectors must be used in the closed environment such as the server room, the control room, and inside the enclosure.
9. M12 connectors must be used in an exposed environment.
10. The use of additional field device(s) such as E-Taps and I/O block are allowed in order to exceed segmentation if approved by the Owner.

J. Network

1. Ethernet network must be able to handle multicast traffic.
2. Ethernet network must be configured for optimal traffic communication.
3. BHS Network must NOT connect all EDSs to a single network segment.

K. Firewall/VPN and Network Security

1. The network security must utilize several layers of protection so that failure of any layer does not allow the BHS system to be breached.
2. The network security must be monitored 24/7/365, and must report unusual or unauthorized activity to the network administrator.
3. Network security equipment as manufactured by:
 - a. Belden/Hirschmann, Eagle series or Tofino
 - b. Cisco
4. The network security system must meet Defense In-Depth requirements and meet current guidelines for critical infrastructure installations as defined by DHS, TSA, and NSA. The requirements include, but are not necessarily limited to:
 - a. Design and employ layered security methods in BHS system to restrict physical and electronic access to the automation products and networks.
 - b. The access to the BHS system must be authorized to those who are in contact with control system equipment.
 - c. Employ firewalls with ingress/egress filtering, intrusion detection/prevention systems, and validate all configurations.
 - d. Evaluate firewall configurations to block unnecessary traffic.
 - e. Provide up to date end-point protection software and hardware firmware such as antivirus software.
 - f. Where applicable, set the PLC key-switch/mode-switch to RUN mode and remove the key.
 - g. Where applicable, lock enclosures/PLC cabinet.
5. The network security system must protect network communication without interruption of BHS system operation as well as the network communication time.
6. The security system must be capable of alerting security issues to network administrators and maintenance personnel via e-mail, text, or alert broadcast.
7. BHSC must coordinate with the airport IT personnel for VPN connectivity to BHS.

L. Network Management and Diagnostics

1. Network diagnostic software as manufactured by:
 - a. Belden/Hirschmann, HiVision

2. Provide network diagnostic software and configuring for all necessary parameters/setting that monitor all network devices.
3. The Ethernet network (LAN/VLAN) health must be monitored via off-the-shelf network diagnostic software installed in the work station.
4. The network management tool must discover, map, and monitor all Ethernet networks and devices within the BHS network.
5. The network management tool must display the network hierarchy and visually represent device identification as well as current actual performance data and communication status.

M. Handheld Scanners

1. Handheld Scanners as manufactured by:
 - a. Motorola LS4208
 - b. SICK IDM26x
2. Scanners must be corded with either RS-232C or USB standard 108" cable and on a retractable reel.
3. Scanners must be supplied with adjustable stands.

N. System Status Displays

1. System Status Display (SSD) as manufactured by:
 - a. LG
 - b. NEC
 - c. Planar
 - d. Samsung
2. System Status Display must be minimum 42" flat panel LCD commercial grade monitors. The quantity of monitors depends on the final size and configuration of the BHS.
3. Minimum resolution of 1920 x 1080
4. Minimum contrast ratio of 4000:1
5. Minimum viewing angle of 89°
6. Minimum input connections RS232, HDMI and DVI

O. User Interface Stations/Human Machine Interface (HMIs)

1. HMIs as manufactured by:
 - a. Allen Bradley, Panel View Plus 7
 - b. Embedded PC assembly, Contec BX-956-DC6311 attached to a touch monitor
 - c. Dell Wyse D90D7 Thin Client attached to a touch monitor
2. Each of the following must be supplied in the quantities shown in the drawings:
 - a. HMI-1 (OTK): 10" to 15"
 - b. HMI-2 (CBRA BSD): 8" to 12"

P. Laptop Computer for Troubleshooting

1. BHSC must provide a laptop computer for the use of troubleshooting performed by the maintenance personnel.
2. Laptop computer as manufactured by:
 - a. HP ProBook 640

3. The laptop computer must include all application software and its licenses required to monitor/troubleshoot PLC programs, HMI programs, BHS network, and field devices.

PART 3 – EXECUTION

3.01 MECHANICAL INSTALLATION

A. General

1. Gaps between end rollers must not exceed 1” with ½” being a design objective. Gaps at power turn transitions and fire doors must be per manufacturer’s recommendation.
2. Uneven joints to top of sideguard must be equipped with a 45-degree transition to prevent bag jams from straps, etc.
3. All joints between conveyor bed sections must be smooth to provide a non-snagging surface.
4. Guards adjacent to power turns must be in alignment with the effective belt width of the turn to prevent interference with baggage movement.
5. Sideguards must provide a continuous, uninterrupted surface.
6. Butt joints must be smooth and snag-free, without the use of epoxy fillers. Where a joint cannot be otherwise economically corrected, BHSC must submit a request to use epoxy to the Owner for approval.
7. Removable sideguards must be fastened with quick disconnect fasteners for easy removal and replacement, and the joints must be smooth and snag-free.

B. Welding

1. Provide welded connections for fabrication and installation of work wherever bolted connections are not required for subsequent removal, or for normal operation, adjustment, inspection, maintenance and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding technicians.
2. All welded surfaces must be ground to create a smooth surface then thoroughly cleaned with a solvent to remove rust, scale, oil, grease, grit, and welding flash.
3. The welded surface must be primed with rust-preventive primer and painted with an alkyd paint to match the shop coat.
4. Weld Certifications are required for all structural welds.

C. Drives

1. Gear boxes and reducers must be mounted with vibration reduction bushings.
2. Gear boxes and reducers must be installed on the conveyor drive shaft so that the compression ring is seated correctly to reduce the amount of wobble of the drive system.
3. Gear boxes and reducers must be installed with a minimum of a ½” of the drive shaft protruding through the gear box or reducer to allow for the proper seating of the drive.
4. All motor reducer packages must be mounted with the motor up in the vertical position regardless of the degree of incline.
5. Reducers must be supplied with a breather vent positioned per the manufacturer’s recommendation based on orientation.
6. Reducers must be supplied with oil and verified after installation. Each reducer must be filled with oil to the proper level per the manufacturer’s recommendation based on orientation.
7. Drip pan mount and location must not affect maintenance.
8. Drip pan must be mounted in a horizontal attitude regardless of motor position.

D. Pulley Assemblies

1. Take-Up Pulleys

- a. All conveyors must be provided with take-ups for field adjustment of at least 4" or 2 percent of the conveyor bed length, whichever is greater.
- b. Take-ups must be an integral part of the drive frames on all intermediate/center drive conveyors.
- c. Adjust the position of all take-up pulley devices after system testing and prior to substantial completion of the system so that no more than 50% of the take-up device adjustment has been used.

E. Return Idler Rollers

1. Return idler rollers must be located on centers not to exceed ten feet, with spacing being reduced in areas where belting may drag against the floor or conveyor structure.
2. The shafts must be mounted to the conveyor bed with adjustable retainers for proper belt tracking.

F. Bearings

1. All exposed bearings in workstation areas must have bearing covers or otherwise meet minimum OSHA enclosure requirements for employee safety.
2. All bearings must be surface mounted flange bearings (or piloted flange bearings mounted internal to the conveyor pulley) attached to the outside of the conveyor bed, unless otherwise specified herein.

G. Slider Bed Sections

1. Return belt must be routed and supported so that it does not contact any stiffening members.

H. Hardware Installation

1. All hardware must be installed in a uniform manner.
2. All fasteners must be locked with a minimum of three threads showing after the nut.

I. Gap Debris Pans

1. Mount gap debris pans with steel chain to permit easy lowering and removal for cleaning and free from interferences from conveyor legs or hanger rods.

J. Floor Supports

1. Floor supports must follow the installation as shown in the approved installation drawings.
2. Floor supports must not interfere with egress.
3. Floor supports cannot block access to other equipment, devices, or control boxes.
4. All floor supports for transportation conveyors must be located on a maximum of 10'-0" centers.
5. Load conveyors must be supported on 5'-0" centers.
6. Support and hanger connections must be made on each end of drive sections, and within 12" of each conveyor bed section joint. Load conveyors must be supported at conveyor bed section joints.
7. Floor supported conveyor units must be braced as required by code for stability.

K. Ceiling Attachments

1. Ceiling attachments must be designed to avoid the transmission of excessive conveyor periodic or transitory loads into the structure. Spring isolators must be provided for all connections.
2. Vibration isolators must be installed in strict accordance with the manufacturer's instructions.
3. Attachments to steel beams must be clamped. Attachments to concrete slabs must be with drilled expansion anchors sized for the load with adequate safety factors. Attachments to concrete beams must be with drilled expansion anchors into the sides of beams only and placed a minimum of 6" up from the bottom of the beam. All attachments must be submitted for approval.
4. Locate hangers as near to the overhead support structure as possible.
5. Replace fireproofing materials to an equal depth as the existing fireproofing at attachment locations. Fireproofing must be of the same type and brand as existing.
6. All thread hanger rods must be continuous with no splices or couplings allowed. An exception is allowed if the all thread length exceeds 12'.
7. All thread hanger rods must be installed so as not to block access to the equipment, or the maintenance thereof.
8. Header steel, steel beams and seals must be installed so as not to block access to the equipment, or the maintenance thereof.
9. All header steel must be continuous with no splices or couplings allowed.
10. All thread hanger rods must be installed not to create vibration deterioration of the all thread hanger rod, equipment or installed devices.
11. Ceiling attachment configurations, including all thread hanger rods and spring isolators must be installed vertical and do not rub against conduit, pipe, duct, beams, or other interferences.
12. All thread hanger rods must have a minimum of 3 threads and a maximum of 6 threads showing after connection hardware. Threaded hanger rods to be square cut.
13. All threaded hanger rod ends in personnel and maintenance areas must have protective caps.
14. All ceiling supported equipment must not interfere with egress.
15. All ceiling supports for transportation conveyors must be located on a maximum of 10'-0" centers.
16. Load conveyors must be supported on 5'-0" centers.
17. Support and hanger connections must be made on each end of drive sections, and within 12" of each conveyor bed section joint. Load conveyors must be supported at conveyor bed section joints.
18. Ceiling supported conveyor units must be braced as required for stability.

L. Belting

1. All belt lacing must be Clipper type, No. 2 or No. 1 sized based upon belt manufacturer's specifications.
2. Belt lacing must be installed to prevent damage.
3. Belting material and the related lacing must be trimmed to provide a 45 degree 3/4" deep V-notch at the corners.

M. Conveyors

1. The queue conveyors that are identified to be removable to facilitate EDS removal/replacement, must be made so by including quick disconnects for the electrical and controls wiring, as well as being equipped with lockable casters, for movement away from the EDSs.

2. Flared side guards must be installed on all the conveyors downstream of conveyor breaks which requires a gap in the side guards (fire/security doors, ATRs, EDS exit queues, etc.)

N. Static Deflectors and Static Guides

1. Post Merge Static Deflectors
 - a. A static deflector must be installed on the merge side of the take-away conveyor sideguard just after the merge point.
2. Pre-BMA or ATR Static Deflectors
 - a. Static deflectors must be installed on alternating sides of the conveyor sideguards of the queues prior to the BMA or ATR.
3. Pre-EDS Static Deflectors
 - a. Static deflectors must be installed on alternating sides of the conveyor sideguards of the queues prior to the gapping and EDS entrance conveyors.
4. Pre-EDS Static Guides
 - a. The entrance conveyor prior to each EDS must have static guides mounted to the sideguards to prevent bags jamming at the transition into the EDS tunnel.
 - b. A closure strip must be provided from the static guide of the queue prior to the EDS and the entrance tunnel of the EDS. Blend the closure strip to form a smooth transition from side wall to the entrance tunnel.

O. Shrouding

1. Pulleys at the tail ends of load belts and at the head end of terminating belts must be covered with a removable metal shroud located just above, but not in contact with, the conveyor-belt surface. These pulley shrouds must match the style and quality of the shrouding on their respective conveyors.
2. Shrouding must be provided for conveyor equipment located in areas where the conveyors are exposed for loading or unloading (CBRA, ticket counters, claim units, transportation conveyors, etc.).
3. All connections must be smooth and flush without openings or projections on which bags or tags may catch.
4. Fasteners and access doors must be hidden from public view whenever practical to do so.
5. The visible side of the ticket counter conveyor must be equipped with removable stainless steel kick plate and back guard.
6. Back guard must contain no gaps between edge and wall.
7. These parts must be provided for the overall length of the conveyor with removable sections for maintenance and repair of components.
8. Removable sections on all conveyors must not exceed 10 feet in length.
9. Removable sections must be designed for ease of maintenance and repair of conveyor components and electrical controls.
10. Skirts must be bolted to the top of the frame rails on the loading side(s) of the conveyor.

P. Inspection Table

1. Provide a physical mock-up of the CBRA inspection and center console backplash to confirm equipment mounting requirements and interface with SVS, HMI, and ETD.

Q. Finishes

1. The belt side of the slider bed must be unpainted for the width equal to the approximate belt width.
2. All structural parts must be powder coated or painted with one shop-coat of phenolic-modified alkyd or acrylic emulsion paint applied to a thickness of 0.0010 -0.0012 inch. Exceptions are galvanized or zinc-plated surfaces, and those normally unpainted (such as rollers, shafts, sprockets, bearings, chains, nameplates, etc.).
3. Painted surfaces must be thoroughly cleaned of rust, scale, oil, grease, grit, welding flash, and all other forms of dirt detrimental to good painting practices.
4. Conveyors in fail safe zones must be identified with red paint on top of side guard.
5. All scuffed or otherwise marred surfaces are to be cleaned, primed with a rust preventative and a touch-up coating of alkyd paint applied to match the shop coat.

R. Graphics

1. Provide and mount all safety signs and graphics for the existing and new BHS equipment. Provide pre-printed phenolic, vinyl or metal signs permanently mounted to the equipment, walls, or structure for which they are intended. Warning and caution signs must be visible to personnel accessing and working within the conveyor areas.
2. Submit examples of all graphic signs to be used within the project. The Owner reserves the right to request additional signage and graphics for personnel protection.
3. As a minimum, graphic and warning signs must include:
 - a. Pinch Points
 - b. Conveyors Start Automatically
 - c. Equipment May Start Without Warning
 - d. Do Not Operate with Guards
 - e. Gate or Door Open
 - f. Do Not Walk Under Conveyor
 - g. Keep Off Conveyor
 - h. Caution Overhead Conveyor
 - i. Do Not Walk on Conveyors
 - j. Caution Low Overhead Clearance
 - k. Turn Off Power Before Opening
 - l. Danger High Voltage
 - m. Turn Off Power Before Working on Conveyor
4. General cautions signs must be located at the entrances to the matrices and include such items as: Do Not Start conveyor without audible or visual "all clear"; Do not operate conveyor with guards or protective equipment removed; Do not remove jammed baggage with conveyor running or power on; Only authorized personnel should operate conveyor; Know location and function of emergency stops; Turn Off all power before working on conveyor; Keep areas around conveyors clear of obstructions and debris; Report all unsafe conditions and practices to your supervisor; Do not walk, ride, sit or climb on conveyor without turning off all power supplies.

S. Conveyor Identification

1. Each conveyor section must be marked on both sides with its respective number.
2. Each conveyor number must be vinyl or carefully and neatly painted or stenciled in a contrasting color, nominally 4" high, in a conspicuous location adjacent to the conveyor drive.

3. In public areas, such identification must be 2" high characters in an inconspicuous location on the conveyor drive.
4. Temporary markings on the conveyors or other equipment must be made with a medium which is readily removable with water or a readily available commercial solvent, such that they may be removed without requiring any refinishing of the surface on which they appear.

T. Equipment Identification

1. Each piece of equipment such as a Vertical Sortation Unit or Horizontal Sortation Unit must be permanently and indelibly marked with its respective number.
2. Each piece of equipment number must be carefully and neatly painted or stenciled in a contrasting color, nominally 4" high, in a conspicuous location adjacent to the drive or disconnect.
3. Consumable equipment such as PE, SE, VFD, stack light, rotating beacon, motor, comm cards will have phenolic tags affixed to the conveyor or mounting plate in close proximity.

U. Draft Curtains

1. Draft curtains must be provided at all conveyor wall penetrations.

V. Fire/Security Doors

1. The installation of fire/security doors must follow manufacturer's instructions.

3.02 ELECTRICAL INSTALLATION

A. General

1. BHSC must provide power and control wiring to all BHS electrical equipment.
2. All electrical installation must meet the requirements of the national, state and local code
3. All electrical installation must follow the manufacturer's installation manuals.
4. All electrical installation must not interfere with operational and maintenance access of conveyors as well as the access of vehicular traffic.
5. All electrical components mounted to the removable BHS equipment must be installed via cannon plugs or equivalent quick-disconnect methods.
6. Double sided tape, glue, and sheet metal screws are not acceptable for installing Control Stations, VFDs, I/O blocks, Motor disconnects, and Motor Starter enclosures.
7. A service loop for all cables including power cables, control cables, and communication cables shall not exceed 12".

B. Conduit, Wireways, and Cable Trays

1. General

- a. Conduit or cable trays must not be installed underground or in floor slabs unless it is provided by GC and approved by the owner.
- b. Conduit or cable trays must not run on the floor.
- c. Conduits must be securely mounted and supported per NEC requirements.
- d. Conduits and cable trays must be installed to prevent rubbing or vibration deterioration against other structures.
- e. Conduits and cable trays must be routed to avoid removable equipment, any sideguards, safeguards, and power turns.
- f. Conduit and cable trays drops must not be supported or secured to the ceiling-supported equipment.

- g. A proper bushing must be provided where a conduit enters junction boxes, pull boxes, enclosures, etc. in order to prevent damage to wire insulation.
 - h. All conduits and cable trays must be concealed from public or finished areas.
 - i. All cut ends of conduits and cable trays must be reamed or finished to remove rough edges.
 - j. 120V/480V electrical wiring must be enclosed in conduit with threaded fittings and couplings
 - k. Control wiring must be routed separately from the power wiring regardless of any voltage.
2. Rigid Metal Conduit (RMC)
- a. RMC installation must meet NEC articles 300 and 344.
 - b. RMC is used in all areas below.
 - 1) At elevations 10' or less above the finished floor
 - 2) Exposed to vehicular traffic
 - 3) Possible damage by operations and maintenance personnel
3. Electrical Metal Tubing (EMT)
- a. EMT installation must meet NEC articles 300 and 358.
 - b. EMT must be used in the areas satisfying all conditions below.
 - 1) At elevations greater than 10' above the finished floor.
 - 2) No risk of damaging by operations and maintenance personnel.
4. Liquid-tight Flexible Metal Conduit (LFMC)
- a. LFMC installation must meet NEC articles 300 and 350; and NEMA RV 3.
 - b. LFMC must not be used where subject to physical damage.
 - c. LFMC must not exceed 12".
 - d. LFMC must be used from Motor Disconnect to Motor connection box.
 - e. LFMC may only be used in the areas below
 - 1) Power cable from disconnect to motor
 - 2) Transition from building supported conduit to conduit mounted from hanging conveyor
5. Wireways
- a. Wireways installation must meet NEC articles 376 and 378.
 - b. Wireways must not be used in any areas subjected to vehicular traffic.
 - c. High voltage power (greater than 150 volts), low voltage (less than 150 and greater than 90 volts), and low voltage (less than 90 volts) must all be separated by metal divider if run in the same wireway.
 - d. Wireways must be accessible from conveyor catwalks.
6. Cable Trays
- a. Cable Tray installation must meet NEC article 392 and NEMA VE 2
 - b. Cable Trays are acceptable to use for low voltage control wiring, data, or communication cables.
 - c. Ethernet cables must be segregated if combined with other low voltage wiring and cables.
 - d. Cable trays must be installed under the conveyors.
 - e. Cables in trays must be marked, easily identified, and removable.
 - f. Loading of cable trays must meet the following criteria.
 - 1) Vender specified weight restrictions

- 2) Cable fill must not exceed 50% of the inside area of the tray or the tray's maximum weight.
- 3) Conductor spacing requirements

C. Conductors

1. General

- a. Installation of conductors must meet NEC Chapter 3.
- b. Wiring must be run continuously from one piece of apparatus to another without splices in conduit.
- c. All wires must not contact the ground or floor.

2. Splicing

- a. Splicing control power, neutral and ground wiring is acceptable only at junction boxes by using terminal blocks.
- b. Splicing signal wires and motor power wires is not acceptable.
- c. Conduit type fittings, control stations, and MCP or PDP raceways must not be used for wire splicing.
- d. Splicing is not permitted in control panels and power panels.

3. Spare Conductors

- a. 5% spare conductors must be provided in all conduit home runs.

D. Pull Boxes, J-boxes

1. Control boxes, access boxes, etc. mounted on equipment or equipment- related material in the field, must be securely mounted to unistrut with minimal horizontal or vertical play.
2. Boxes must be installed for ease of maintenance. Boxes must be mounted on the catwalk side of the equipment.
3. Boxes installed that can be considered a "Head Knocker" must be clearly marked with yellow and black caution tape.
4. Boxes must be installed in a manner to not block access to the equipment.
5. All junction box covers must be permanently identified with the system served, circuits, and destination.
6. All unused openings in junction boxes, pull boxes and MCPs must be sealed with NEMA 12 watertight conduit knockout closers.

E. Motor Starters (Distributed Controls)

1. Motor starters must be mounted at their respective drive locations and within the Motor Starter Panel (MSP), along with their associated controls, overloads, fuses, etc.
2. Motor starters and overload relays must be wired to a Point I/O or an I/O block, and all signals are transmitted via EtherNet/IP.

F. VFDs

1. All conveyor sections with VFDs must utilize dynamic braking.
2. All belts with frequent start/stop operations, such as indexing belts, queue conveyors and merges must be controlled by VFDs and utilize dynamic braking via VFD.
3. VFDs must be mounted at their respective motors.
4. All conveyors in tracking zones to be controlled by a VFD.
5. All queue conveyors must be controlled by a VFD.
6. All merge conveyors must be controlled by a VFD.

G. Motor Safety Disconnects

1. Installation of motor safety disconnects must meet NEC articles 430.102.
2. Motor safety disconnects must be integral to the motor drive package if the drive package is adjacent to the motor.
3. Concealed motors or motor driven pulleys must have separate safety disconnects.
4. Motor safety disconnects must be installed in sight from the motor location.

H. Power Cable

1. Power cables must not exceed six feet in length.

I. Quick Disconnect Cables

1. Quick disconnect cables must be secured per manufacturer's recommendation.
2. Plastic tie-wrap for cable support is not acceptable.

J. Field Devices

1. General

- a. Field Devices such as but not limited to: control stations, photoeyes, control boxes, Motor disconnect switches and shaft encoders must be mounted on equipment or equipment-related material.
- b. All excess power cable, control cable etc. must be neatly rolled and placed inside the device J-box when possible. In all other cases, the excess cord must be neatly rolled and strapped to the backside of the conveyor leg.
- c. All field devices must be mounted for ease of maintenance. Where catwalk is installed, all field devices must be mounted on the catwalk side of the equipment.
- d. All field devices must be mounted as to prevent damage to the device.
- e. All field devices must be mounted on the equipment for which the device controls.
- f. All devices must be installed in a manner not to block access to the equipment.
- g. All devices must be mounted such a way that diagnostic LEDs are visible to the maintenance personnel.
- h. When a device is mounted horizontally, 90 degree connectors must be used.

2. Photoeyes

a. General

- 1) All conveyors must be supplied with head end photoeyes
- 2) Photoeyes must be mounted on structural members attached to the machinery structure so that minimal vibration is transmitted to these units.
- 3) No more than two penetrations per sensor (one each for the photoeye and the reflector) must be allowed in conveyor sideguards.
- 4) Each penetration must not exceed 1-1/2" in diameter.
- 5) Hex Head 1/4"-20 bolts of appropriate length and related 1/4"-20 hardware (flat washers, lock washers and nuts) must be used for the mounting of the photoeyes. Round head bolts are not acceptable.
- 6) On level transitions from conveyor to conveyor, photoeye holes must be punched 1-1/2" above the conveyor bed.
- 7) On incline/decline transitions from conveyor to conveyor, the head end photoeye hole must be punched no more than 2-1/2" above the conveyor bed.

- 8) Photoeye holes punched on power turn and spiral power turns must be 1-1/2" above bed on the inside of the turn, and mounted no higher than 2-1/2" on the outside of the power turn.
- 9) Head End photoeye holes must be punched based on the following table:

Conveyor Type	PE Location from Head End
36" queues	6"
Conveyors 180 fpm or less	12"
Conveyors 180 fpm to 240 fpm	18"
Conveyors greater than 240 fpm	24"

Table 10: PE Locations

- 10) Last Bag photoeye must be located just downstream of the fire/security door.
 - 11) Over Length photoeye located just downstream of the fire/security door must not be triggered by the draft curtains when normal baggage passes through the fire/security door. The Over Length photoeye can also be used as the Last Bag photoeye.
 - 12) Over Height photoeye located just downstream of the fire/security door must not be triggered by the draft curtains when normal baggage passes through the fire/security door.
- b. Mainline/Transport Conveyors
 - 1) In addition to merge and diverting photoeye, mainline and transport conveyors must be supplied with head end photoeye.
 - c. Pre EDS Queue Conveyors
 - 1) The pre EDS queue conveyors must supplied with a head end photoeye.
 - d. Post EDS Queue Conveyor
 - 1) The exit queue conveyor must be supplied with a head end photoeye.
 - e. Reverse Merge Photoeyes
 - 1) All 45 degree reverse merges must have two photoeyes installed.
 - a) The first photoeye must be installed at the head end of the conveyor.
 - b) The second photoeye must be located six inches from the tail end of the reverse merge.
 - 2) The head end photoeye must be used for jam detection and tracking.
 - 3) The tail end photoeye must be used for jam detection and divert confirmation.
3. Light Curtain Assemblies
 - a. Provide a light curtain assembly on the second queue upstream of each EDS machine.
 - b. The light curtain assemblies must be installed 3" from the head end of the queue conveyor.
 - c. The bottom sensor on the light curtain assemblies must be installed at 0.5" from Top of Bed (TOB).
 - d. Each light curtain must have a deflector installed upstream at the same queue of the light curtain assembly.
 4. Push Button Control Stations

- a. General
 - 1) Push button stations in public view, at ticket counters, and at claim areas must be flush-mounted with stainless steel cover plates.
 - 2) Load conveyor control stations in non-public areas must be surface-mounted.
 - 3) Maintenance access must be provided at all control stations.
 - b. Locations
 - 1) Type 1A - Primary CS at input conveyors with security system integration must be mounted near input load conveyors and adjacent to security swipe card reader
 - 2) Type 1B - Primary CS at input conveyors must be mounted near input load conveyors of reversible sub-system such as an oversize line
 - 3) Type 2- Inbound/Transfer CS mounted input load conveyors
 - 4) Type 3- Secondary CS at input conveyors/secondary CS at make-up units/manual input must be field mounted at load conveyors
 - 5) Type 4- maintenance CS at make-up units must be field mounted and located at make-up drive units
 - 6) Type 5 - Fire/Security Door Maintenance Interface must be located adjacent to each Fire/Security Door control panel
 - 7) Type 7 –Horizontal Sortation Unit Interface must be located adjacent to the HSU control panel
 - 8) Type 8 (HOA) - CS must be located adjacent to each drive that is controlled. (Must be field mounted and located at each drive, not required if VFD has integral HOA).
 - 9) Type 9 E-Stop/ Jam Reset- must be field mounted and located within each E-Stop zone.
 - 10) Type 10 - Vertical Sorter Interface must be mounted adjacent to the VSU control panel
 - 11) Type 11 - MCP Door Interface must be located on the MCP door
 - 12) Type 12A - Master Emergency Stop must be located as shown per drawings
 - 13) Type 12B - Emergency Stop must be located adjacent to each BRP in CBRA
 - 14) Type 13 - Emergency Stop Lanyard. Refer to 3.02J.5.
 - 15) Type 14 – Reserved
 - 16) Type 15 - Reserved
 - c. Ticket Counter/Curbside Input Conveyors

Each ticket counter/curbside input conveyor must be supplied with the following controls and equipment with corresponding functions:

 - 1) One Type 1A control station located within 8'-0" of the fire/security door, with an integrated security card reader.
 - 2) One Type 3 control station located no further than every 25'-0", beyond the Type 1B control station, along the ticket counter conveyors.
 - 3) A fire/security door with a draft curtain and a Type 5 control station for maintenance operation of the fire/security door.
5. Emergency Stop Lanyards
 - a. Emergency Stop lanyards must be installed per OEM recommendation at the locations shown on drawings.
 6. Shaft Encoders
 - a. Shaft encoders must be mounted on the tail end pulley shaft.
 - b. Shaft encoders must be located on all conveyors, except vertical sortation units, within the tracked zones of the BHS to provide positive feedback regarding belt speed and

distance traveled. The encoders must be monitored to verify that they are operating correctly.

7. Stack Lights

- a. Type SL-1 to be mounted at exit of each EDS.
- b. Type SL-2 to be mounted at several locations within non-public areas to indicate start-up of conveyors or a fault occurrence. The locations include makeup units, CBIS sub-systems, CBRA, and sortation sub-systems.
- c. Type SL-3 to be mounted at each divert point with a failsafe function.
- d. Type SL-4 to be mounted at each public claim unit; public side of conveyors such as curbside and oversized conveyors, and locations specified on the drawings.
- e. Type SL-5 to be mounted on the top of MCP to indicate a faulted or jammed conveyor(s) powered by the MCP.

8. EtherNet/IP Taps (E-Taps)

- a. Each E-Tap required for the field device must be mounted inside an enclosure and located near the device requiring the E-Taps.
- b. E-Taps required for the Ethernet switch must be mounted inside an Ethernet switch enclosure or an enclosure along with other Controls equipment.

K. Wire and Cable Identification

1. Labeling

- a. BHSC must label all conduits and raceways using DuraLabel™ Pipe Markers on the exterior as to what type of wiring/cabling is contained within.
- b. Dymo-type labels are not acceptable.
- c. Labels must include the following information at a minimum: 480VAC Power, 240VAC Power, 120VAC Power, 120VAC Power & Control, 24Volt Direct Current (VDC) Power, 24VDC Power & Control, Data and Communication.
- d. Labeling must occur on 20 foot intervals
- e. Field electric wire and cable must be color-coded and must have the wire numbers as shown on the electrical drawings affixed to both ends of each wire. Coding is defined below.
- f. Text height must be between the diameter and a half of the diameter of the wire size.

2. Control wires

- a. Labeled a minimum eight digit alpha/numeric designation such as 12345678.
- b. The first two numbers (1,2) represent the Panel number, the next two numbers (3,4) represent the rack, the next two numbers (5,6) represent the slot number, and the last two numbers (7,8) represent the actual input/output that the wire derives from.

3. Network Node Cables (Industrial Ethernet)

- a. Each cable must be labeled with a unique identifier:
- b. A – BB/CCCC.D (e.g., C-SE/SS1-01.1, F-SW/PLC1.5)
- c. “A” references cable type (C: copper, F: fiber).
- d. “BB” references device identifier (an example is: “SE” as shaft encoder, “IOB” as I/O block).
- e. “CCCC” references conveyor name or device name (an example is: SS1-01, PLC1).
- f. “D” represents port number.

4. Safety Relay E-Stop Cabling

- a. Each cable must be labeled with a unique identifier NP(XX)-S(Y)
 - b. XX references the associated Node Panel source, i.e. 01 to 27.
 - c. Y references the trunk line number coming from the panel (1,2,3,4)
5. Power wiring numbers must be labeled with the PDP name, conveyor name, and T1, T2, or T3 depending on the phasing of the wire.
 6. Power Wiring – Line Side: This code applies to all field power wiring from source to the line side of the circuit breaker in the PDP and MDP. The neutral, if applicable, must terminate at the terminal board.

Voltage	<u>120 / 208</u>	<u>277 / 480</u>
Phase "A"	Black	Brown
Phase "B"	Red	Orange
Phase "C"	Blue	Yellow
Neutral	White	Gray
Mech. Ground	Green	Green

Table 11: Power Wiring Colors

7. Control Power Wiring – Load Side: The color code for field power and control wiring from the load side of the fuses and/or circuit breakers in the PDP and NP to all other devices must be as follows:

Wire Type	Color
A.C. Control Power	Black
A.C. Control Signal	Red
A.C. Control Neutral	White
D.C. Control Positive	Blue
D.C. Control Negative	Blue/White Stripe
Mech. Ground	Green

Table 12: Control Power Wiring Colors

L. Electrical Equipment Identification

1. General
 - a. Each Panel/Station/Device must be supplied with a laminated name plate permanently attached, corrosion proof, etched, engraved, or stamped identification laminated plates.
 - b. Lettering must be a minimum of 1/8” characters using contrasting colors (i.e. white on black background).
 - c. Dymo-type labels are not acceptable.
2. Motor Control Panel
 - a. Must be permanently labeled or marked with the name of the conveyors controlled by the panel.
3. Power Distribution Panels (PDPs)

- Each PDP must be supplied with a name plate identifying, as a minimum, following information:
- a. PDP Number
 - b. Voltage
 - c. Hertz
 - d. Phase
 - e. Full Load Amps (FLA)
 - f. Associated Conveyors
 - g. Location/name of breaker that the power fed from
 - h. SCCR Rating
 - i. All Warning, Caution, and Safety Signs
4. Panel boards
 - a. Panel boards must follow the existing nomenclature used by the Airport or Airport authority to identify high and low voltage panels.
 - b. The main and all branch circuit breakers must be labeled identifying the equipment they serve.
 5. Field Devices
 - a. Each device must be identified by a unique number in a minimum of 1/8" font character using contrasting colors (white on black name plates). The name plate must read the device type and the conveyor ID. When multiple devices of similar nature are located on the same equipment, a unique identifier must follow each device.
 6. Motor Safety Disconnects
 - a. Motor safety disconnects must be identified by a unique number in a minimum of 1/8" characters using contrasting colors (white on black name plates).
 - b. Motor safety disconnect numbers must be as follows; MSD-(Conveyor ID)-(Unique Identifier) and must be mounted 1" above the motor safety disconnect switch.
 7. Control Stations
 - a. Each control station must be identified by a unique number.
 - b. The control station number must be as follows; CS-(Conveyor ID)-(Unique Identifier).
 8. Safety Disconnects
 - a. Each motor safety disconnect must be identified by a unique number.
 - b. The motor safety disconnect number must be as follows; MSD-(Conveyor ID)-(Unique Identifier) and must be mounted 1" above the motor safety disconnect switch.
 9. Photoeyes
 - a. Each photoeye must be identified by a unique number.
 - b. The photoeye number must be as follows; PE-(Conveyor ID)-(Unique Identifier) and must be mounted on the conveyor within 2" of the photoeye location.
 10. Shaft Encoders
 - a. Each shaft encoder must be identified by a unique number.
 - b. The shaft encoder number must be as follows; SE-(Conveyor ID)-(Unique Identifier) and must be mounted on the conveyor within 2" of the shaft encoder location.
 11. All panels that contain PLC I/O must have a laminated I/O cross reference chart attached to the inside of the left-most panel door. This chart must include, at a minimum, the I/O point

identification number along with the wire number and device description to which it is connected.

12. Stack Lights

- a. Each stack light must be identified by a unique number.
- b. The stack light number must be as follows; SL-(Conveyor ID)-(Unique Identifier) and must be mounted on the conveyor within 2” of the stack light location.

M. Control Device Identification

1. Node Panel (NP) component identification must be provided so that all relays, timers, starters, overloads, fuses, circuit breakers, etc., can be readily identified when the NP door is opened.
2. Items mounted to the door must be identified on the inside of the door.
3. In addition to all prime manufacturers' nameplates, all electrical and mechanical control items mounted in or on panels or push button stations must be further identified in the system by permanently attached corrosion-proof, etched, engraved, or stamped identification plates.
4. Dymo-type labels are not acceptable.

3.03 CONTROLS INSTALLATION

A. Programmable Logic Controller (PLC)

1. PLCs must be located in the PLC Cabinet(s) specified on the plans, unless otherwise noted.
2. Requested Packet Interval (RPI) must be set approximately at half of PLC scan time for the critical I/O. The BHSC must optimize RPI so that the PLC logic does not miss I/O signals.
3. The capacity of each network must not exceed 80% of its total capacity.
4. The scan time of the tracking PLC must not exceed 40 ms. BHSC is responsible for programming PLC logic properly so that the scan time does not interfere with positive tracking.
5. Zone Faults
 - a. Provide at minimum a 16-point dry contact output module for the purpose of zone faults.
 - b. Zone faults must be coordinated with the Owner.
 - c. Owner will be responsible for all connections from this point to their maintenance system.

B. Uninterruptible Power Supply (UPS) for BHS System

1. UPS for PLCs must be mounted in the PLC cabinet.
2. UPS for the servers must be located in the server rack.

C. BHS Server

1. BHS servers must be mounted in a rack located in the BHS Control Room. The rack must include a rack-mounted keyboard, monitor, and mouse with a KVM switch.

D. Operator Workstation

1. A computer(s) and monitors must be contained in an operator console located in the BHS Control Room
2. The operator console must have a built-in writing tabletop below all the monitors.
3. The writing top must be at a standard desk height, and have space available for the keyboard and mouse.

4. An alarm and reset button must be mounted in this workstation rack system to provide an audible alarm for system faults.
5. Provide a workstation in OSR for TSA to be able to print their SSI reports.

E. Printers

1. A printer(s) must be installed in the BHS Control Room and OSR.
2. The printer(s) must be networked with the Diagnostic Computer, the BHS server and workstation PCs.

F. Ethernet Switch

1. The Ethernet Switch for the Upper Level System must be located in the server rack in the BHS Control Room.
2. The Ethernet Switch for the Lower Level system must be mounted in the Ethernet Switch Enclosure, and located on-site, unless noted otherwise.

G. Network Cables

1. The Ethernet cable must be installed by BIC IS (Building Industry Consulting Service International) installer certified personnel or RCDD (Registered Communications Distribution Designer) certified personnel.
2. Provide proper grounding and bonding of the shielded cables.
3. Cables and wires must be segregated per EMC categories.
4. Bend radius must meet manufacturer's specifications.
5. Network Cable Installer must follow the communication wiring prepared by BHSC.
6. Fiber optic installation must be per manufacturers' methods.
7. Network Cable Installer must verify proper connection of each cable segment installed in the BHS system.
8. One redundant cable is required per segment between PLC and Ethernet switches as well as among Ethernet switches.

H. Handheld Scanners

1. A handheld scanner must be mounted at each BSD.

I. System Status Displays

1. System Status Display (SSD) must be installed in the following locations.
 - a. BHS Control Room
 - b. CBRA
 - c. OSR Room

J. User Interface Stations/Human Machine Interface (HMIs)

1. HMI-1 (OTK)
 - a. Each OTK HMI must be located adjacent to the OTK bag removal point for each SS line.
 - b. Location must not obstruct the EDS removal path and baggage removal/induction points.
2. HMI-2 Bag Status Display (BSD)
 - a. Each CBRA BSD HMI must be located at the location required by PGDS.

PART 4 SUB-SYSTEM FUNCTIONALITY

4.01 SEQUENCE OF OPERATIONS

A. Pre-Start Conditions

In order to start the system the following conditions must be met:

1. PDP, MDP, NP and PLC enclosure power disconnects must be in the 'ON' position.
2. No E-Stops in the zone are depressed.
3. No motor overload faults in the zone are present.
4. No jam faults in the zone are present.
5. No Motor Disconnects in the zone are in the 'OFF' position.
6. No active building Fire/Alarm Signal.
7. Ticket Counter Operator Key switch is in the 'ENABLE' position (where applicable).
8. Security card swipe permissive signal/interlock is in the 'ENABLE' position (where applicable).

B. System Start-Up Procedure

1. Prior to initiating any conveyor motion, the following start-up procedure must occur. The pre-start conditions described above must be met prior to beginning this system start-up procedure.
2. Normal system start must be initiated from any 'START/RESET' push button (SPB) provided along each load belt. Depressing any of the enabled load belt SPB must initiate the start alarm sequence and open the associated fire/security door. When the alarm times out, the associated subsystem, all downstream conveyors, and make-up devices must start.
3. In public areas, a security card swipe or a keyed switch enables the authorized use of the SPB on the associated control station.
 - a. An authorized operator will have a preset time period (adjustable by timer in the PLC) to use the SPB.
 - b. If the associated control station (Type 1B) is not activated within the preset time period, the controls must become inactive and require a security card swipe to reactivate.
4. Each make-up unit must have a group of control stations with a SPB. Each of the make-up units must have one of these control stations that incorporates a two-position maintained contact key locked selector switch which must enable/disable all make-up SPBs. Depressing any of the make-up SPBs must initiate the start alarm sequence and start the make-up unit only.
5. Activating the SPB on the Re-Induction Line (RL) conveyor will initiate the start alarm sequence to start the RL conveyors and all associated downstream conveyors.

C. Start Alarm Sequence

1. The Start Alarm sequence must be initiated by depressing any SPB to start or restart from a system fault (motor overload, jam, E-Stop, etc.).
2. This must activate the start alarm devices for a predetermined amount of time (adjustable by timer in the PLC).
3. Depressing the SPB at the "Public" load belts must open the associated fire/security doors.
4. When the start alarm times out and no faults exist, the associated conveyor system(s) must start.

D. Start Alarm/Fault Beacon

1. The remotely mounted start-up alarm beacon, categorized as type SL-2, must serve as a start and fault beacon. Faults that require both visual and audible indications are any faults associated with field devices and field equipment. Motor disconnect-off does not require this annunciations as it is not a fault; rather, is a maintenance feature.
2. When a fault occurs, the beacon closest to the affecting fault must produce an audible alarm.
3. Functionalities of beacon color and sound for start-up and faults are described in 4.02G
4. Fail-safe alarm must use type SL-3 and functionalities are specified in 4.02G

E. Cascade Starting

1. The conveyor system must start in a cascading fashion from the most downstream conveyor backwards.
2. The motor start logic for each conveyor must be linked to the conveyor that is directly downstream.
3. In all areas, the start-up delay between two motors starting must be programmed to maintain all merge and divert windows to meet all specified processing rates.

F. Cascade Stopping

1. In the event downstream conveyors cannot accept bags for some reason such as a jam, motor overload, etc., the upstream conveyors equipped with a head end photoeye must enter cascade stopping mode.
2. In cascade stopping mode, the conveyors must continue to run as long as their head end photoeye is clear. When a bag arrives at the head end photoeye, the associated conveyor must be stopped along with all upstream conveyors up to the next head end photoeye. This feature allows the system to keep running and accumulate as many bags as possible during a fault condition. Cascaded conveyors must display as cascaded on the system status displays.
3. For safety purposes, the cascade stop condition must be latched in the PLC logic so that the cascade stopped conveyor will remain stopped even if its photoeye is cleared, and the conveyor downstream is not running. This condition must become unlatched when downstream conveyors become available and are running.

G. Normal System Stop

1. Normal system stop occurs by one of two methods: Auto-Stop/Time Out or push button/key switch.
2. Auto-Stop/Time Out
 - a. In order to conserve energy and limit wear on the system, each subsystem or zone must be equipped with an auto-stop sensor that will shut down the subsystem/zone if there has been no bag traffic detected for 10 minutes.
 - b. OOG line and sortation piers/makeup units must consider bags' destination to enable auto-stop/time out.
 - c. The mainline sub-system with a merging line(s) must have multiple auto-stop zones such that a specific section of mainline conveyors can time out when a baggage flow is not detected from a merging line(s).
 - d. This auto-stop timer must be adjustable in the PLC and must be adjustable for system functionality. Any downstream auto-stop times must be inhibited as long as any upstream subsystem is running.
 - e. Each zone must continue to run until the auto-stop timer for each zone is complete.
 - f. As each zone times out and stops, it must start the next downstream zone auto-stop timer. This must continue until the entire system times out and stops.

- g. Auto-stop timers must be inhibited whenever any conveyor in the subsystem/zone is not running due to a fault condition.
 - h. When the ticket counter load belt auto-stop timer runs a predetermined amount of time, if not reset by bag traffic, it must stop the load belts prior to the fire/security door and close the door. The remainder of the subsystems/zones must “time out” as described above.
3. Push Button/Key Switch
- a. When the push button is depressed or the key switch is turned to the off position, it must initiate the normal stop sequence.
 - b. The associated ticket counter load belts prior to the fire/security door must stop immediately and the associated door must close.
 - c. The remainder of the subsystems/zones must “time out” as described above.

4.02 FUNCTIONAL DESIGN DESCRIPTIONS

A. Emergency Stop (E-Stop)

When an E-Stop is activated, the following sequence must occur:

1. All conveyors in the E-Stop zone must stop until reset.
2. The ‘E-STOP’ push button pressed must illuminate and flash.
3. Other ‘E-STOP’ push buttons within the same zone must illuminate.
4. When an ‘E-STOP’ is activated, the beacon closest to the affected control station must produce an audible alarm and the red light must flash until the ‘E-STOP’ is released.
5. All stopped conveyors within that E-Stop zone must show RED on the system status displays (Graphics). The Graphics also indicates the approximate location of the affected control station.
6. An alarm message with the name of affected control station and E-Stop zone must appear on the fault displays in RED.
7. All fire/security doors in normal operation in the affected zone must be disabled until reset.
8. Life safety functionality must not be compromised.

B. Emergency Stop (E-Stop) Reset

The following sequence must be required to reset the E-Stop:

1. Pull out the ‘E-STOP’ push button.
2. The ‘E-STOP’ push button must illuminate solid.
3. All other ‘E-STOP’ push buttons within the same zone must extinguish.
4. All conveyors within the E-Stop zone must display Red on the graphic display.
5. Press the SPB and the following must occur:
 - a. The associated emergency stop latch must be reset.
 - b. Start alarm and beacon(s) on the associated conveyor lines must sound and illuminate for no less than eight seconds.
 - c. Conveyors in the zone must cascade start.
 - d. The system status displays must update and show the affected E-Stop zone has been reset and is operating under normal conditions.
 - e. The alarm message must be cleared from the fault displays.

C. Fault Detections

1. General

- a. The conveyor(s) with the fault must stop and the upstream conveyors will cascade stop.

- b. A fault indicator beacon light and audible alarm that are nearest to the fault location must indicate the fault.
 - c. The affected conveyor(s) must be displayed on the system status displays and an alarm message with the name of the fault must be shown on the fault displays.
 - d. The status indication must remain active until the fault has been resolved.
2. Bag Jam
- a. All photoeyes except over-height photoeyes must have jam functionality.
 - b. A bag jam is detected when a bag blocks the photoeye for an interval of time exceeding the set point of the associated jam timer equal to the amount of time, based on belt speed, that it takes three bags to accumulate.
 - c. The conveyor with the jam photoeye and the adjacent downstream conveyor must stop.
 - d. A control station, a fault indicator beacon light, and audible alarm that are nearest to the jam photoeye must indicate the jam and SPB to reset the jam.
 - e. The jam indicator light illuminates when the jam photoeye is blocked. It flashes when the jam photoeye is cleared yet the jam condition is not reset.
 - f. The photoeye and the associated conveyor must be indicated on the system status displays.
 - g. Once the jam has been cleared, actuation of the associated SPB must clear the jam indication and restart the stopped conveyors.
 - h. A single jam indicator beacon light and audible alarm must be utilized where there are multiple jam photoeye locations within a 25 foot diameter.
 - i. Jam detection circuitry must only function when the respective conveyor is running. If a conveyor stops running and as a result, a bag blocks a jam photoeye; no false jam indication must be generated. No more than three bags, real or virtual, must be involved in any given jam event.
 - j. The bag jam event rate must not exceed 1.0% in a 24-hour period.
3. Missing Bag Jam
- a. Missing bag jam is detected when three bags in succession are detected as missing from the same tracking photoeye.
 - b. The conveyor on which the missing bag photoeye is located and the next upstream conveyor must stop.
 - c. A control station, a fault indicator beacon light, and audible alarm that are nearest to the missing bag jam photoeye must indicate the missing bag jam and SPB to reset the missing bag jam.
 - d. The jam indicator light flashes until the missing bag jam is reset.
 - e. Once the missing bag jam has been resolved, actuation of the associated SPB must clear the jam indication and the start-up procedure begins followed by restarting the conveyor.
 - f. A single jam indicator beacon light and audible alarm must be utilized where there are multiple missing bag jam photoeye locations within a 25 foot diameter.
4. Motor Overload Trip/VFD Fault
- a. Once the fault is resolved, depressing any SPB along the associated subsystem must reset the fault. This action also initiates the start-up alarm sequence and then the affected conveyor restarts.
5. Position Failures
- a. Position failures must be generated when BHS equipment fails to change position. Such equipment includes (but not limited to) doors, VSU, HSU, VMU and VLU.

- b. The equipment that has a dedicated control panel assembly must follow the OEM reset procedure.
 - c. Once the fault is resolved, depressing a SPB of the associated sub-system must reset the fault. This action also initiates the start-up alarm sequence and then the affected conveyor restarts.
6. Shaft Encoder Fault
- a. Shaft encoder fault must be generated when one of the following events occur:
 - 1) The total encoder counts/steps for a specific period of time are not within the anticipated encoder counts while the associated conveyor is running.
 - 2) No feedback from the encoder while the associated conveyor is running.
 - b. The encoder fault resets by itself when the above events are resolved.
 - c. Shaft encoder fault does not stop the conveyor. The conveyors must continue to run.
7. Communication Fault
- a. Communication Faults include (but not limited to) communication module faults and network failures in the field.
 - b. Fault display must indicate specific equipment and location associated with the failure.
8. Fail-safe Detection
- a. Fail-safe functionality must be programmed at all Level 1 and Level 2 decision points to prevent non-cleared bags from being diverted to a clear line.
 - b. In the event that a non-clear bag is diverted to a clear line it is considered a fail-safe condition.
 - c. If HSU is used at Level 1 or Level 2 decision points, a fail-safe is activated when there is a “missing bag” on the first conveyor of the non-clear line after the divert point.
 - d. Any bag that has increased in length by 12 inches or more at the decision photoeye upstream of the diverter must be conveyed to the CBRA with a status of “Length Change”. The change in length measured at the photoeye prior to the divert point must be checked against the baseline length measured at the light curtain upstream of the EDS.
 - e. When a fail-safe occurs, two clear line conveyors downstream of the divert point must stop immediately, and an alarm must sound notifying the TSA of a security fault.
 - f. The misdirected bag must stop at the head-end photoeye on the clear conveyor. The audible alarm and indication remain until this photoeye is cleared.
 - g. When a fail-safe occurs, the pre-EDS sorter for that individual SS line will stop feeding bags to that line. Bags already on that line will be directed to the OSR line. A clear bag sent to the OSR line will be directed to the clear line at the Level 2 decision point.
 - h. The fail-safe function must be activated by less than 0.5% of the total daily bag volume, measured by the number of individual bags tripping the fail-safe.

D. Baggage Tracking

- 1. All bag tracking must utilize PLC logic.
- 2. PLCs must use photoeyes to detect bag presence, and shaft encoders to monitor belt travel.
- 3. There are two system tracking zones: the BHS matrix and the make-up sortation.
 - a. BHS matrix bag tracking must begin at the photoeye prior to the ATR or BMA, and continue through the BHS matrix until the bag has been diverted to a clear line.
 - b. Make-up sortation tracking, if required, must begin at the clear line ATR and end at the sort destination.
- 4. Bag tracking statistics must be maintained for each tracking photoeye.

5. Tracking Faults

a. Lost-In-Track (Missing Bag)

- 1) A bag becomes 'Lost-In-Track' if it fails to appear at the next scheduled photoeye within its time window and number of pulses from the shaft encoder.
- 2) This condition is also marked as a 'missing bag'.

b. Unknown Bag

- 1) If a bag appears at a photoeye unexpectedly, the bag is identified as an 'Unknown Bag'.

c. Change in Length

- 1) 'Change in Length' is when a bag's length has changed by 12" or more between two adjacent tracking photoeyes on straight conveyors.
- 2) Bags identified as 'Change in Length' must be treated as an 'Unknown' bag.
- 3) 'Change in Length' measurements must be excluded from tracked merges and HSU diverts.

E. Merge Control

1. The merge control must be programmed to establish dynamic merge windows with the consideration of the bag length and throughput requirements.
2. Low Volume Merging
 - a. Low volume merging occurs when each ticket counter conveyor and associated merge can freely merge onto the mainline/transport conveyor with limited or no metering of the bags, provided bags are not inducted onto the mainline/transport conveyor closer than the specified window, but may merge at various time intervals.
 - b. Merge conveyors must not stop a bag to create a merge window when the mainline conveyor is clear. Similarly, the mainline conveyor must not stop a bag for a merge window when no bag is coming from the merging line.
3. High Volume Merging
 - a. High volume merging onto the mainline/transport conveyor occurs when the queues of the merging line start to back up and before the standard transport conveyors shut down.
 - b. The induction of bags onto the mainline/transport conveyor must be metered to release a bag from the furthest upstream merge and only on the specified time intervals creating one and two bag merge windows for the downstream merges.
 - c. Each merge must be monitored based on the number of queue conveyors available. The merging line with the most bags must have priority over the other merging lines. This process must continue until all merge lines are free to merge without dieback.
4. Only one bag must be staged on a merge conveyor at a time. Merge conveyors may receive a bag while releasing a bag at the same time, provided the merge conveyor retains the integrity of staging only one bag at a time.
5. Maintain positive belt tracking through the merge.
 - a. Merge conveyor belt speeds must be equal to or greater than the mainline take-away conveyor.
 - b. Merge logic must consist of a minimum of three photoeyes:
 - 1) One head end photoeye located on the merge for properly staging the bag without obstructing or interfering with the bags traveling on the mainline transport conveyor.

- 2) One photoeye located upstream of the merge on the mainline take-away conveyor (distance upstream must be belt speed dependent) for setting the merge window on the mainline take-away conveyor.
- 3) One photoeye located a maximum of 1'-0" downstream of the merge for jam detection.

F. Control Stations

1. EMERGENCY STOP (E-STOP) Push-Pull Button

- a. Activation of this button must remove power from the PLC outputs that control the associated motor starters and all associated components, which will in turn stop all component motion for its control zone area. E-Stop interlock must not drop power to the photoeyes/encoders. The E-Stop auxiliary interface contact must isolate controls power for input and outputs.
- b. Operates as described in the Section 4.02.

2. START/RESET Push Button (SPB)

- a. Ticket Counter Control Stations SPB
 - 1) The button must be illuminated when the permissive/interlock is 'Enabled'.
 - 2) The button must be extinguished when the permissive/interlock is 'Disabled'.
- b. Operates as described in the Section 4.02.

3. STOP Push Button

- a. Operates as described in the Section 4.01G.

4. Jam Indicator

- a. Baggage Jam
 - 1) The light must illuminate steady when a jam is detected at the associated photoeye.
 - 2) It starts flashing when the photoeye has been cleared.
 - 3) The light extinguishes when the SPB is depressed.
- b. Missing Bag Jam
 - 1) The light must flash until the SPB is pressed.

5. ADVANCE Push Button

- a. The button advances the conveyor at the manual encoding station to the merge conveyor to the mainline.
- b. Bag tag information is transferred so that tracking can be maintained.

6. JOG Push Button

- a. The JOG push button must only be active when the AUTO/MAINTENANCE selector switch is in the 'MANUAL' position. The device must run as long as the JOG push button is pressed, but once the JOG push button is released, the operator must wait five seconds before pressing it again to allow the soft start to properly control the operation of the device.
- b. Use of the JOG push button to run the device must bypass the start alarm and start delay timers.

7. Door OPEN/CLOSE Push Buttons (OPB or CLB)

- a. Operation of the button is enabled when the AUTO/MAINTENANCE switch on the same control station is 'MAINTENANCE' position.

- b. Activation of the OPB must open the door.
 - c. Activation of the CLB must close the door.
8. ENABLE/DISABLE Switch
- a. In the left position, it enables all SPBs associated with the make-up unit or the load conveyors.
9. AUTO/MAINTENANCE Switch
- a. In the left position, it enables the maintenance push button station associated with the make-up unit/baggage claim device.
10. HAND/OFF/AUTO (HOA) Selector Switch
- a. Motors must be equipped with an integral or separate HOA switch.
 - b. The stations must be located such as to be able to overlook the elements which are to be controlled by the HOA station.
 - 1) The HAND (H) position must bypass the control circuit and run the conveyor regardless of jam conditions or surrounding conveyor status. Do not bypass E-stop.
 - 2) The OFF (O) position must stop the conveyor.
 - 3) The AUTO (A) position must run the conveyor under normal PLC control, and must initiate the normal start up alarm sequence followed by the restarting of the conveyor if the downstream conveyors are running.

G. Stack/Warning Light

1. Type SL-1
- a. This is used to indicate security status of the bag.
 - b. The stack lights are triggered when a bag blocks the head end photoeye of the first exit queue conveyor.
 - c. Green indicates a clear decision from the machine for the bag.
 - d. Red indicates an alarm decision from the machine for the bag.
 - e. Clear/ White indicates any other status such as an “Error” or “Lost-In-Track”.
 - f. The lights extinguish after the bag is no longer blocking the exit conveyor photoeye.
2. Type SL-2
- a. This is used to indicate the system start-up and the system faults.
 - b. Functionalities of visual and audible alarm must be as follows:

Event Type	Light		Audible Alarm (long tone: 3 sec, short tone: 1 sec, break: 1 sec)	Priority
	Red	Amber		
E-Stop	x		3 long tones - 3 short tones - 3 long tones (repeat 3 times)	1
Start-up	x		Half second on and off (for 8 seconds)	2
Jam/ Missing Bag Jam		x	1 long tone – break (repeat 3 times)	3
Other Faults		x	3 long tones – break (repeat 3 times)	4
Communication		x	2 short tones – break (repeat 3 times)	5

Event Type	Light		Audible Alarm (long tone: 3 sec, short tone: 1 sec, break: 1 sec)	Priority
	Red	Amber		
Faults				

Table 13: Type SL-2 Functions

- c. Follow the priority in the table if multiple events occur simultaneously.
 - d. The light indicator for faults must remain on until the fault is resolved.
3. Type SL-3
 - a. This is used to indicate fail-safe alarm.
 - b. The stack light and the audible alarm are triggered when a bag blocks the tail end photoeye of the first exit conveyor on the clear line.
 - c. The audible alarm is deactivated after a predetermined amount of time.
 - d. The light extinguishes when the fail-safe condition is cleared.
 4. Type SL-4
 - a. This is used to indicate the system start-up of the specified sub-system(s) in public area.
 5. Type SL-5
 - a. This is used to indicate the system start-up and the system faults of the sub-systems associated with the MCP.

H. Sortation

1. The system must sort the baggage by flights or carriers to the designated make-up device or sort pier based on the characters utilized in the 10-digit IATA bag tag.
2. The sortation must be PLC base sortation with ATR directly communicating with PLC. Sort Allocation Controller (SAC) must not manage bag IDs.
3. No-read bags and bags missing diverts to their respective make-up device must be routed to a default destination or a manual encode station specified on the plans.
4. The system must be able to utilize fall back sortation (IATA fall back or pier tag fall back) in case of SAC failure

4.03 EQUIPMENT CONTROL DESCRIPTIONS

A. Fire/Security Doors

The controls for the two types of doors are functionally the same, with the exception of how the door behaves during a fire emergency.

1. Normal Operation

a. Door Opening

- 1) Fire security doors and conveyor start interlocked to a permissive card swipe. Only authorized personnel can start specified load belts. A dry contact or 24v signal will be provided by the General Contractor to provide a valid swipe signal. When a valid swipe signal is received, the CS must be activated for a period of no more than 10 seconds.
- 2) Once a system is commanded to start, the conveyors must begin the startup sequence, sounding the warning alarm, and the door must begin to open. After the door is in the fully open position, the conveyor system must cascade start.

- 3) The conveyor must be prohibited from running until the door is detected to be fully open.
 - 4) If the door does not fully open, a 'Door Failed to Open' fault must be generated and the system must not start.
 - 5) The door is fully open when the associated 'Door Open' photoeye or limit switch is engaged.
 - 6) Once the 'Door Open' photoeye or proximity switch becomes active, the open command must be deactivated.
 - 7) Once the door opens properly, the conveyor system must run normally.
- b. Door Closing
- 1) Once the conveyors have stopped, the door must close, provided that the 'Door Clear' photoeye is clear. If the 'Door Clear' photoeye is blocked, the conveyors must continue to run.
 - 2) The door must not be commanded to close until the 'Door Clear' photoeye has been cleared and the conveyor has stopped.
 - 3) If the door is commanded to close and the 'Door Open' photoeye remains on for more than five seconds, or the 'Door Closed' photoeye is not activated within 45 seconds, a 'Door Failed to Close' fault must be generated and a local alarm must be generated.
 - 4) If at any time during normal operation the 'Door Open' photoeye disengages, the system must be stopped and a 'Door Failed to Open' fault must be generated.
 - 5) Door position must be indicated on the BHS Control Room HMI graphics.
 - 6) Fire security doors must be specified with coiling self-closure upon loss of normal building power. Provide power to the door from the conveyor control panel. Upon loss of building power, the doors must close.
- c. Fire Input Signal
- 1) Upon receipt of an input from the fire safety system, the BHS PLC must perform the following steps:
 - a) Run the conveyor until the door clear photoeye is unblocked.
 - b) If the 'Door Clear' photoeye does not become clear after five seconds, then stop the conveyor(s) and close the door regardless of the photoeye status.
 - c) Close the door once the conveyor has stopped.
 - d) If the door disconnect is in the 'OFF' position, the PLC must not command it to close. Once the disconnect is returned to the 'ON' position, the door must be in a 'Door Failed to Close' fault.
 - e) Once the door is closed, or after 30 seconds if the door is not sensed closed, the PLC must shut down all the conveyors under the control of the associated MCP.
 - f) The fire alarm fault must be reset when the fire alarm input is deactivated. The system security input must be enabled and only the SPB at the associated load conveyor can be used to activate the start procedure.
- B. System Queue Conveyors
1. Use of a head-end photoeye must allow only one bag to be staged on a queue conveyor at a time. Queue conveyors must be able to receive a bag while releasing a bag at the same time, provided the queue conveyor retains the integrity of staging only one bag on it at a time.
- C. Merge Conveyors
1. Merge conveyors must be used to stage bags and control the induction of a bag onto a mainline/transport conveyor.

D. EDS Line Conveyors

1. Matrix bag distribution
 - a. See Section 1.17G.1
2. Pre EDS Queues
 - a. The EDS delivery queue, two gapping queues and two positioning queues comprise the delivery system to the EDS. The following listing is in order upstream of the EDS:
 - 1) The first queue (EDS delivery) must run at a speed equal to the EDS entrance tunnel conveyor and must not be used for gapping.
 - 2) The second and third queues (gapping queues) must run at variable speeds as called for in the design drawings.
 - 3) The fourth queue (positioning queue) must be the OTK input location and be supplied with a static deflector and low coefficient belting.
 - 4) The fifth queue (positioning queue) must be supplied with a static deflector and low coefficient belting for the positioning of bags.
 - b. Light curtain assemblies must be used on the second queue to detect the leading and trailing edges of the bags. The light curtain assemblies must be used to achieve the 12" spacing between bags.

E. CBRA Conveyors

1. Functionalities of CBRA conveyors must comply with PGDS.

F. Vertical Sortation Unit (VSU)

1. Each vertical sorter must track the bag through the sorter and confirm that each bag has been sorted to the correct take-away conveyor. A confirmation signal must be sent to the BDR.
2. The vertical sorter must remain in the last state until a divert signal has been received by the control system.
3. The vertical sorter must be equipped with sensors to detect both sort positions, and photoeyes at both discharge positions.
4. A mis-sort must be detected if any of the following events occur:
 - a. The 'Divert Confirm' photoeye located at the discharge end of the diverter is not activated with the proper sort destination, or the 'Divert Confirm' photoeye is not activated within the correct tracking window.
 - b. A jam or position failure must be detected when the conveyors are not in the proper position within the appropriate cycle time.
5. In the event of a baggage jam or mis-sort at the vertical sorter, the first conveyor downstream of each take-away conveyor must stop immediately while remaining upstream conveyors go into cascade mode.

G. Horizontal Sortation Unit (HSU)

1. The conveyor controls for the conveyors associated with each HSU location must be programmed to track the bag through the divert and confirm that each bag has been diverted to the correct take-away conveyor.
2. The divert decision must be made with both a divert photoeye (to confirm the physical location of the bag) and tracking information (to confirm where the bag is to be sorted).
3. The HSU must remain in the last state until a divert signal has been received by the control system.

4. The HSU must be equipped with sensors to detect both the home position and sort position. There must be photoeyes located on the conveyors at both discharge positions beyond the HSU.
5. A mis-sort must be detected when the 'Divert Confirm' photoeye located at the discharge end of the diverter is not activated with the proper sort destination, or the 'Divert Confirm' photoeye is not activated within the correct tracking window.
6. A jam or position failure must be detected when the conveyors are not in the proper position within the appropriate cycle time.
7. In the event of a baggage jam or mis-sort, the conveyor immediately downstream of each HSU take-away conveyor must stop, while the remaining upstream conveyors go into cascade mode.
8. The HSU must be adjusted to maintain bag orientation through the divert.
9. The take-away belt for HSU must have a photoeye installed six inches from the tail end of the conveyor for jam detection and divert confirmation.

H. Make-Up Units and Baggage Claims

1. Under normal operations, the device must run as long as any of the lines feeding it are running. Once all the feed lines have stopped, the device must continue to run for 20 minutes (adjustable) to allow baggage handlers/passengers to remove the baggage.
2. At make-up units if the period of time is not long enough to remove all of the baggage, the baggage handlers will be able to press one of the SPBs and restart the unit. The make-up unit must then run an additional 20 minutes (adjustable).
3. Pressing the SPB will cause the combination alarm and beacon to sound and start the device. No other conveyors must start.
4. The maintenance control station is to allow maintenance personnel to 'JOG' the device while they are making repairs.
5. Switching the selector switch from either 'AUTO' to 'MANUAL' or 'MANUAL' to 'AUTO' must cause the device to stop until the start pushbutton is pressed.

4.04 OPERATOR INTERFACE DESCRIPTIONS

A. Maintenance Diagnostic System (MDS)

1. MDS must serve as the gateway to present the BHS system graphically and allow an operator to monitor system status, alarm messages, and critical event occurrence.
2. MDS must be capable of generating Key Performance Indicator (KPI) dashboards to represent real time and historical data.

B. System Status and Fault Display

1. The System Status and Fault Display must display a graphical representation of the entire baggage handling system color coding the status of each component, i.e., Stopped, Running, Faulted, Overload, etc.
2. Status and Fault Messages must be shown when the fault occurred, when a startup has occurred, and when a fault has been reset.

C. Graphical Representation Color Codes

1. The graphical representation of each event must be color coded according to the following standards and they consist of three categories:
 - a. Category 1

- 1) The base color must be selected from aqua, blue, red, or yellow. Flashing color, if used any, must be selected from black, gray, or white.
 - 2) This category presents faults and failures that require further actions for resolution.
- b. Category 2
- 1) The base color must be selected from brown or orange. Flashing color, if used any, must be selected from black, gray, or white.
 - 2) This category presents manual intervene, faults, and warnings that may or may not require further actions for resolution.
- c. Category 3
- 1) The base color must be selected from black, green, magenta, or white. Flashing color, if used any, must be selected from black, gray, or white.
 - 2) This category presents equipment status.

Color			Condition
Description	Base	Flash	
Category 1			
Red		n/a	Equipment E-stop
Flashing Red/White			Equipment E-stop not Reset (Reset Request)
Flashing Red/Gray			Fire Alarm
Aqua		n/a	VFD Fault
Flashing Aqua/White			ATR/BMA Fault (faults not listed in other colors)
Flashing Aqua/Gray			EDS Fault (faults not listed in other colors)
Blue			Motor Overload/Start Fault
Flashing Blue/White			Fail-safe
Yellow		n/a	Equipment Jam
Flashing Yellow/White			Missing Bag Jam
Category 2			
Brown		n/a	Disconnect-Off, Equipment Maintenance Mode
Flashing Brown/White			Communication/Network Fault
Flashing Brown/Gray			UPS Fault (EDS UPS and BHS UPS)
Flashing Brown /Black			Equipment Over Temperature
Orange		n/a	Encoder Failure
Flashing Orange/White			EDS not in Normal Mode (including Bypass, OTK, Calibration, and Stand-by)
Category 3			

Color			Condition
Description	Base	Flash	
Green		n/a	Equipment Running
Flashing Green/White			Equipment Running Reverse
Flashing Green/Gray			Equipment Forced On (including divert-up and divert-all)
White		n/a	Equipment/Sub-system Full
Magenta			Equipment Cascade Stopped
Black		n/a	Equipment/Sub-system Time Out
Flashing Black/Gray			Equipment Forced Off (including divert-down and pass-all)

Table 14: Graphic Color Codes

2. The color of graphical representations must match to the standard RGB codes.

D. User Interface Stations and Human Machine Interface (HMIs)

1. HMI-1 (OTK)-Each EDS line must have an OTK HMI which display the Main Menu, allowing the operator to select one of the following screens:

a. “Auto-Test-Bypass” Mode Screen. This screen must allow the operator to place the EDS line in Auto, Test, or Bypass modes for EDS setup and inspection.

1) Auto Mode must place the EDS line in the normal operations mode.

2) Test Mode must place the EDS line in test operations mode and have the following features.

a) Inhibit bags from diverting onto the respective EDS line and stop baggage prior to the OTK Insertion point queue.

b) Allow the Image Quality Test (OTK) article to be placed safely and properly onto the OTK Test Insertion point queue.

c) Restart the EDS entrance conveyors and feed the OTK article into the EDS.

d) Stop the OTK article on the queue conveyor immediately after the EDS.

e) Allow repeat OTK as necessary.

3) Bypass Mode must place the EDS machine to be used without x-ray. Bags must go through the EDS machine without inspection. Refer to the EDS OEM manual and IRD for further requirements.

b. “EDS/BHS Communications Status” Screen. This menu displays the BHS tracking number transmitted to the EDS machine and updates with each new number transmitted.

c. “Baggage Status” Screen. This menu displays the bag ID number shared by the EDS and the BHS, plus the status assigned by the EDS or the BHS at the time the bag exits the machine, Level 1 Decision (Cleared, Alarmed or Decision Pending).

d. “BHS Status” Screen. This screen is a graphical representation of the BHS status of the conveying system from Area 2 Zone 3 - Zone 5 of related EDS line.

2. HMI-2 CBRA Bag Status Display (BSD) -Each BSD HMI must be installed per the location defined by PGDS. BSD HMIs must include all functions and format required by PGDS.

Coordinate communications of the transmittal of baggage ID information and the associated wiring with EDS OEM.

E. Sort Allocation Controller (SAC)

1. Sortation must be a carrier based sortation.
2. SAC must provide a sort allocation table for an operator to be able to modify sort destinations per carrier.

4.05 SYSTEM REPORTS

A. General

1. The BHS control system must be provided with standard reporting functions.
2. Refer to PGDS for TSA required format and contents.
3. All reports must show SSI markings when including data on EDS and OSR Alarm Rates, and bags tracked to CBRA.
4. Reporting must meet the following criteria:
 - a. Availability to generate report from the operator work station(s) during operational hours. Report process time must not affect operation.
 - b. Specified level of accessibilities/permissions
 - c. Storage capacity to be able to archive data for a minimum of a year
 - d. The results that can be exported to a different file format such as CSV, PDF, or/and EXCEL
 - e. Dashboard features per Key Performance Indicators (KPI)

B. Reporting Frequency

The system must be capable of recording the data in the following time frames. All reports must be in a format that can be searched, retrieved, and printed in the following time frames:

1. Real Time (+/- 60 seconds)
2. Hourly
3. Daily
4. Weekly
5. Monthly
6. Quarterly
7. Annually
8. Manually Entered Time Dates

C. Reporting Category

The system reports are categorized in three main areas:

1. Operation

The operational reports are featured to show the system performance such as equipment usage, equipment faults and events, system throughputs, tracking performance, and sortation. The reports are used to support daily operational activities. The system must generate the following operational reports with the detailed fields listed in each report.

a. Equipment Operational Summary

This report must show statistics of normal operation, events, faults, and malfunctions. Each category must be able to view per device. The report must be capable of showing at least the following information:

- 1) Time period (starting date/time and ending date/time)
 - 2) Equipment name
 - 3) Number of cycles
 - 4) Number of bags diverted/merged (to each direction)
 - 5) Number of faults (to be shown per fault)
 - 6) Tracking photoeye name
 - 7) Number of tracking malfunctions (to be shown per event such as missing bags, unknown bags, missing bag jams, etc.)
 - 8) Jam photoeye name
 - 9) Number of jams
- b. ATR Statistics
- This report must provide statistics related to ATR performance. The data must be shown per ATR. The report must include the following fields:
- 1) Time period (starting date/time and ending date/time)
 - 2) ATR name
 - 3) ATR Description (e.g., Tracking or Sortation)
 - 4) Number of bags seen by the ATR
 - 5) Number of bags read by the ATR
 - 6) Number of no-read
 - 7) Read rate
 - 8) Number of valid tags
 - 9) Number of conflict tags
 - 10) Number of tags without BSM information (if applicable)
 - 11) Total number of IATA tags that are read at ATR and passed to the EDS
 - 12) Total number of IATA tags that are sent to the EDS and reconciled at the EDS exit
- c. BMA Statistics
- This report must display statistics related to BMA performance including, but not limited to the following items:
- 1) Time period (starting date/time and ending date/time)
 - 2) BMA name
 - 3) Number of bags seen by the BMA
 - 4) Number of OOG bags
 - 5) Number of in-gauge bags
 - 6) Number of bags without BMA result
- d. Throughput
- This report must contain the overall system throughput and throughput for selected sub-systems such as input conveyors, SSM lines, SS lines, OSR lines, sortation lines, manual encode line, and CBRA. The system must be able to report throughput in user-selected time intervals.
- 1) Time interval (starting date/time and ending date/time)
 - 2) Name of the selected sub-system
 - 3) Throughput
- e. System Baggage Volumes
- The system must be capable of reporting the following System Baggage Volumes.
- 1) By Input Conveyors
 - 2) By Make-up Devices
 - 3) By Screening Areas

- 4) EDS
- 5) CBRA
- 6) CBRA Screening Stations

f. Day End Report (Executive Summary Report)

This report must provide the overall system performance. The information includes, but is not limited to the following:

- 1) Time period (starting date/time and ending date/time)
- 2) Input volume measured at input conveyor locations
- 3) Output volume measured at sort destinations
- 4) ATR statistics
- 5) EDS statistics
- 6) Tracking performance

g. Bag Trace (Bag Data) Report

This report is mainly used to trace a bag with its associated tracking ID during a specific time period. This report must include time stamps, critical events, and associated locations at where a bag traveled through the system. The following presents common fields for this report. The report is searchable per each field.

- 1) Time period (starting date/time and ending date/time)
- 2) Tracking ID (IATA or/and BHS tracking ID)
- 3) Time stamped at CBIS ATR/RFID
- 4) Name of the CBIS ATR/RFID
- 5) Time stamped at BMA
- 6) Name of BMA
- 7) Bag type
- 8) Name of EDS that a bag was screened
- 9) Time stamped when entering into the EDS
- 10) Time stamp when an OOG bag is diverted to OOG line
- 11) Level 1 screening status
- 12) Time stamped at level 1 screening decision
- 13) Level 2 screening status
- 14) Time stamped at level 2 screening decision
- 15) Time stamped when diverted to CBRA
- 16) Time stamped when diverted to a clear line
- 17) Time stamped at sortation ATR/RFID
- 18) Name of the sortation ATR/RFID
- 19) Time stamped when diverted to makeup unit, or received at run-out
- 20) Time stamped at last known tracked conveyor
- 21) Time stamped when an unknown bag is found
- 22) Location where the unknown bag is detected
- 23) Time stamped when a bag is detected as missing
- 24) Location where the missing bag is detected

h. Carrier Summary

This report must generate summaries of bags processed per carrier. The following data must be available on the report.

- 1) Time period (starting date/time and ending date/time)
- 2) Carrier Code
- 3) Name of the assigned destination

- 4) Number of total bags sorted to that carrier
- i. Sortation Issue Report

This report must show a list of bags that were not able to sort.

 - 1) Time period (starting date/time and ending date/time)
 - 2) Bags with sort destination issues
 - a) Bag tag number
 - b) Name of the event and the device caused the problem
 - c) Time stamp of the event caused the problem
 - d) Time stamped when the bag arrived at the run-out
 - e) Reasons of the sort failure
2. Maintenance

The maintenance reports assist maintenance activities and also used to identify equipment malfunctions. Malfunctions include both faults and events. A fault is defined as a “cause” (jams and motor overload). An event is defined as the “effect” of a fault (Fail-Safe) or the “effect” of human interaction in the system (E-Stop and disconnect off).

 - a. Equipment Malfunction and Correction

This report must show all equipment malfunctions that occurred and were cleared during a selected interval.

 - 1) Time period (starting date/time and ending date/time)
 - 2) Name of the device
 - 3) Description of the malfunction
 - 4) Time stamped when the malfunction occurred
 - 5) Time stamped when the malfunction was cleared
 - 6) Duration of the malfunction
 - b. Equipment Malfunction Summary

This report must generate summaries of the equipment malfunctions and corrections. It must contain at least the following items:

 - 1) Time period (starting date/time and ending date/time)
 - 2) Name of the device with malfunction
 - 3) Total number of occurrences for each malfunction
 - 4) Sum of all malfunction time
3. TSA
 - a. The TSA reports contain the information about baggage screening and the local TSA must have access to these reports.

PART 5 ACCEPTANCE TESTING AND TRAINING

5.01 TESTING

A. General

1. Prior to the BHS being approved and used for operations, the following must be completed, if applicable:
 - a. Factory Acceptance Test (FAT) - conducted by BHSC
 - b. BHSC Static, Dynamic, Functional and Load Testing

- c. Owner Static, Dynamic and Functional Testing
 - d. BHSC Pre-Integrated Site Acceptance Test (P-ISAT) to be conducted per SSTP. BHSC will submit documentation and results of each test, and inform VTC and Owner in writing as to the readiness for Owner P-ISAT testing.
 - e. Owner P-ISAT
 - f. Test Readiness Review (TRR) - conducted by BHSC, witnessed by TSA and Owners representative.
 - g. Integrated Site Acceptance Test (ISAT) - conducted by TSA with assistance from BHSC
 - h. Sortation Test
2. Test Equipment
- a. BHSC must provide all test bags and testing material in bags (i.e. clothing, packing material and material that will cause EDS to alarm).
 - b. All test bags must be clearly marked as test baggage.
 - c. Provide four hundred test bags (for systems less than four EDSs), or one hundred test bags per EDS (for systems exceeding four EDSs).
 - d. The test bags must be used for all baggage testing other than ISAT.
 - e. Alarm bags must have approved alarming material placed inside the bag, with three-inch metal numbers placed inside the bag to correspond with a permanent marked number on the outside of the bag, and easily identifiable as alarmed baggage (i.e. red in color).
 - f. Test bag set must consist of “stream of commerce” representative checked bags (see PGDS Appendix D for bag weight & dimensions). The bag set must comprise the variety of types (including but not limited to: totes, carry-on sized bags, soft sided bags, golf bags, hard sided bags, garment bags, duffel bags, military-style duffel bags, gun cases, coolers, etc.) of baggage expected to be checked. The clear or alarm bags will not contain more than 30% of a similar type bag.
 - g. Test bag set must consist of materials, condition, and sizes seen during typical BHS operations, including bags with straps, wheels, handles, tags, etc. An idealized bag set – for example, without handles or straps, or reinforced corners – will not be considered or accepted as valid.
 - h. Low profile tubs must also be used during testing as appropriate for bags that would be placed in tubs as outlined in the Owner’s tubbing policy.
 - i. The required test equipment must include, but not be limited to: clamp on type ammeter, direct FPM digital readout tachometer, radios, etc.
 - j. Provide any necessary test or measuring equipment required to demonstrate the characteristics and performance of the equipment prior to acceptance.
 - k. All the material and personnel required for load tests must be provided by the BHSC. The BHSC must have a representative on site during all periods of the system(s) conditional inspection, as well as final acceptance inspection and testing sessions.
3. Test Personnel
- a. Provide all labor and trades required to inspect both the mechanical and electrical systems of the BHS to the Owner, VTC, and Code Compliance inspector.
 - b. Provide all required personnel to support BHS testing (Owner, TRR and ISAT). The personnel include but not limited to:
 - 1) BHSC Controls Engineer
 - 2) Millwright
 - 3) Electrician
 - 4) Baggage Porters
 - 5) Jam Runners

- c. Provide qualified personnel on-site during the acceptance inspection and testing period(s) to service or adjust, as required, the BHS equipment as well as to open control boxes, control station covers, drive assembly chain/v-belt guards, covers, etc.
 - d. The BHSC must provide all necessary testing, measuring, and recording devices required to demonstrate the operational characteristics and performance of the equipment to the satisfaction of Owner.
4. Test Documentation
- a. All passed or failed tests must be documented. The documentation must include but not be limited to: BHS Reports, EDS reports, ATR reports and all handwritten forms from both OSR and CBRA workstations. Documentation from OSR and CBRA must be recorded on the forms provided within the BHS SSTP.
 - b. BHSC testing documentation must be submitted to Owner for review at least 72 hours prior to commencement of Owner's testing.
 - c. BHSC must respond to the QLR and TSR discrepancies with corrections and back up documentation.
5. Test Failure
- a. Failure during any test period will be defined as any design characteristic or malfunction of BHSC furnished equipment, or materials that damage baggage or degrade any operating rate to below specified levels.
 - b. Conditions resulting from improper loading of product or loading product of sizes not included in specifications requirements will be considered test failures.
 - c. At the discretion of the Owner, a test failure may result in a 24-hour suspension of further testing until documentation of corrections made to the system and a passed test has been presented to the Owner.
 - d. The BHSC must prove consistency and repeatability in passing all tests. If BHSC fails a single test more than twice, that test will not be accepted until BHSC passes that test two consecutive times.

B. FAT

1. The BHSC must demonstrate through emulation/simulation/analysis at the FAT that the system, as engineered by the BHSC, meets the minimum design and performance criteria identified in this specification.
2. The BHSC must invite the Owner and VTC to their facility for a demonstration and review of the BHSC's developed controls systems software, sortation and maintenance diagnostics computer software/hardware and operator interfaces, including but not limited to EDS interfaces and facility interfaces with other airport systems and devices (e.g., Fire Alarm and Airport Security Systems). The BHSC must conduct sortation demonstrations validating the system can effectively sort baggage as required by the specifications.
3. The BHSC must submit a detailed FAT agenda to the Owner and VTC for review and approval. The FAT must take place prior to the on-site installation of the BHS computer software and associated hardware.
4. All items identified during the FAT as being deficient must be rectified prior to installation on-site. The BHSC is solely responsible for any additional monies incurred regarding completion of this task and will not be granted any schedule variances.

C. BHSC Testing

1. General

- a. Perform system testing in accordance with the BHSC's Owner-approved test plan. The test plan must be submitted to the Owner and VTC for review and approval at least 45 days prior to the operation start-up date for the BHS(s). Testing must include static and dynamic electric, static and dynamic mechanical, functional testing and load test.
2. Static
 - a. Static testing must include, but not be limited to:
 - 1) Bolt torque verification
 - 2) Conveyor installation
 - 3) Belt tension
 - 4) Material and equipment verification
 - 5) Electrical wiring and cabling installation
 - 6) Control panel and control station installation
 - 7) Network validation and certification
 - b. BHSC must perform static testing and reconcile any noted deficiencies or discrepancies prior to start of dynamic testing.
 - c. Network Validation and Certification
 - 1) BHSC is responsible for having a network specialist to validate and certify the installed network prior to testing/commissioning.
 - 2) Any network cable that does not meet testing criteria must be re-terminated or re-pulled until passing test is achieved.
 - 3) The network specialist must supply certification sheets which include, at a minimum:
 - a) Copper Cables
 - (1) Cable ID
 - (2) Test Summary
 - (3) Headroom (proper bend radius for the cable)
 - (4) Wire Map
 - (5) Length (ft)
 - (6) Propagation Delay (ns)
 - (7) Delay Skew (ns)
 - (8) Insertion Loss Margin (dB)
 - (9) Frequency (MHz)
 - (10) Limit (dB)
 - b) Fiber Cables
 - (1) Cable ID
 - (2) Test Summary Headroom (proper bend radius for the cable)
 - (3) Test Limit
 - (4) Propagation Delay (ns)
 - (5) Length (ft)
 - (6) Loss (dB), Loss Limits (dB), and Loss Margin (dB) must be shown for all required wavelengths.
 - d. Perform a complete inspection of all mechanical aspects of the BHS(s).
3. Dynamic
 - a. Dynamic testing must include, but not be limited to:
 - 1) E-Stop functionality
 - 2) Load testing voltage
 - 3) Belt tracking
 - 4) Belt speeds

- 5) Photoeye alignment
 - 6) Motor rotation
 - b. BHSC must demonstrate that all E-Stop zones are operational and correct prior to load testing.
 - c. Load Test
 - 1) BHSC will provide VTC and the Owner a complete motor manifest showing no-load amps, along with their respective belt speeds prior to load testing.
 - 2) Perform 40-hours of break-in prior to system load test (this time may include run time during static, dynamic, and functional testing).
 - 3) Submit in writing to VTC and the Owner all “no load” amp, actual speeds, and full load motor current readings after the break-in period has been completed.
 - 4) All amp readings must be recorded from the load side of the starter on non-VFDs, and on the load side of VFDs.
 - 5) All amp readings must be conducted and recorded with weight using load specified by this document 1.14D.
 - 6) The recorded information will be considered as the system empirical readings, and will be included in the O&M Manuals for reference.
 - d. Inspect the BHS(s) and make adjustments to belts and programming as required. Such adjustments will be considered as fine tuning.
 - e. BHSC must perform dynamic testing and reconcile any noted deficiencies or discrepancies prior to start of functional testing.
 - f. BHSC must demonstrate the operating speed of each component of the system(s). Any component not operating within the acceptable limits of design speed will be reworked to bring it up to the proper speed.
 - g. Noise Level
 - 1) Fabricate and install the BHS to limit combined equipment and controlled ambient noise levels to the allowable maximum values as shown in Section 1.14K. The measurements will be taken at a maximum distance of 3 feet vertically or horizontally from noise producing components.
 - 2) BHSC must conduct baseline noise level readings during peak operating hours prior to any work done on the system. The BHSC must record the time, location and the noise level for each reading.
 - 3) Ambient noise level measurements will be taken during peak operating hours to establish a baseline prior to work being accomplished in an area. Equipment such as air-conditioning and heating equipment will be on and outside noise sources (from aircraft and mobile ground equipment) will be as normal.
 - 4) BHSC must conduct noise level readings after work is complete on the system at the same time and location for the same peak operating period.
 - 5) The noise level measurement will be accomplished utilizing a calibrated A-weighted sound level meter at slow response or a calibrated 1/3 band octave analyzer and converted to A-weighted sound pressure levels supplied by the BHSC.
 - 6) Where conveyors are located in the ceiling spaces of non-bag room areas, the noise measurements will be taken after the architectural ceilings are in place.
4. Functional
- a. Functional testing must include, but not be limited to:
 - 1) BHS full system testing
 - 2) Control Interfaces (Push button stations, HMI graphics, HMI interface, stack lights, etc.)
 - 3) Merge logic

- 4) Divert logic
- 5) Matrix distribution
- 6) Sortation
- 7) Controls Redundancy
- b. Demonstrate the capability of the system to handle the specified processing rates, using all components/units to achieve specified rates.
- c. Demonstrate the system(s) fault monitoring and system or status display panel graphics.
- d. Demonstrate controls functionality to include alarm tags, graphics, horns, and stack lights, etc.
- e. All tests must satisfy the criteria as stated in the latest revision of the SSTP.
- f. All system tests will be conducted with the EDSs placed in "Show Alarm" mode only.
- g. Mixed bag system test will be performed with a minimum of 1% of total bags used for testing considered Out-Of-Gauge.
- h. All items must be tagged with 10 digit IATA bar coded bag tags.
- i. Any system that is capable of using IATA, Non-IATA, and pier tags shall be tested using an even mixture of each style tag.
- j. System Sortation Test
 - 1) The sortation test must demonstrate the appropriate routing of Lost in Track and No Read baggage.
 - 2) The BHSC must demonstrate the read rate capacity of the scanner array with a minimum of 200 bags at each scanner array, while maintaining a 99% read rate accuracy.
 - 3) The BHSC must demonstrate to VTC and the Owner the ability of the BHS to properly and successfully process all aspects of sortation methods required in the specifications.
 - 4) The BHSC must validate interface with BSM, FIDS, and BPM (if required).
 - 5) The sortation test will require reconciliation of all bags with the sortation table(s) and reporting. Bags include but not limited to ones with IATA tag, without tag (no read bags), unknown bags, and bags are too close.
 - 6) The BHSC must demonstrate fall back sortation (IATA fall back or pier tag fall back) so that the system has a mechanism to sort bags in case of SAC failure.
- k. Controls Redundancy Testing
 - 1) PLC configuration
 - 2) Upper Level system configuration
 - 3) Network configuration

D. Owner (Pre-ISAT)Testing

BHSC must demonstrate the system in accordance with the approved SSTP to Owner or designated representative. Passage of this testing in no way relieves responsibility for corrections of noted discrepancies during this testing or subsequent testing. Upon successful completion of Pre-ISAT, Owner will inform TSA in writing as to the system readiness for the TRR.

E. TRR

BHSC must demonstrate the system in accordance with the approved SSTP to the TSA Pre-Certification test representative. Upon successful completion, TSA will be notified as to the system readiness for TSA ISAT.

F. ISAT

BHSC must provide personnel to support TSA ISAT.

5.02 SCHEDULED TRAINING

All training sessions must be digitally recorded by the BHSC with the Owner receiving two digital copies of the training sessions in either MP4 or AVI format.

The training sessions must be organized, using presentation materials, handouts, Power Point presentations and other training tools to thoroughly demonstrate and explain the operational, maintenance and safety characteristics of the system.

Training must include classroom and hands-on instruction.

Prior to the start of use, BHSC must provide the following training to Owner, TSA and tenant airline personnel:

A. Airport Operations Training

1. 16 total hours (separated into two sessions, am and pm) of training for the Carriers, Airport, and 3rd party operators, to cover the operational functions of all systems and all pertinent sections of the Operations Manual.

a. Operator training must include, but not be limited to:

- 1) BHS orientation and layout
- 2) System safety
- 3) Startup procedures
- 4) Upper level Menu and navigation
- 5) HMI alarms System Reporting
- 6) Manual encode
- 7) Controls functionality, Modes of operation, operational limitations
- 8) Any BHSC provided equipment
- 9) BHS control interface provided to conduct the OTK procedures
- 10) BHS orientation and layout
- 11) BHS Fail-Safe procedures and layout

b. All operators or individuals with access to either viewing or printing reports must be properly trained in SSI procedures prior to operation. The training sessions must be conducted prior to the operational startup of the respective BHS.

B. Airport Maintenance Training

1. Total eighty hours of training (separated into two sessions, am and pm as well as separated into electrical and mechanical), including classroom and hands-on type programs. Hands-on training includes actual troubleshooting, adjustment of equipment, and component removal/replacement.

a. Maintenance training must include, but not be limited to:

- 1) BHS orientation and layout
- 2) System safety
- 3) Startup procedures
- 4) Instruction on the routine and periodic maintenance required including component removal/replacement of the system.
- 5) HMI alarms System Reporting
- 6) Manual encode

- 7) Any BHSC provided equipment to include, but not limited to, PLC, network, field devices
 - b. All individuals with access to either viewing or printing reports must also be properly trained in SSI procedures by the BHSC prior to operation. The training sessions must be conducted prior to the operational startup of the respective BHSC.
- C. TSA Operations Training
 1. This training is distinct from maintenance training. It must be provided to TSA for mechanical, electrical, and computer functions required to properly operate the TSA staffed portions of the system.
 2. 16 total hours (separated into two sessions, am and pm) of training to cover the operational functions of all systems and all pertinent sections of the Operations Manual.
 - a. Training materials and documentation to be presented must be submitted to TSA for review prior to the first scheduled training session. All training sessions must be digitally recorded; two copies of which are to be provided to TSA prior to live bag screening.
 - b. TSA training must include, but not be limited to:
 - 1) BHS orientation and layout
 - 2) System safety
 - 3) Any BHSC provided equipment located in the CBRA
 - 4) Any BHSC provided equipment located in the OSR Room
 - 5) BHS control interface provided to conduct the OTK procedures
 - 6) BHS orientation and layout
 - 7) BHS Fail-Safe procedures and layout
 - 8) System safety
 - 9) BHS/TSA reporting
- D. Airline Operations Training
 1. 8 total hours (separated into two sessions, am and pm) of training for the Carriers, Airport, and 3rd party operators, to cover the operational functions of all systems and all pertinent sections of the Operations Manual.
 - a. Operator training must include, but not be limited to:
 - 1) System safety
 - 2) BHS orientation and layout
 - 3) Emphasis will be placed on baggage hygiene and areas of impact (i.e. ATR, BMA and jam points)
- E. Supplemental Training

Should Owner require supplemental training beyond that specified above, it must be provided by BHSC at a time and at rates as mutually agreed upon between Owner and BHSC.

END OF SECTION 34 77 39

EXHIBIT A TO STANDARD SPECIFICATIONS OPERATIONS AND MAINTENANCE MANUAL
FORMAT

OPERATION AND MAINTENANCE MANUAL
AIRPORT NAME HERE LOCATION

TITLE PAGE

MANUAL TABLE OF CONTENTS

CHAPTER 1 INTRODUCTION

General (Purpose and scope of the manual)

Field Return (Warranty) Procedure

Weight and Size Limitations

CHAPTER 2 SYSTEM DESCRIPTION AND OPERATION

Physical Description

(A concise physical description of the overall BHS/BHS, identifying each conveyor subsystem, its location and primary components, operator controls, and accessory components required for efficient operation of the total system. The overall system must be illustrated on an 11" x 17" fold-out. Reference to manufacturers' literature must be made where such descriptive material is presented by the manufacturer, such as for power turns, etc.)

Electrical Description

(A concise description of the control panels, each operator control, special switches, photo-detectors, audio visual alarms, and drive motors. Electrical installation must be referenced by drawing number. The drawings referenced must be included in a "Drawing Book" separate from the manual.)

Functional Description

(A Functional description of each conveyor subsystem must be given. Specific drawings for each electrical control schematic must be referenced. The drawings must be included in a "Drawings Book" separate from the manual.)

CHAPTER 3 OPERATING INSTRUCTIONS

(Safety precautions to be followed by operating personnel, specific operating procedures, and operating procedures (to include start-up, shutdown, special maintenance procedures, and emergency procedures). Reference each operator control to a specific drawing that illustrates the control. The drawings must be included in a "Drawing Book" separate from the manual.)

CHAPTER 4 PREVENTATIVE MAINTENANCE

(Include procedures for periodic inspection, lubrication, oil change, cleaning, conveyor belt checking, tensioning and tracking, and component adjustment in this chapter.)

CHAPTER 5 TROUBLESHOOTING

(Troubleshooting procedures to aid maintenance personnel in diagnosing conveyor system or subsystem malfunctions and isolating the trouble to a replaceable component or assembly.)

CHAPTER 6 REMOVAL AND INSTALLATION PROCEDURES

Safety Precautions

List pertinent safety precautions to be followed by maintenance personnel. An additional statement must inform personnel that ..."when a possibility exists that personnel could be injured when performing a procedural step, a WARNING must precede the procedural step wherein the injury could occur. If a possibility exists that equipment could be damaged when performing a procedural step, a CAUTION must be included preceding the step. A NOTE must call attention to special information that should be considered when performing a procedural step.)

Special Tools and Equipment

(List any special tools or equipment required for maintenance of the BHS/BHS by nomenclature and part number. The purpose of each tool or equipment must also be given. Include information on how the tool is used in the procedure where the tool is required.)

Component Removal and Installation

(Include procedures for removing and installing motors, brakes, reducers, pulleys, taper-lock bushings, sheaves, sprockets and other components together with any special disassembly and testing on reassembly before installation.)

CHAPTER 7 PARTS LIST/RECOMMENDED SPARES LIST


(This chapter must be an indentured parts listing of major mechanical, electrical, and electronic parts used in the system. Include exploded views of prime equipment. List recommended spare parts in numerical order following the indentured parts list. The suggested minimum stock quantity for each part spared must also be given. Include the Federal Supply Code Identification Number of the firm from which replacement or maintenance parts may be obtained.)


CHAPTER 8 GLOSSARY OF TERMS AND SYMBOLS

MANUFACTURERS' LITERATURE


(Include descriptive literature covering assemblies and major components not manufactured by the BHSC.)


EXHIBIT B TO STANDARD SPECIFICATIONS - REPORT FORMAT AS REQUIRED BY THE TSA

 Transportation Security Administration		Daily CBIS Summary Report	
		Screening System Name	[Text]
Report Type		Terminal	[Text]
From	Daily	Airport	[Text]
To	[Date/time]		
		Report Run Date	[Date/time]
Total CBIS Baggage Throughput		0 bags	
Average Time Bag in CBIS		0.0 minutes	
1 Bag Volume	In-Gauge	Out-of-Gauge	Oversize
Number of bags	0	0	0
Percentage of Total Bag Volume	0.00%	0.00%	0.00%
2 CBIS/BHS Faults/Events	Number	Down Time	Average Time to Clear
2A Faults			
Pre-EDS Lost in Track	0	N/A	N/A
Post-EDS Lost in Track	0	N/A	N/A
Diverter/Door Failure	0	0:00:00	0:00:00
...	0	0:00:00	0:00:00
2B Events			
Jams	0	0:00:00	0:00:00
E-Stops	0	0:00:00	0:00:00
Fail-Safe	0	0:00:00	0:00:00
...	0	0:00:00	0:00:00
Total Faults/Events	0	0:00:00	0:00:00
3 Bag Time in CBIS (Minutes)	Average	Average	Average
	0.0	0.0	0.0
4 Upstream tracking accuracy (%)	Total		
IATA	0.0		
OOG (Relative)	0.0		
Total CBIS Throughput = Total Bag Count of bags exiting the EDS machines during report time period Bag time in CBIS = Single bag time from pre-EDS ATR to last chance diver or CBRA clear line $\text{Average Time Bag in CBIS} = \frac{\sum \text{Total CBIS Baggage Throughput Bag time in CBIS}}{\text{Total CBIS Baggage Throughput}}$ Pre-EDS Lost in Track is a bag lost between the pre-EDS ATR and the EDS. NO time is associated with this fault Post-EDS Lost in Track is a bag lost between the EDS and the last chance divert or CBRA. No time is associated with this fault A Diverter/Door Failure is recorded when... ... (to be completed for each category listed under Faults) A Jam Event is recorded when a PEC is blocked for x seconds while the associated conveyor belt is running An E-Stop event is recorded whenever an E-stop button is pressed (this can be further segmented based on e-stop location) A Fail-Safe events recorded when the CBIS prevents the conveyance of any non-cleared bag to airside locations following a component failure ... (to be completed for each category listed under Faults)			

 Transportation Security Administration		Daily CBIS Bag Volume Report	
		Screening System Name [Text] Terminal [Text] Airport [Text]	
Report Type From [Date/time] To [Date/time]		Report Run Date [Date/time]	
1 Input Conveyors			
	Number of Bags	Percentage	
TC1	0		
TC2	0		
Subtotal	0	0.00%	
CS	0		
Subtotal	0	0.00%	
MIC	0		
Subtotal	0	0.00%	
OS	0		
Subtotal	0	0.00%	
Total	0		
2 Sizing			
In-Gauge	0	0.00%	
Out-of-Gauge	0	0.00%	
Oversize	0	0.00%	
Total	0		

SENSITIVE SECURITY INFORMATION

 Transportation Security Administration		CBIS Executive Summary Report																																																																																															
		Screening System Name Airport Terminal	TSIF CBSS TSA Systems Integration Facility N/A																																																																																														
Report Type From To	Daily 2009-01-08 04:00 2009-01-08 22:00	Report Run Date	2009-01-08 13:45																																																																																														
<table border="1"> <thead> <tr> <th rowspan="2">EDS Machine</th> <th rowspan="2">Total Bags</th> <th colspan="4">Machine Decisions</th> <th colspan="4">OSR Decisions</th> <th rowspan="2">Bags tracked to CBRA</th> <th rowspan="2">Tracking Accuracy %</th> </tr> <tr> <th>Total</th> <th>Cleared</th> <th>% Cleared</th> <th>Alarmed</th> <th>% Alarm</th> <th>Total</th> <th>Cleared</th> <th>% Cleared</th> <th>Alarmed</th> <th>% Alarm</th> </tr> </thead> <tbody> <tr> <td>EDS-SS1</td> <td>2,056</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>99.85%</td> </tr> <tr> <td>EDS-SS2</td> <td>6,228</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>100.00%</td> </tr> <tr> <td>EDS-SS3</td> <td>6,302</td> <td></td> <td></td> <td>SSI</td> <td></td> <td></td> <td></td> <td>SSI</td> <td></td> <td></td> <td>99.94%</td> </tr> <tr> <td>EDS-SS4</td> <td>6,285</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>99.95%</td> </tr> <tr> <td>EDS-SS5</td> <td>6,283</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>100.00%</td> </tr> <tr> <td>Total</td> <td>27,154</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>99.96%</td> </tr> </tbody> </table>	EDS Machine	Total Bags	Machine Decisions				OSR Decisions				Bags tracked to CBRA	Tracking Accuracy %	Total	Cleared	% Cleared	Alarmed	% Alarm	Total	Cleared	% Cleared	Alarmed	% Alarm	EDS-SS1	2,056										99.85%	EDS-SS2	6,228										100.00%	EDS-SS3	6,302			SSI				SSI			99.94%	EDS-SS4	6,285										99.95%	EDS-SS5	6,283										100.00%	Total	27,154										99.96%			
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SENSITIVE SECURITY INFORMATION			
 Transportation Security Administration		CBRA Executive Summary Report	
		Screening System Name Airport Terminal	TSIF CBSS TSA Systems Integration Facility N/A
Report Type From To	Daily 2013-01-21 2013-01-21	04:00 22:00	Report Run Date 2013-01-21 15:30
Bag Status		Total Bag	
EDS Total Volume		27,154	
CBRA Total Volume		SSI	% of Total CBRA Volume
Cleared			
<ul style="list-style-type: none"> • Cleared (CLR) • PRE-Clear (P-CLR) • SEL-Clear (S-CLR) 			
Alarmed			
<ul style="list-style-type: none"> • Alarmed (ALM) • PRE-Alarmed (P-ALM) • SEL-Alarmed (S-ALM) • No Decision • Purged • Queue Time Out (Q-TimeOut) • Operator Time Out (O-TimeOut) 			
Lost in Tracking			
<ul style="list-style-type: none"> • Mistracked • Bag Length Tracking • Following Lost Bag • Too Close • Security Re-route 			
Unscreened			
<ul style="list-style-type: none"> • OS • OOG 			
CBRA Bag totals		QTY	100%
CBRA Statistics		% of Total Bags to CBRA	CBRA Invalid Arrivals Rate
CBRA Error Rate		SSI	SSI
<p> % of Total CBRA Volume for each category= Total # of Bags for each category arriving in CBRA/(Total CBRA Volume) A Cleared Bag is a bag with either an EDS or Operator Clear decision that arrives in CBRA... (to be completed for all categories listed) % of Total Bags to CBRA = Total CBRA Bags/(EDS Total Volume+OOG Bags+OS Bags) CBRA Error Rate = (Sum of... list all Invalid categories)/(Total CBRA Volume) </p>			
<p> WARNING: This record contains Sensitive Security Information that is controlled under 49 CFR parts 15 and 1520. No part of this record may be disclosed to persons without a "need to know" as defined in 49 CFR parts 15 and 1520, except with the written permission of the Administrator of the Transportation Security Administration, or the Secretary of Transportation. Unauthorized disclosure may result in civil penalty or other action. For U.S. Government agencies, public release is governed by 5 U.S.C. 552 and 49 CFR parts 15 and 1520. </p>			


 Transportation Security Administration		PEC TRACKING REPORT				
		Screening System Name Terminal Airport	[Text] [Text] [Text]			
Report Type From To	Daily [Date/time] [Date/time]	Report Run Date	[Date/time]			
Photocell	Bags	Unknown bags	Missing Bags	Jams	Missing Bag Jams	Purged Bags
PE_AL-01	0	0	0	0	0	0
PE_AL-02	0	0	0	0	0	0
PE_AL-03	0	0	0	0	0	0
PE_AL-04	0	0	0	0	0	0
PE_AL-05	0	0	0	0	0	0
PE_AL-06	0	0	0	0	0	0
PE_AL-07	0	0	0	0	0	0
PE_AL-08	0	0	0	0	0	0
PE_AL-09	0	0	0	0	0	0
PE_AL-10	0	0	0	0	0	0

EXHIBIT D TO STANDARD SPECIFICATIONS - SPARE PARTS DATA SHEET

FIELD NAME	INFORMATION REQUIRED
Supplier Name	Company name
Supplier Point of Contact	POC name
Supplier POC Telephone	POC land line and mobile telephone
Supplier POC Fax	POC fax number
Supplier POC E-mail	POC e-mail address
Description	The name and description with technical identification information such as size, rating, color code, etc. must be given as complete as possible in this field. (No
Classification	Capital, Insurance, Overhaul, Wear and Tear, or Consumables and COTS
Application	Description of where the spare part is used
System Location (s)	Description of where spare part is located within the system
Supplier Part Number	The unique number that is used by the supplier to identify the product
Manufacturer Name	Company name
Manufacturer Model Number	The unique number that is allocated to certain items by the manufacturer for future identification and purchase. The model number is used for a specific compound unit
Manufacturer Part Number	The unique number that is used by the manufacturer to identify the product
Catalogue Number	Supplier/Manufacturer catalogue number
Drawing Number	Supplier/Manufacturer drawing number
Drawing Item Number	Supplier/Manufacturer drawing item number
Lead Time in Days	
Total System Quantity	Number of parts in system
Recommended Quantity	
Unit Cost	
Total Cost	Recommended Quantity x Unit Cost
Storage Area Required	Type of storage needed

CONSTRUCTION SAFETY AND PHASING PLAN (CSPP)
FOR
CONSTRUCT BAGGAGE HANDLING SYSTEM (BHS) AND
WEST TERMINAL EXPANSION
AT THE
DESTIN – FORT WALTON BEACH AIRPORT



FOR THE
OKALOOSA COUNTY, FLORIDA
BOARD OF COUNTY COMMISSIONERS

ITB AP 59-20

FAA AIP Project No. TBD

May 2020

PREPARED BY:



2300 Maitland Center Parkway, Suite 210
Maitland, Florida 32751
FL Certificate of Authorization No. P08036

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FOR
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Appendix C:
FAA AC 150/5200-18C – Airport Safety Self Inspection

Appendix D:
Project Layout Plan Exhibit

CONSTRUCTION SAFETY AND PHASING PLAN
FOR
CONSTRUCT BAGGAGE HANDLING SYSTEM (BHS) AND
WEST TERMINAL EXPANSION
AT THE
DESTIN – FORT WALTON BEACH AIRPORT

INTRODUCTION

This Construction Safety and Phasing Plan (CSPP) has been prepared as a supplement to the contract documents for the Baggage Handling System/West Terminal Expansion project at the Destin – Fort Walton Beach Airport to set forth requirements for operational safety during the construction phase of the project. The contractor is required to become familiar with and follow the procedures set forth in this plan. In addition, the contractor must, after reviewing the CSPP and prior to receiving a Notice to Proceed (NTP), prepare a Safety Plan Compliance Document (SPCD) in accordance with FAA AC 150/5370-2F – Operational Safety on Airports During Construction, included herein as Appendix “A” of the bid documents, describing how the contractor will comply with the CSPP.

PROJECT DESCRIPTION

Okaloosa County (COUNTY) and the airport staff (AIRPORT) desire to construct a one-story baggage handling expansion with a checked baggage inspection system room, a checked baggage resolution area room, and support spaces. The project also includes a one-story terminal expansion with airline ticketing areas and restrooms. Impacts to existing airport facilities will be incurred including water, sewer, electrical, parking, site lighting, fencing, gates, security cameras, and covered walkways.

1. COORDINATION

a. Contractor Progress Meetings: Progress meetings shall be held on a weekly basis at the airport at which operational schedules of the contractor, airport, airlines and other tenants will be discussed. Additional meetings will be held when requested by the Owner or the Contractor. The contractor’s project manager and site superintendent shall be present at a minimum. Representatives of subcontractors and the Engineer will be asked to attend when the contractor feels their presence is needed or when the Owner requests their attendance.

b. Scope or Schedule Changes: Proposed scope and/or schedule changes will be discussed at each progress meeting along with their impact on the CSPP and the need to revise the CSPP.

c. FAA ATO Coordination Procedures: Work is entirely in a non-movement area of Eglin AFB. No communication with the ATCT will be required; however, the contractor shall coordinate with Airport Operations regarding the schedule of arriving/departing flights in order to safely pull back all men and equipment adjacent to existing Terminal Gate A-1 and future Concourse Gate C-1 as necessary.

2. PHASING

The project has 3 facility construction phases, none of which consist of work within the terminal apron taxilane object free area (TOFA), but some work will occur in the existing airfield operations areas adjacent to existing Terminal Gate A-1 and future Concourse Gate C-1. It is not anticipated that operations at existing Gate A-1 or future Gate C-1 will be impacted by the construction. The facility construction phases are shown on the Project Layout Plan Exhibit and generally described below:

Phase 1: Expansion of the baggage handling facility including new facility construction west of Grid Line C and south of Grid Line 7.

Phase 2: Expansion of the terminal including new facility construction west of Grid Line C and north of Grid Line 7. This work can be performed concurrently with Phase 1.

Phase 3: Modifications and enclosure of the existing baggage handling facility and terminal east of Grid Line C.

These facility construction phases are controlled by the phasing of the baggage handling systems construction, demolition, and switchovers. The baggage handling system phases can be seen in more detail on Sheets QM8-001 through QM8-004 of the construction documents.

Aircraft access to existing Terminal Gate A-1 and future Concourse Gate C-1 must be maintained at all times. Barricades will be placed along the edge of the work area separating it from the active airfield and airline ground service personnel and equipment. Barricades will be low profile and lighted with flags meeting the requirements of AC 150/5370-2G. Barricades are to be provided at the perimeter of the work area adjacent to the airfield operations area (AOA) and at specific locations determined by the Engineer and Owner.

The contractor shall submit a phasing plan 7 days prior to the pre-construction conference. During the weekly construction coordination meetings, the contractor will be required to identify upcoming work he will be working on for the following 2 weeks and to provide a plan of barricade locations.

3. AREAS AND OPERATIONS AFFECTED BY CONSTRUCTION ACTIVITIES

The only existing airfield operations areas affected by this project are the locations

directly adjacent to existing Terminal Gate A-1 and future Concourse Gate C-1 . These general areas are shown on the Project Layout Plan Exhibit included herein. Airport tenants will be briefed on the phasing plan. Construction equipment will not penetrate any taxilane object free area (TOFA) or runway obstacle free zone (OFZ). There are no permanent structures included in this project that penetrate the FAR Part 77 airspace.

4. PROTECTION OF NAVIGATION AIDS (NAVAIDS)

The project is not located in the area of any NAVAIDS, and the contractor is prohibited from entering areas outside the project limits or haul routes shown on the Project Layout Plan Exhibit. The contractor is subject to fines for entering AOA areas outside these limits.

5. CONTRACTOR ACCESS

a. The contractor's access points, access/haul routes, and possible staging areas are identified on the Project Layout Plan Exhibit. The contractor is not to use runways and taxiways as a haul routes.

b. The Contractor's employee personal vehicles will not be allowed in the AOA and will be required to park outside the airfield AOA security fence. The contractor's work vehicles must have company signs on each side of the vehicle. Additionally, any work vehicle operating on the airport AOA must also have a flashing yellow beacon.

c. Two-Way Radio Communication: All work for this project is located outside the movement area, so communications with the Air Traffic Control Tower is not needed or allowed. The contractor will be required to stay in contact with Airport Operations Communications Center (AOC) via cell phone.

6. WILDLIFE MANAGEMENT

There are no wildlife issues at the Destin – Fort Walton Beach Airport that this project will affect. The following wildlife attractant mitigation procedures are in place:

a. The contractor will be required to immediately collect and dispose of any food scraps from construction personnel activity.

7. FOREIGN OBJECT DEBRIS (FOD) MANAGEMENT

The contractor will be required to continuously clear the project site of any and all debris capable of being blown by wind onto active airfield areas. Any debris or dirt from the project site deposited on any airfield pavement shall be cleaned immediately by a motor driven sweeper or vacuum, which the contractor is required to have onsite at all times. Sweepers must be equipped with non-metallic bristles.

8. HAZARDOUS MATERIALS (HAZMAT) MANAGEMENT

The project site drains to an existing stormwater retention area which will prevent hazardous material spills from being discharged offsite; however, the contractor will not be required or allowed to bring hazardous materials onsite and will not be required to provide a plan for the management of such materials.

The project involves grading and excavation work and includes a Stormwater Pollution Prevention Plan for erosion and sediment control. The contractor will be required to file with the FDEP a Notice of Intent (NOI) to use the NPDES generic permit for stormwater discharges for large and small construction projects.

9. NOTIFICATION OF CONSTRUCTION ACTIVITIES

a. The Owner shall maintain and distribute a list of responsible representatives/points of contacts with phone numbers and e-mail addresses. For the Owner this shall include the Project Manager, Construction Manager, and the Engineer's Resident Project Representative (RPR). Contacts from the Contractor will include the Project Manager, Site Superintendant, Safety Officer, and any subcontractor representatives. It will also include representatives from the FAA ADO office, and the Engineer of Record. The Contractor's Safety Officer shall be on call 24 hours a day for emergency maintenance of airport hazard lighting, barricades, and other safety features.

b. The contractor shall notify the Airport's Project Manager, Operations Manager, or Inspector of upcoming work activity that will impact the active AOA not less than 48 hours prior to that activity.

c. The contractor will need to call the AOC for medical, firefighting, and police response who will notify the Aircraft Rescue and Fire Fighting (ARFF) facility and/or Airport Police. The Engineer's RPR is also to be immediately notified.

d. All the above information, including the appropriate phone numbers, will be distributed at the pre-construction conference.

e. The FAA will need to be notified of equipment and operations that affects navigable airspace. Upon notice of award, the contractor will be asked to provide the Owner with a list of equipment and their height, so this can be reported to the FAA using form 7460-1 and/or the FAA OE/AAA website.

f. None of the Airport's NAVAIDs will be affected by this project.

10. INSPECTION REQUIREMENTS

The Engineer's Resident Project Representative will conduct daily inspections at a

minimum. The Engineer of Record will make periodic inspections to verify compliance with the phasing and safety plan and as needed to resolve questions or disputes.

11. UNDERGROUND UTILITIES

The project will require relocation/extension of existing water lines, sanitary lines, and storm lines. These relocations/extensions will be completely within the airport property. No easements will be required.

12. PENALTIES

Any fines or assessments levied against the Sponsor as a result of unauthorized intrusions in the AOA, which include entering AOA areas outside the project limits, or other violations by the Contractor's personnel or those of his subcontractors will be passed on to the Contractor. In addition, the Contractor will be subject to a fine of \$1,000.00 per incident, assessed by the Sponsor.

13. SPECIAL CONDITIONS

The airport has not identified any special conditions requiring any special response/mitigation plan.

14. RUNWAY AND TAXIWAY/TAXILANE VISUAL AIDS

a. Taxiways/Taxilanes: Lighted low-profile barricades must be installed as described in Section 2 above or as directed by Airport Operations. There is no existing airfield lighting or lighted guidance signage affected by the project, and no new taxiway lighting or guidance signage is included in the project.

b. Runways and NAVAIDS: There is no work in this project that affects the runways or NAVAIDS on the airport.

15. MARKING AND SIGNS FOR ACCESS ROUTES

Access Routes will be staked and marked with "CONSTRUCTION HAUL ROUTE".

16. HAZARD MARKING AND LIGHTING

Airfield barricades will be required to have red flashing or steady burning lights. In the event night work is required, the Contractor's vehicles will be required to have yellow flashing beacons. Additional requirements are in AC 150/5210-5D – Painting, Marking, and Lighting of Vehicles used on Airports, attached herein as Appendix "B". The contractor's Safety Officer, as discussed in Section 9 above will be responsible for maintenance of barricades.

17. WORK ZONE LIGHTING FOR NIGHTTIME CONSTRUCTION

If lighting for nighttime construction is necessary, all lighting shall be directed towards

project area only, and no lighting shall be pointed southward in direction of adjacent taxiway or existing Terminal Gate A-1 or future Concourse Gate C-1.

18. PROTECTION OF RUNWAY AND TAXIWAY SAFETY AREAS AND OBJECT FREE AREAS.

a. Taxilanes: Barricades are to be provided at the perimeter of the work area adjacent to the AOA (end of existing taxilane) and at specific locations determined by the Engineer and Owner as described above in Section 2. There is no work in this project within the terminal apron taxilane object free area (TOFA).

b. Runways: There is no work in this project that affects any runway safety or object free area.

c. Penalties as discussed in Section 12 may be levied against the contractor for any entry into these areas.

19. OTHER LIMITATIONS ON CONSTRUCTION

There are no other limitations on construction.

APPENDIX A

FAA AC 150/5370-2G

OPERATIONAL SAFETY ON AIRPORTS DURING CONSTRUCTION



U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

Subject: Operational Safety on
Airports During Construction

Date: 12/13/2017
Initiated By: AAS-100

AC No: 150/5370-2G
Change:

1 **Purpose.**

This AC sets forth guidelines for operational safety on airports during construction.

2 **Cancellation.**

This AC cancels AC 150/5370-2F, *Operational Safety on Airports during Construction*, dated September 29, 2011.

3 **Application.**

This AC assists airport operators in complying with Title 14 Code of Federal Regulations (CFR) Part 139, *Certification of Airports*. For those certificated airports, this AC provides one way, but not the only way, of meeting those requirements. The use of this AC is mandatory for those airport construction projects receiving funds under the Airport Improvement Program (AIP). See Grant Assurance No. 34, *Policies, Standards, and Specifications*. While we do not require non-certificated airports without grant agreements or airports using Passenger Facility Charge (PFC) Program funds for construction projects to adhere to these guidelines, we recommend that they do so to help these airports maintain operational safety during construction.

4 **Related Documents.**

ACs and Orders referenced in the text of this AC do not include a revision letter, as they refer to the latest version. [Appendix A](#) contains a list of reading material on airport construction, design, and potential safety hazards during construction, as well as instructions for obtaining these documents.

5 **Principal Changes.**

The AC incorporates the following principal changes:

1. Notification about impacts to both airport owned and FAA-owned NAVAIDs was added. See paragraph [2.13.5.3](#), NAVAIDs.

2. Guidance for the use of orange construction signs was added. See paragraph 2.18.4.2, Temporary Signs.
3. Open trenches or excavations may be permitted in the taxiway safety area while the taxiway is open to aircraft operations, subject to restrictions. See paragraph 2.22.3.4, Excavations.
4. Guidance for temporary shortened runways and displaced thresholds has been enhanced. See Figure 2-1 and Figure 2-2.
5. Figures have been improved and a new Appendix F on the placement of orange construction signs has been added.

Hyperlinks (allowing the reader to access documents located on the internet and to maneuver within this document) are provided throughout this document and are identified with underlined text. When navigating within this document, return to the previously viewed page by pressing the “ALT” and “ ← ” keys simultaneously.

Figures in this document are schematic representations and are not to scale.

6 **Use of Metrics.**

Throughout this AC, U.S. customary units are used followed with “soft” (rounded) conversion to metric units. The U.S. customary units govern.

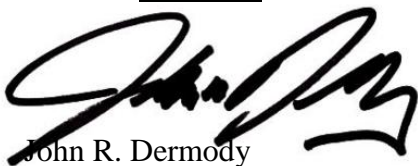
7 **Where to Find this AC.**

You can view a list of all ACs at

http://www.faa.gov/regulations_policies/advisory_circulars/. You can view the Federal Aviation Regulations at http://www.faa.gov/regulations_policies/faa_regulations/.

8 **Feedback on this AC.**

If you have suggestions for improving this AC, you may use the Advisory Circular Feedback form at the end of this AC.



John R. Dermody

Director of Airport Safety and Standards

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CHAPTER 1. PLANNING AN AIRFIELD CONSTRUCTION PROJECT

1.1 Overview.

Airports are complex environments, and procedures and conditions associated with construction activities often affect aircraft operations and can jeopardize operational safety. Safety considerations are paramount and may make operational impacts unavoidable. However, careful planning, scheduling, and coordination of construction activities can minimize disruption of normal aircraft operations and avoid situations that compromise the airport's operational safety. The airport operator must understand how construction activities and aircraft operations affect one another to be able to develop an effective plan to complete the project. While the guidance in this AC is primarily used for construction operations, the concepts, methods and procedures described may also enhance the day-to-day airport maintenance operations, such as lighting maintenance and snow removal operations.

1.2 Plan for Safety.

Safety, maintaining aircraft operations, and construction costs are all interrelated. Since safety must not be compromised, the airport operator must strike a balance between maintaining aircraft operations and construction costs. This balance will vary widely depending on the operational needs and resources of the airport and will require early coordination with airport users and the FAA. As the project design progresses, the necessary construction locations, activities, and associated costs will be identified and their impact to airport operations must be assessed. Adjustments are made to the proposed construction activities, often by phasing the project, and/or to airport operations to maintain operational safety. This planning effort will ultimately result in a project Construction Safety and Phasing Plan (CSPP). The development of the CSPP takes place through the following five steps:

1.2.1 Identify Affected Areas.

The airport operator must determine the geographic areas on the airport affected by the construction project. Some, such as a runway extension, will be defined by the project. Others may be variable, such as the location of haul routes and material stockpiles.

1.2.2 Describe Current Operations.

Identify the normal airport operations in each affected area for each phase of the project. This becomes the baseline from which the impact on operations by construction activities can be measured. This should include a narrative of the typical users and aircraft operating within the affected areas. It should also include information related to airport operations: the Aircraft Approach Category (AAC) and Airplane Design Group (ADG) of the airplanes that operate on each runway; the ADG and Taxiway Design Group (TDG)¹ for each affected taxiway; designated approach visibility minimums;

¹ Find Taxiway Design Group information in [AC 150/5300-13, Airport Design](#).

available approach and departure procedures; most demanding aircraft; declared distances; available air traffic control services; airport Surface Movement Guidance and Control System (SMGCS) plan; and others. The applicable seasons, days and times for certain operations should also be identified as applicable.

1.2.3 Allow for Temporary Changes to Operations.

To the extent practical, current airport operations should be maintained during the construction. In consultation with airport users, Aircraft Rescue and Fire Fighting (ARFF) personnel, and FAA Air Traffic Organization (ATO) personnel, the airport operator should identify and prioritize the airport's most important operations. The construction activities should be planned, through project phasing if necessary, to safely accommodate these operations. When the construction activities cannot be adjusted to safely maintain current operations, regardless of their importance, then the operations must be revised accordingly. Allowable changes include temporary revisions to approach procedures, restricting certain aircraft to specific runways and taxiways, suspension of certain operations, decreased weights for some aircraft due to shortened runways, and other changes. An example of a table showing temporary operations versus current operations is shown in Appendix E.

1.2.4 Take Required Measures to Revise Operations.

Once the level and type of aircraft operations to be maintained are identified, the airport operator must determine the measures required to safely conduct the planned operations during the construction. These measures will result in associated costs, which can be broadly interpreted to include not only direct construction costs, but also loss of revenue from impacted operations. Analysis of costs may indicate a need to reevaluate allowable changes to operations. As aircraft operations and allowable changes will vary widely among airports, this AC presents general guidance on those subjects.

1.2.5 Manage Safety Risk.

The FAA is committed to incorporating proactive safety risk management (SRM) tools into its decision-making processes. FAA Order 5200.11, *FAA Airports (ARP) Safety Management System (SMS)*, requires the FAA to conduct a Safety Assessment for certain triggering actions. Certain airport projects may require the airport operator to provide a Project Proposal Summary to help the FAA determine whether a Safety Assessment is required prior to FAA approval of the CSPP. The airport operator must coordinate with the appropriate FAA Airports Regional or District Office early in the development of the CSPP to determine the need for a Safety Risk Assessment. If the FAA requires an assessment, the airport operator must at a minimum:

1. Notify the appropriate FAA Airports Regional or District Office during the project "scope development" phase of any project requiring a CSPP.
2. Provide documents identified by the FAA as necessary to conduct SRM.
3. Participate in the SRM process for airport projects.
4. Provide a representative to participate on the SRM panel.

5. Ensure that all applicable SRM identified risks elements are recorded and mitigated within the CSPP.

1.3 **Develop a Construction Safety and Phasing Plan (CSPP).**

Development of an effective CSPP will require familiarity with many other documents referenced throughout this AC. See Appendix A for a list of related reading material.

1.3.1 List Requirements.

A CSPP must be developed for each on-airfield construction project funded by the Airport Improvement Program (AIP) or located on an airport certificated under Part 139. For on-airfield construction projects at Part 139 airports funded without AIP funds, the preparation of a CSPP represents an acceptable method the certificate holder may use to meet Part 139 requirements during airfield construction activity. As per FAA Order 5200.11, projects that require Safety Assessments do not include construction, rehabilitation, or change of any facility that is entirely outside the air operations area, does not involve any expansion of the facility envelope and does not involve construction equipment, haul routes or placement of material in locations that require access to the air operations area, increase the facility envelope, or impact line-of-sight. Such facilities may include passenger terminals and parking or other structures. However, extraordinary circumstances may trigger the need for a Safety Assessment and a CSPP. The CSPP is subject to subsequent review and approval under the FAA's Safety Risk Management procedures (see paragraph 1.2.5).

1.3.2 Prepare a Safety Plan Compliance Document (SPCD).

The Safety Plan Compliance Document (SPCD) details how the contractor will comply with the CSPP. Also, it will not be possible to determine all safety plan details (for example specific hazard equipment and lighting, contractor's points of contact, construction equipment heights) during the development of the CSPP. The successful contractor must define such details by preparing an SPCD that the airport operator reviews for approval prior to issuance of a notice-to-proceed. The SPCD is a subset of the CSPP, similar to how a shop drawing review is a subset to the technical specifications.

1.3.3 Assume Responsibility for the CSPP.

The airport operator is responsible for establishing and enforcing the CSPP. The airport operator may use the services of an engineering consultant to help develop the CSPP. However, writing the CSPP cannot be delegated to the construction contractor. Only those details the airport operator determines cannot be addressed before contract award are developed by the contractor and submitted for approval as the SPCD. The SPCD does not restate nor propose differences to provisions already addressed in the CSPP.

1.4 **Who Is Responsible for Safety During Construction?**

1.4.1 Establish a Safety Culture.

Everyone has a role in operational safety on airports during construction: the airport operator, the airport's consultants, the construction contractor and subcontractors, airport users, airport tenants, ARFF personnel, Air Traffic personnel, including Technical Operations personnel, FAA Airports Division personnel, and others, such as military personnel at any airport supporting military operations (e.g. national guard or a joint use facility). Close communication and coordination between all affected parties is the key to maintaining safe operations. Such communication and coordination should start at the project scoping meeting and continue through the completion of the project. The airport operator and contractor should conduct onsite safety inspections throughout the project and immediately remedy any deficiencies, whether caused by negligence, oversight, or project scope change.

1.4.2 Assess Airport Operator's Responsibilities.

An airport operator has overall responsibility for all activities on an airport, including construction. This includes the predesign, design, preconstruction, construction, and inspection phases. Additional information on the responsibilities listed below can be found throughout this AC. The airport operator must:

- 1.4.2.1 Develop a CSPP that complies with the safety guidelines of Chapter 2, Construction Safety and Phasing Plans, and Chapter 3, Guidelines for Writing a CSPP. The airport operator may develop the CSPP internally or have a consultant develop the CSPP for approval by the airport operator. For tenant sponsored projects, approve a CSPP developed by the tenant or its consultant.
- 1.4.2.2 Require, review and approve the SPCD by the contractor that indicates how it will comply with the CSPP and provides details that cannot be determined before contract award.
- 1.4.2.3 Convene a preconstruction meeting with the construction contractor, consultant, airport employees and, if appropriate, tenant sponsor and other tenants to review and discuss project safety before beginning construction activity. The appropriate FAA representatives should be invited to attend the meeting. See AC 150/5370-12, Quality Management for Federally Funded Airport Construction Projects. (Note “FAA” refers to the Airports Regional or District Office, the Air Traffic Organization, Flight Standards Service, and other offices that support airport operations, flight regulations, and construction/environmental policies.)
- 1.4.2.4 Ensure contact information is accurate for each representative/point of contact identified in the CSPP and SPCD.
- 1.4.2.5 Hold weekly or, if necessary, daily safety meetings with all affected parties to coordinate activities.
- 1.4.2.6 Notify users, ARFF personnel, and FAA ATO personnel of construction and conditions that may adversely affect the operational safety of the airport via Notices to Airmen (NOTAM) and other methods, as appropriate. Convene a meeting for review and discussion if necessary.
- 1.4.2.7 Ensure construction personnel know applicable airport procedures and changes to those procedures that may affect their work.
- 1.4.2.8 Ensure that all temporary construction signs are located per the scheduled list for each phase of the project.
- 1.4.2.9 Ensure construction contractors and subcontractors undergo training required by the CSPP and SPCD.
- 1.4.2.10 Ensure vehicle and pedestrian operations addressed in the CSPP and SPCD are coordinated with airport tenants, the airport traffic control tower (ATCT), and construction contractors.
- 1.4.2.11 At certificated airports, ensure each CSPP and SPCD is consistent with Part 139.

- 1.4.2.12 Conduct inspections sufficiently frequently to ensure construction contractors and tenants comply with the CSPP and SPCD and that there are no altered construction activities that could create potential safety hazards.
 - 1.4.2.13 Take immediate action to resolve safety deficiencies.
 - 1.4.2.14 At airports subject to 49 CFR Part 1542, *Airport Security*, ensure construction access complies with the security requirements of that regulation.
 - 1.4.2.15 Notify appropriate parties when conditions exist that invoke provisions of the CSPP and SPCD (for example, implementation of low-visibility operations).
 - 1.4.2.16 Ensure prompt submittal of a Notice of Proposed Construction or Alteration (Form 7460-1) for conducting an aeronautical study of potential obstructions such as tall equipment (cranes, concrete pumps, other), stock piles, and haul routes. A separate form may be filed for each potential obstruction, or one form may be filed describing the entire construction area and maximum equipment height. In the latter case, a separate form must be filed for any object beyond or higher than the originally evaluated area/height. The FAA encourages online submittal of forms for expediency at <https://oeaaa.faa.gov/oeaaa/external/portal.jsp>. The appropriate FAA Airports Regional or District Office can provide assistance in determining which objects require an aeronautical study.
 - 1.4.2.17 Ensure prompt transmission of the Airport Sponsor Strategic Event Submission, FAA Form 6000-26, located at https://oeaaa.faa.gov/oeaaa/external/content/AIRPORT_SPONSOR_STRATEGIC_EVENT_SUBMISSION_FORM.pdf, to assure proper coordination for NAS Strategic Interruption per Service Level Agreement with ATO.
 - 1.4.2.18 Promptly notify the FAA Airports Regional or District Office of any proposed changes to the CSPP prior to implementation of the change. Changes to the CSPP require review and approval by the airport operator and the FAA. The FAA Airports Regional or District office will determine if further coordination within the FAA is needed. Coordinate with appropriate local and other federal government agencies, such as Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), Transportation Security Administration (TSA), and the state environmental agency.
- 1.4.3 Define Construction Contractor's Responsibilities.
The contractor is responsible for complying with the CSPP and SPCD. The contractor must:

- 1.4.3.1 Submit a Safety Plan Compliance Document (SPCD) to the airport operator describing how it will comply with the requirements of the CSPP and supply any details that could not be determined before contract award. The SPCD must include a certification statement by the contractor, indicating an understanding of the operational safety requirements of the CSPP and the assertion of compliance with the approved CSPP and SPCD unless written approval is granted by the airport operator. Any construction practice proposed by the contractor that does not conform to the CSPP and SPCD may impact the airport's operational safety and will require a revision to the CSPP and SPCD and re-coordination with the airport operator and the FAA in advance.
- 1.4.3.2 Have available at all times copies of the CSPP and SPCD for reference by the airport operator and its representatives, and by subcontractors and contractor employees.
- 1.4.3.3 Ensure that construction personnel are familiar with safety procedures and regulations on the airport. Provide a point of contact who will coordinate an immediate response to correct any construction-related activity that may adversely affect the operational safety of the airport. Many projects will require 24-hour coverage.
- 1.4.3.4 Identify in the SPCD the contractor's on-site employees responsible for monitoring compliance with the CSPP and SPCD during construction. At least one of these employees must be on-site when active construction is taking place.
- 1.4.3.5 Conduct sufficient inspections to ensure construction personnel comply with the CSPP and SPCD and that there are no altered construction activities that could create potential safety hazards.
- 1.4.3.6 Restrict movement of construction vehicles and personnel to permitted construction areas by flagging, barricading, erecting temporary fencing, or providing escorts, as appropriate, and as specified in the CSPP and SPCD.
- 1.4.3.7 Ensure that no contractor employees, employees of subcontractors or suppliers, or other persons enter any part of the air operations area (AOA) from the construction site unless authorized.
- 1.4.3.8 Ensure prompt submittal through the airport operator of Form 7460-1 for the purpose of conducting an aeronautical study of contractor equipment such as tall equipment (cranes, concrete pumps, and other equipment), stock piles, and haul routes when different from cases previously filed by the airport operator. The FAA encourages online submittal of forms for expediency at <https://oeaaa.faa.gov/oeaaa/external/portal.jsp>.

- 1.4.3.9 Ensure that all necessary safety mitigations are understood by all parties involved, and any special requirements of each construction phase will be fulfilled per the approved timeframe.
- 1.4.3.10 Participate in pre-construction meetings to review construction limits, safety mitigations, NOTAMs, and understand all special airport operational needs during each phase of the project.

1.4.4 Define Tenant's Responsibilities.

If planning construction activities on leased property, Airport tenants, such as airline operators, fixed base operators, and FAA ATO/Technical Operations sponsoring construction are strongly encouraged to:

1. Develop, or have a consultant develop, a project specific CSPP and submit it to the airport operator. The airport operator may forgo a complete CSPP submittal and instead incorporate appropriate operational safety principles and measures addressed in the advisory circular within their tenant lease agreements.
2. In coordination with its contractor, develop an SPCD and submit it to the airport operator for approval issued prior to issuance of a Notice to Proceed.
3. Ensure that construction personnel are familiar with safety procedures and regulations on the airport during all phases of the construction.
4. Provide a point of contact of who will coordinate an immediate response to correct any construction-related activity that may adversely affect the operational safety of the airport.
5. Identify in the SPCD the contractor's on-site employees responsible for monitoring compliance with the CSPP and SPCD during construction. At least one of these employees must be on-site when active construction is taking place.
6. Ensure that no tenant or contractor employees, employees of subcontractors or suppliers, or any other persons enter any part of the AOA from the construction site unless authorized.
7. Restrict movement of construction vehicles to construction areas by flagging and barricading, erecting temporary fencing, or providing escorts, as appropriate, as specified in the CSPP and SPCD.
8. Ensure prompt submittal through the airport operator of Form 7460-1 for conducting an aeronautical study of contractor equipment such as tall equipment (cranes, concrete pumps, other), stock piles, and haul routes. The FAA encourages online submittal of forms for expediency at <https://oeaaa.faa.gov/oeaaa/external/portal.jsp>.
9. Participate in pre-construction meetings to review construction limits, safety mitigations, NOTAMs, and understand all special airport operational needs during each phase of the project.

CHAPTER 2. CONSTRUCTION SAFETY AND PHASING PLANS

2.1 **Overview.**

Aviation safety is the primary consideration at airports, especially during construction. The airport operator's CSPP and the contractor's Safety Plan Compliance Document (SPCD) are the primary tools to ensure safety compliance when coordinating construction activities with airport operations. These documents identify all aspects of the construction project that pose a potential safety hazard to airport operations and outline respective mitigation procedures for each hazard. They must provide information necessary for the Airport Operations department to conduct airfield inspections and expeditiously identify and correct unsafe conditions during construction. All aviation safety provisions included within the project drawings, contract specifications, and other related documents must also be reflected in the CSPP and SPCD.

2.2 **Assume Responsibility.**

Operational safety on the airport remains the airport operator's responsibility at all times. The airport operator must develop, certify, and submit for FAA approval each CSPP. It is the airport operator's responsibility to apply the requirements of the FAA approved CSPP. The airport operator must revise the CSPP when conditions warrant changes and must submit the revised CSPP to the FAA for approval. The airport operator must also require and approve a SPCD from the project contractor.

2.3 **Submit the CSPP.**

Construction Safety and Phasing Plans should be developed concurrently with the project design. Milestone versions of the CSPP should be submitted for review and approval as follows. While these milestones are not mandatory, early submission will help to avoid delays. Submittals are preferred in 8.5 × 11 inch or 11 × 17 inch format for compatibility with the FAA's Obstruction Evaluation / Airport Airspace Analysis (OE / AAA) process.

2.3.1 Submit an Outline/Draft.

By the time approximately 25% to 30% of the project design is completed, the principal elements of the CSPP should be established. Airport operators are encouraged to submit an outline or draft, detailing all CSPP provisions developed to date, to the FAA for review at this stage of the project design.

2.3.2 Submit a CSPP.

The CSPP should be formally submitted for FAA approval when the project design is 80 percent to 90 percent complete. Since provisions in the CSPP will influence contract costs, it is important to obtain FAA approval in time to include all such provisions in the procurement contract.

2.3.3 Submit an SPCD.

The contractor should submit the SPCD to the airport operator for approval to be issued prior to the Notice to Proceed.

2.3.4 Submit CSPP Revisions.

All revisions to a previously approved CSPP must be re-submitted to the FAA for review and approval/disapproval action.

2.4 **Meet CSPP Requirements.**

2.4.1 To the extent possible, the CSPP should address the following as outlined in Chapter 3, Guidelines for Writing a CSPP. Details that cannot be determined at this stage are to be included in the SPCD.

1. Coordination.
 - a. Contractor progress meetings.
 - b. Scope or schedule changes.
 - c. FAA ATO coordination.
2. Phasing.
 - a. Phase elements.
 - b. Construction safety drawings.
3. Areas and operations affected by the construction activity.
 - a. Identification of affected areas.
 - b. Mitigation of effects.
4. Protection of navigation aids (NAVAIDs).
5. Contractor access.
 - a. Location of stockpiled construction materials.
 - b. Vehicle and pedestrian operations.
6. Wildlife management.
 - a. Trash.
 - b. Standing water.
 - c. Tall grass and seeds.
 - d. Poorly maintained fencing and gates.
 - e. Disruption of existing wildlife habitat.
7. Foreign Object Debris (FOD) management.
8. Hazardous materials (HAZMAT) management.
9. Notification of construction activities.

- a. Maintenance of a list of responsible representatives/ points of contact.
 - b. NOTAM.
 - c. Emergency notification procedures.
 - d. Coordination with ARFF Personnel.
 - e. Notification to the FAA.
10. Inspection requirements.
 - a. Daily (or more frequent) inspections.
 - b. Final inspections.
 11. Underground utilities.
 12. Penalties.
 13. Special conditions.
 14. Runway and taxiway visual aids. Marking, lighting, signs, and visual NAVAIDs.
 - a. General.
 - b. Markings.
 - c. Lighting and visual NAVAIDs.
 - d. Signs, temporary, including orange construction signs, and permanent signs.
 15. Marking and signs for access routes.
 16. Hazard marking and lighting.
 - a. Purpose.
 - b. Equipment.
 17. Work zone lighting for nighttime construction (if applicable).
 18. Protection of runway and taxiway safety areas, object free areas, obstacle free zones, and approach/departure surfaces.
 - a. Runway Safety Area (RSA).
 - b. Runway Object Free Area (ROFA).
 - c. Taxiway Safety Area (TSA). Provide details for any adjustments to Taxiway Safety Area width to allow continued operation of smaller aircraft. See paragraph 2.22.3.
 - d. Taxiway Object Free Area (TOFA). Provide details for any continued aircraft operations while construction occurs within the TOFA. See paragraph 2.22.4.
 - e. Obstacle Free Zone (OFZ).
 - f. Runway approach/departure surfaces.
 19. Other limitations on construction.
 - a. Prohibitions.

b. Restrictions.

2.4.2 The Safety Plan Compliance Document (SPCD) should include a general statement by the construction contractor that he/she has read and will abide by the CSPP. In addition, the SPCD must include all supplemental information that could not be included in the CSPP prior to the contract award. The contractor statement should include the name of the contractor, the title of the project CSPP, the approval date of the CSPP, and a reference to any supplemental information (that is, “I, (Name of Contractor), have read the (Title of Project) CSPP, approved on (Date), and will abide by it as written and with the following additions as noted:”). The supplemental information in the SPCD should be written to match the format of the CSPP indicating each subject by corresponding CSPP subject number and title. If no supplemental information is necessary for any specific subject, the statement, “No supplemental information,” should be written after the corresponding subject title. The SPCD should not duplicate information in the CSPP:

1. Coordination. Discuss details of proposed safety meetings with the airport operator and with contractor employees and subcontractors.
2. Phasing. Discuss proposed construction schedule elements, including:
 - a. Duration of each phase.
 - b. Daily start and finish of construction, including “night only” construction.
 - c. Duration of construction activities during:
 - i. Normal runway operations.
 - ii. Closed runway operations.
 - iii. Modified runway “Aircraft Reference Code” usage.
3. Areas and operations affected by the construction activity. These areas and operations should be identified in the CSPP and should not require an entry in the SPCD.
4. Protection of NAVAIDs. Discuss specific methods proposed to protect operating NAVAIDs.
5. Contractor access. Provide the following:
 - a. Details on how the contractor will maintain the integrity of the airport security fence (gate guards, daily log of construction personnel, and other).
 - b. Listing of individuals requiring driver training (for certificated airports and as requested).
 - c. Radio communications.
 - i. Types of radios and backup capabilities.
 - ii. Who will be monitoring radios.
 - iii. Who to contact if the ATCT cannot reach the contractor’s designated person by radio.

- d. Details on how the contractor will escort material delivery vehicles.
6. Wildlife management. Discuss the following:
 - a. Methods and procedures to prevent wildlife attraction.
 - b. Wildlife reporting procedures.
7. Foreign Object Debris (FOD) management. Discuss equipment and methods for control of FOD, including construction debris and dust.
8. Hazardous Materials (HAZMAT) management. Discuss equipment and methods for responding to hazardous spills.
9. Notification of construction activities. Provide the following:
 - a. Contractor points of contact.
 - b. Contractor emergency contact.
 - c. Listing of tall or other requested equipment proposed for use on the airport and the timeframe for submitting 7460-1 forms not previously submitted by the airport operator.
 - d. Batch plant details, including 7460-1 submittal.
10. Inspection requirements. Discuss daily (or more frequent) inspections and special inspection procedures.
11. Underground utilities. Discuss proposed methods of identifying and protecting underground utilities.
12. Penalties. Penalties should be identified in the CSPP and should not require an entry in the SPCD.
13. Special conditions. Discuss proposed actions for each special condition identified in the CSPP.
14. Runway and taxiway visual aids. Including marking, lighting, signs, and visual NAVAIDs. Discuss proposed visual aids including the following:
 - a. Equipment and methods for covering signage and airfield lights.
 - b. Equipment and methods for temporary closure markings (paint, fabric, other).
 - c. Temporary orange construction signs.
 - d. Types of temporary Visual Guidance Slope Indicators (VGSI).
15. Marking and signs for access routes. Discuss proposed methods of demarcating access routes for vehicle drivers.
16. Hazard marking and lighting. Discuss proposed equipment and methods for identifying excavation areas.
17. Work zone lighting for nighttime construction (if applicable). Discuss proposed equipment, locations, aiming, and shielding to prevent interference with air traffic control and aircraft operations.

18. Protection of runway and taxiway safety areas, object free areas, obstacle free zones, and approach/departure surfaces. Discuss proposed methods of identifying, demarcating, and protecting airport surfaces including:
 - a. Equipment and methods for maintaining Taxiway Safety Area standards.
 - b. Equipment and methods to ensure the safe passage of aircraft where Taxiway Safety Area or Taxiway Object Free Area standards cannot be maintained.
 - c. Equipment and methods for separation of construction operations from aircraft operations, including details of barricades.
19. Other limitations on construction should be identified in the CSPP and should not require an entry in the SPCD.

2.5 **Coordination.**

Airport operators, or tenants responsible for design, bidding and conducting construction on their leased properties, should ensure at all project developmental stages, such as predesign, prebid, and preconstruction conferences, they capture the subject of airport operational safety during construction (see [AC 150/5370-12, *Quality Management for Federally Funded Airport Construction Projects*](#)). In addition, the following should be coordinated as required:

2.5.1 Progress Meetings.

Operational safety should be a standing agenda item for discussion during progress meetings throughout the project developmental stages.

2.5.2 Scope or Schedule Changes.

Changes in the scope or duration at any of the project stages may require revisions to the CSPP and review and approval by the airport operator and the FAA (see paragraph [1.4.2.17](#)).

2.5.3 FAA ATO Coordination.

Early coordination with FAA ATO is highly recommended during the design phase and is required for scheduling Technical Operations shutdowns prior to construction. Coordination is critical to restarts of NAVAID services and to the establishment of any special procedures for the movement of aircraft. Formal agreements between the airport operator and appropriate FAA offices are recommended. All relocation or adjustments to NAVAIDs, or changes to final grades in critical areas, should be coordinated with FAA ATO and may require an FAA flight inspection prior to restarting the facility. Flight inspections must be coordinated and scheduled well in advance of the intended facility restart. Flight inspections may require a reimbursable agreement between the airport operator and FAA ATO. Reimbursable agreements should be coordinated a minimum of 12 months prior to the start of construction. (See paragraph [2.13.5.3.2](#) for required FAA notification regarding FAA-owned NAVAIDs.)

2.6 **Phasing.**

Once it has been determined what types and levels of airport operations will be maintained, the most efficient sequence of construction may not be feasible. In this case, the sequence of construction may be phased to gain maximum efficiency while allowing for the required operations. The development of the resulting construction phases should be coordinated with local Air Traffic personnel and airport users. The sequenced construction phases established in the CSPP must be incorporated into the project design and must be reflected in the contract drawings and specifications.

2.6.1 Phase Elements.

For each phase the CSPP should detail:

- Areas closed to aircraft operations.
- Duration of closures.
- Taxi routes and/or areas of reduced TSA and TOFA to reflect reduced ADG use.
- ARFF access routes.
- Construction staging, disposal, and cleanout areas.
- Construction access and haul routes.
- Impacts to NAVAIDs.
- Lighting, marking, and signing changes.
- Available runway length and/or reduced RSA and ROFA to reflect reduced ADG use.
- Declared distances (if applicable).
- Required hazard marking, lighting, and signing.
- Work zone lighting for nighttime construction (if applicable).
- Lead times for required notifications.

2.6.2 Construction Safety Drawings.

Drawings specifically indicating operational safety procedures and methods in affected areas (i.e., construction safety drawings) should be developed for each construction phase. Such drawings should be included in the CSPP as referenced attachments and should also be included in the contract drawing package.

2.7 **Areas and Operations Affected by Construction Activity.**

Runways and taxiways should remain in use by aircraft to the maximum extent possible without compromising safety. Pre-meetings with the FAA ATO will support operational simulations. See Appendix E for an example of a table showing temporary operations versus current operations. The tables in Appendix E can be useful for coordination among all interested parties, including FAA Lines of Business.

2.7.1 Identification of Affected Areas.

Identifying areas and operations affected by the construction helps to determine possible safety problems. The affected areas should be identified in the construction safety drawings for each construction phase. (See paragraph 2.6.2.) Of particular concern are:

2.7.1.1 **Closing, or Partial Closing, of Runways, Taxiways and Aprons, and Displaced Thresholds.**

When a runway is partially closed, a portion of the pavement is unavailable for any aircraft operation, meaning taxiing, landing, or takeoff in either direction on that pavement is prohibited. A displaced threshold, by contrast, is established to ensure obstacle clearance and adequate safety area for landing aircraft. The pavement prior to the displaced threshold is normally available for take-off in the direction of the displacement and for landing and takeoff in the opposite direction. Misunderstanding this difference, may result in issuance of an inaccurate NOTAM, and can lead to a hazardous condition.

2.7.1.1.1 Partially Closed Runways.

The temporarily closed portion of a partially closed runway will generally extend from the threshold to a taxiway that may be used for entering and exiting the runway. If the closed portion extends to a point between taxiways, pilots will have to back-taxi on the runway, which is an undesirable operation. See Figure 2-1 for a desirable configuration.

2.7.1.1.2 Displaced Thresholds.

Since the portion of the runway pavement between the permanent threshold and a standard displaced threshold is available for takeoff and for landing in the opposite direction, the temporary displaced threshold need not be located at an entrance/exit taxiway. See Figure 2-2.

2.7.1.2 Closing of aircraft rescue and fire fighting access routes.

2.7.1.3 Closing of access routes used by airport and airline support vehicles.

2.7.1.4 Interruption of utilities, including water supplies for fire fighting.

2.7.1.5 Approach/departure surfaces affected by heights of objects.

2.7.1.6 Construction areas, storage areas, and access routes near runways, taxiways, aprons, or helipads.

Figure 2-1. Temporary Partially Closed Runway

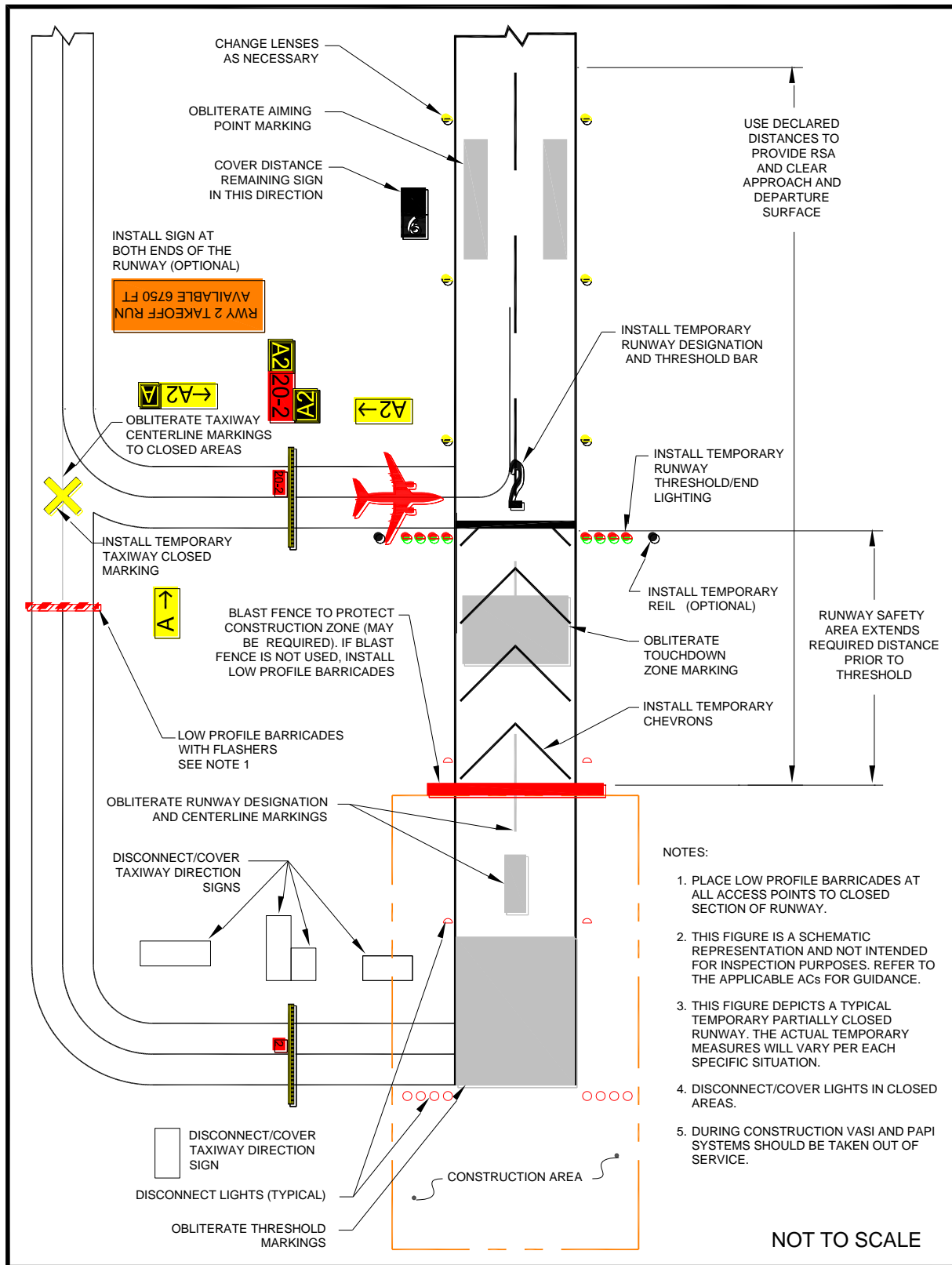
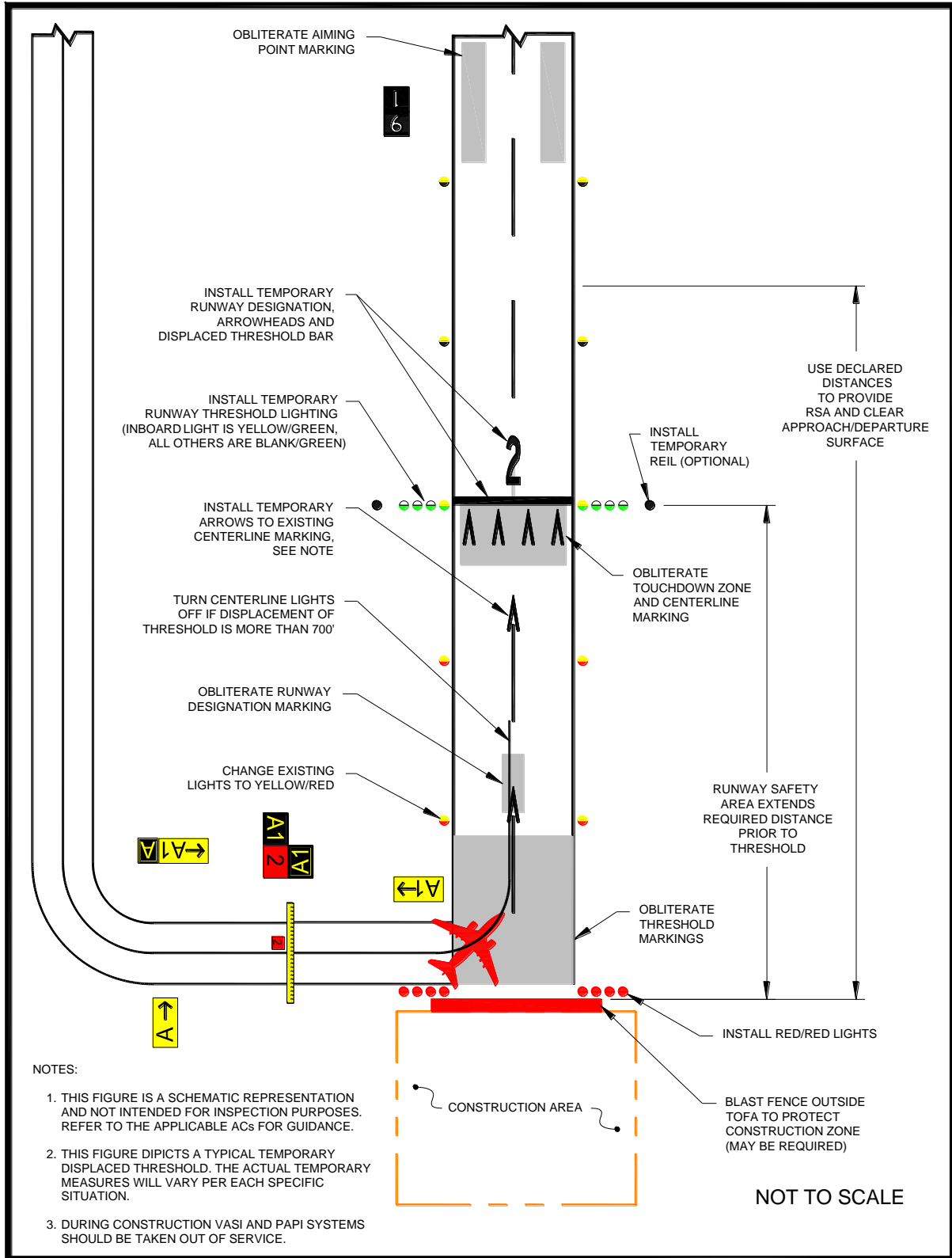


Figure 2-2. Temporary Displaced Threshold



Note: See paragraph 2.18.2.5.

2.7.2 Mitigation of Effects.

Establishment of specific procedures is necessary to maintain the safety and efficiency of airport operations. The CSPP must address:

- 2.7.2.1 Temporary changes to runway and/or taxi operations.
- 2.7.2.2 Detours for ARFF and other airport vehicles.
- 2.7.2.3 Maintenance of essential utilities.
- 2.7.2.4 Temporary changes to air traffic control procedures. Such changes must be coordinated with the ATO.

2.8 **Navigation Aid (NAVAID) Protection.**

Before commencing construction activity, parking vehicles, or storing construction equipment and materials near a NAVAID, coordinate with the appropriate FAA ATO/Technical Operations office to evaluate the effect of construction activity and the required distance and direction from the NAVAID. (See paragraph 2.13.5.3.) Construction activities, materials/equipment storage, and vehicle parking near electronic NAVAIDs require special consideration since they may interfere with signals essential to air navigation. If any NAVAID may be affected, the CSPP and SPCD must show an understanding of the “critical area” associated with each NAVAID and describe how it will be protected. Where applicable, the operational critical areas of NAVAIDs should be graphically delineated on the project drawings. Pay particular attention to stockpiling material, as well as to movement and parking of equipment that may interfere with line of sight from the ATCT or with electronic emissions. Interference from construction equipment and activities may require NAVAID shutdown or adjustment of instrument approach minimums for low visibility operations. This condition requires that a NOTAM be filed (see paragraph 2.13.2.) Construction activities and materials/equipment storage near a NAVAID must not obstruct access to the equipment and instruments for maintenance. Submittal of a 7460-1 form is required for construction vehicles operating near FAA NAVAIDs. (See paragraph 2.13.5.3.)

2.9 **Contractor Access.**

The CSPP must detail the areas to which the contractor must have access, and explain how contractor personnel will access those areas. Specifically address:

2.9.1 Location of Stockpiled Construction Materials.

Stockpiled materials and equipment storage are not permitted within the RSA and OFZ, and if possible should not be permitted within the Object Free Area (OFA) of an operational runway. Stockpiling material in the OFA requires submittal of a 7460-1 form and justification provided to the appropriate FAA Airports Regional or District Office for approval. The airport operator must ensure that stockpiled materials and equipment adjacent to these areas are prominently marked and lighted during hours of restricted visibility or darkness. (See paragraph 2.18.2.) This includes determining and

verifying that materials are stabilized and stored at an approved location so as not to be a hazard to aircraft operations and to prevent attraction of wildlife and foreign object damage from blowing or tracked material. See paragraphs [2.10](#) and [2.11](#).

2.9.2 Vehicle and Pedestrian Operations.

The CSPP should include specific vehicle and pedestrian requirements. Vehicle and pedestrian access routes for airport construction projects must be controlled to prevent inadvertent or unauthorized entry of persons, vehicles, or animals onto the AOA. The airport operator should coordinate requirements for vehicle operations with airport tenants, contractors, and the FAA air traffic manager. In regard to vehicle and pedestrian operations, the CSPP should include the following, with associated training requirements:

2.9.2.1 **Construction Site Parking.**

Designate in advance vehicle parking areas for contractor employees to prevent any unauthorized entry of persons or vehicles onto the AOA. These areas should provide reasonable contractor employee access to the job site.

2.9.2.2 **Construction Equipment Parking.**

Contractor employees must park and service all construction vehicles in an area designated by the airport operator outside the OFZ and never in the safety area of an active runway or taxiway. Unless a complex setup procedure makes movement of specialized equipment infeasible, inactive equipment must not be parked on a closed taxiway or runway. If it is necessary to leave specialized equipment on a closed taxiway or runway at night, the equipment must be well lighted. Employees should also park construction vehicles outside the OFA when not in use by construction personnel (for example, overnight, on weekends, or during other periods when construction is not active). Parking areas must not obstruct the clear line of sight by the ATCT to any taxiways or runways under air traffic control nor obstruct any runway visual aids, signs, or navigation aids. The FAA must also study those areas to determine effects on airport design criteria, surfaces established by 14 CFR Part 77, Safe, Efficient Use, and Preservation of the Navigable Airspace (Part 77), and on NAVAIDs and Instrument Approach Procedures (IAP). See paragraph [2.13.1](#) for further information.

2.9.2.3 **Access and Haul Roads.**

Determine the construction contractor's access to the construction sites and haul roads. Do not permit the construction contractor to use any access or haul roads other than those approved. Access routes used by contractor vehicles must be clearly marked to prevent inadvertent entry to areas open to airport operations. Pay special attention to ensure that if construction traffic is to share or cross any ARFF routes that ARFF right of way is not impeded at any time, and that construction traffic on haul

roads does not interfere with NAVAIDs or approach surfaces of operational runways. Address whether access gates will be blocked or inoperative or if a rally point will be blocked or inaccessible.

- 2.9.2.4 Marking and lighting of vehicles in accordance with AC 150/5210-5, *Painting, Marking, and Lighting of Vehicles Used on an Airport*.
- 2.9.2.5 Description of proper vehicle operations on various areas under normal, lost communications, and emergency conditions.
- 2.9.2.6 Required escorts.
- 2.9.2.7 **Training Requirements for Vehicle Drivers to Ensure Compliance with the Airport Operator's Vehicle Rules and Regulations.**
Specific training should be provided to vehicle operators, including those providing escorts. See AC 150/5210-20, *Ground Vehicle Operations on Airports*, for information on training and records maintenance requirements.
- 2.9.2.8 **Situational Awareness.**
Vehicle drivers must confirm by personal observation that no aircraft is approaching their position (either in the air or on the ground) when given clearance to cross a runway, taxiway, or any other area open to airport operations. In addition, it is the responsibility of the escort vehicle driver to verify the movement/position of all escorted vehicles at any given time. At non-towered airports, all aircraft movements and flight operations rely on aircraft operators to self-report their positions and intentions. However, there is no requirement for an aircraft to have radio communications. Because aircraft do not always broadcast their positions or intentions, visual checking, radio monitoring, and situational awareness of the surroundings is critical to safety.
- 2.9.2.9 **Two-Way Radio Communication Procedures.**
- 2.9.2.9.1 General.
The airport operator must ensure that tenant and construction contractor personnel engaged in activities involving unescorted operation on aircraft movement areas observe the proper procedures for communications, including using appropriate radio frequencies at airports with and without ATCT. When operating vehicles on or near open runways or taxiways, construction personnel must understand the critical importance of maintaining radio contact, as directed by the airport operator, with:
1. Airport operations
 2. ATCT

3. Common Traffic Advisory Frequency (CTAF), which may include UNICOM, MULTICOM.
4. Automatic Terminal Information Service (ATIS). This frequency is useful for monitoring conditions on the airport. Local air traffic will broadcast information regarding construction related runway closures and “shortened” runways on the ATIS frequency.

2.9.2.9.2 Areas Requiring Two-Way Radio Communication with the ATCT.

Vehicular traffic crossing active movement areas must be controlled either by two-way radio with the ATCT, escort, flagman, signal light, or other means appropriate for the particular airport.

2.9.2.9.3 Frequencies to be Used.

The airport operator will specify the frequencies to be used by the contractor, which may include the CTAF for monitoring of aircraft operations. Frequencies may also be assigned by the airport operator for other communications, including any radio frequency in compliance with Federal Communications Commission requirements. At airports with an ATCT, the airport operator will specify the frequency assigned by the ATCT to be used between contractor vehicles and the ATCT.

2.9.2.9.4 Proper radio usage, including read back requirements.

2.9.2.9.5 Proper phraseology, including the International Phonetic Alphabet.

2.9.2.9.6 Light Gun Signals.

Even though radio communication is maintained, escort vehicle drivers must also familiarize themselves with ATCT light gun signals in the event of radio failure. See the FAA safety placard “Ground Vehicle Guide to Airport Signs and Markings.” This safety placard may be downloaded through the Runway Safety Program Web site at http://www.faa.gov/airports/runway_safety/publications/ (see “Signs & Markings Vehicle Dashboard Sticker”) or obtained from the FAA Airports Regional Office.

2.9.2.10 **Maintenance of the secured area of the airport, including:**

2.9.2.10.1 Fencing and Gates.

Airport operators and contractors must take care to maintain security during construction when access points are created in the security fencing to permit the passage of construction vehicles or personnel. Temporary gates should be equipped so they can be securely closed and locked to prevent access by animals and unauthorized people. Procedures should be in place to ensure that only authorized persons and vehicles have access to the AOA and to prohibit “piggybacking” behind another person or vehicle. The Department of Transportation (DOT) document DOT/FAA/AR-

00/52, *Recommended Security Guidelines for Airport Planning and Construction*, provides more specific information on fencing. A copy of this document can be obtained from the Airport Consultants Council, Airports Council International, or American Association of Airport Executives.

2.9.2.10.2 Badging Requirements.

Airports subject to 49 CFR Part 1542, *Airport Security*, must meet standards for access control, movement of ground vehicles, and identification of construction contractor and tenant personnel.

2.10 **Wildlife Management.**

The CSPP and SPCD must be in accordance with the airport operator's wildlife hazard management plan, if applicable. See AC 150/5200-33, *Hazardous Wildlife Attractants On or Near Airports*, and CertAlert 98-05, *Grasses Attractive to Hazardous Wildlife*. Construction contractors must carefully control and continuously remove waste or loose materials that might attract wildlife. Contractor personnel must be aware of and avoid construction activities that can create wildlife hazards on airports, such as:

2.10.1 Trash.

Food scraps must be collected from construction personnel activity.

2.10.2 Standing Water.

2.10.3 Tall Grass and Seeds.

Requirements for turf establishment can be at odds with requirements for wildlife control. Grass seed is attractive to birds. Lower quality seed mixtures can contain seeds of plants (such as clover) that attract larger wildlife. Seeding should comply with the guidance in AC 150/5370-10, *Standards for Specifying Construction of Airports*, Item T-901, Seeding. Contact the local office of the United States Department of Agriculture Soil Conservation Service or the State University Agricultural Extension Service (County Agent or equivalent) for assistance and recommendations. These agencies can also provide liming and fertilizer recommendations.

2.10.4 Poorly Maintained Fencing and Gates.

See paragraph 2.9.2.10.1.

2.10.5 Disruption of Existing Wildlife Habitat.

While this will frequently be unavoidable due to the nature of the project, the CSPP should specify under what circumstances (location, wildlife type) contractor personnel should immediately notify the airport operator of wildlife sightings.

2.11 Foreign Object Debris (FOD) Management.

Waste and loose materials, commonly referred to as FOD, are capable of causing damage to aircraft landing gears, propellers, and jet engines. Construction contractors must not leave or place FOD on or near active aircraft movement areas. Materials capable of creating FOD must be continuously removed during the construction project. Fencing (other than security fencing) or covers may be necessary to contain material that can be carried by wind into areas where aircraft operate. See AC 150/5210-24, *Foreign Object Debris (FOD) Management*.

2.12 Hazardous Materials (HAZMAT) Management.

Contractors operating construction vehicles and equipment on the airport must be prepared to expeditiously contain and clean-up spills resulting from fuel or hydraulic fluid leaks. Transport and handling of other hazardous materials on an airport also requires special procedures. See AC 150/5320-15, *Management of Airport Industrial Waste*.

2.13 Notification of Construction Activities.

The CSPP and SPCD must detail procedures for the immediate notification of airport users and the FAA of any conditions adversely affecting the operational safety of the airport. It must address the notification actions described below, as applicable.

2.13.1 List of Responsible Representatives/points of contact for all involved parties, and procedures for contacting each of them, including after hours.

2.13.2 NOTAMs.

Only the airport operator may initiate or cancel NOTAMs on airport conditions, and is the only entity that can close or open a runway. The airport operator must coordinate the issuance, maintenance, and cancellation of NOTAMs about airport conditions resulting from construction activities with tenants and the local air traffic facility (control tower, approach control, or air traffic control center), and must either enter the NOTAM into NOTAM Manager, or provide information on closed or hazardous conditions on airport movement areas to the FAA Flight Service Station (FSS) so it can issue a NOTAM. The airport operator must file and maintain a list of authorized representatives with the FSS. Refer to AC 150/5200-28, *Notices to Airmen (NOTAMs) for Airport Operators*, for a sample NOTAM form. Only the FAA may issue or cancel NOTAMs on shutdown or irregular operation of FAA owned facilities. Any person having reason to believe that a NOTAM is missing, incomplete, or inaccurate must notify the airport operator. See paragraph 2.7.1.1 about issuing NOTAMs for partially closed runways versus runways with displaced thresholds.

2.13.3 Emergency notification procedures for medical, fire fighting, and police response.

2.13.4 Coordination with ARFF.

The CSPP must detail procedures for coordinating through the airport sponsor with ARFF personnel, mutual aid providers, and other emergency services if construction requires:

1. The deactivation and subsequent reactivation of water lines or fire hydrants, or
2. The rerouting, blocking and restoration of emergency access routes, or
3. The use of hazardous materials on the airfield.

2.13.5 Notification to the FAA.

2.13.5.1 **Part 77.**

Any person proposing construction or alteration of objects that affect navigable airspace, as defined in Part 77, must notify the FAA. This includes construction equipment and proposed parking areas for this equipment (i.e., cranes, graders, other equipment) on airports. FAA Form 7460-1, *Notice of Proposed Construction or Alteration*, can be used for this purpose and submitted to the appropriate FAA Airports Regional or District Office. See Appendix A to download the form. Further guidance is available on the FAA web site at oeaaa.faa.gov.

2.13.5.2 **Part 157.**

With some exceptions, Title 14 CFR Part 157, *Notice of Construction, Alteration, Activation, and Deactivation of Airports*, requires that the airport operator notify the FAA in writing whenever a non-Federally funded project involves the construction of a new airport; the construction, realigning, altering, activating, or abandoning of a runway, landing strip, or associated taxiway; or the deactivation or abandoning of an entire airport. Notification involves submitting FAA Form 7480-1, *Notice of Landing Area Proposal*, to the nearest FAA Airports Regional or District Office. See Appendix A to download the form.

2.13.5.3 **NAVAIDs.**

For emergency (short-notice) notification about impacts to both airport owned and FAA owned NAVAIDs, contact: 866-432-2622.

2.13.5.3.1 Airport Owned/FAA Maintained.

If construction operations require a shutdown of 24 hours or greater in duration, or more than 4 hours daily on consecutive days, of a NAVAID owned by the airport but maintained by the FAA, provide a 45-day minimum notice to FAA ATO/Technical Operations prior to facility shutdown, using Strategic Event Coordination (SEC) Form 6000.26 contained within FAA Order 6000.15, *General Maintenance Handbook for National Airspace System (NAS) Facilities*.

2.13.5.3.2 FAA Owned.

1. The airport operator must notify the appropriate FAA ATO Service Area Planning and Requirements (P&R) Group a minimum of 45 days prior to implementing an event that causes impacts to NAVAIDs, using SEC Form 6000.26.
2. Coordinate work for an FAA owned NAVAID shutdown with the local FAA ATO/Technical Operations office, including any necessary reimbursable agreements and flight checks. Detail procedures that address unanticipated utility outages and cable cuts that could impact FAA NAVAIDs. Refer to active Service Level Agreement with ATO for specifics.

2.14 **Inspection Requirements.**

2.14.1 Daily Inspections.

Inspections should be conducted at least daily, but more frequently if necessary to ensure conformance with the CSPP. A sample checklist is provided in Appendix D, Construction Project Daily Safety Inspection Checklist. See also AC 150/5200-18, Airport Safety Self-Inspection. Airport operators holding a Part 139 certificate are required to conduct self-inspections during unusual conditions, such as construction activities, that may affect safe air carrier operations.

2.14.2 Interim Inspections.

Inspections should be conducted of all areas to be (re)opened to aircraft traffic to ensure the proper operation of lights and signs, for correct markings, and absence of FOD. The contractor should conduct an inspection of the work area with airport operations personnel. The contractor should ensure that all construction materials have been secured, all pavement surfaces have been swept clean, all transition ramps have been properly constructed, and that surfaces have been appropriately marked for aircraft to operate safely. Only if all items on the list meet with the airport operator's approval should the air traffic control tower be notified to open the area to aircraft operations. The contractor should be required to retain a suitable workforce and the necessary equipment at the work area for any last minute cleanup that may be requested by the airport operator prior to opening the area.

2.14.3 Final Inspections.

New runways and extended runway closures may require safety inspections at certificated airports prior to allowing air carrier service. Coordinate with the FAA Airport Certification Safety Inspector (ACSI) to determine if a final inspection will be necessary.

2.15 Underground Utilities.

The CSPP and/or SPCD must include procedures for locating and protecting existing underground utilities, cables, wires, pipelines, and other underground facilities in excavation areas. This may involve coordinating with public utilities and FAA ATO/Technical Operations. Note that “One Call” or “Miss Utility” services do not include FAA ATO/Technical Operations.

2.16 Penalties.

The CSPP should detail penalty provisions for noncompliance with airport rules and regulations and the safety plans (for example, if a vehicle is involved in a runway incursion). Such penalties typically include rescission of driving privileges or access to the AOA.

2.17 Special Conditions.

The CSPP must detail any special conditions that affect the operation of the airport and will require the activation of any special procedures (for example, low-visibility operations, snow removal, aircraft in distress, aircraft accident, security breach, Vehicle / Pedestrian Deviation (VPD) and other activities requiring construction suspension/resumption).

2.18 Runway and Taxiway Visual Aids.

This includes marking, lighting, signs, and visual NAVAIDs. The CSPP must ensure that areas where aircraft will be operating are clearly and visibly separated from construction areas, including closed runways. Throughout the duration of the construction project, verify that these areas remain clearly marked and visible at all times and that marking, lighting, signs, and visual NAVAIDs that are to continue to perform their functions during construction remain in place and operational. Visual NAVAIDs that are not serving their intended function during construction must be temporarily disabled, covered, or modified as necessary. The CSPP must address the following, as appropriate:

2.18.1 General.

Airport markings, lighting, signs, and visual NAVAIDs must be clearly visible to pilots, not misleading, confusing, or deceptive. All must be secured in place to prevent movement by prop wash, jet blast, wing vortices, and other wind currents and constructed of materials that will minimize damage to an aircraft in the event of inadvertent contact. Items used to secure such markings must be of a color similar to the marking.

2.18.2 Markings.

During the course of construction projects, temporary pavement markings are often required to allow for aircraft operations during or between work periods. During the design phase of the project, the designer should coordinate with the project manager,

airport operations, airport users, the FAA Airports project manager, and Airport Certification Safety Inspector for Part 139 airports to determine minimum temporary markings. The FAA Airports project manager will, wherever a runway is closed, coordinate with the appropriate FAA Flight Standards Office and disseminate findings to all parties. Where possible, the temporary markings on finish grade pavements should be placed to mirror the dimensions of the final markings. Markings must be in compliance with the standards of AC 150/5340-1, *Standards for Airport Markings*, except as noted herein. Runways and runway exit taxiways closed to aircraft operations are marked with a yellow X. The preferred visual aid to depict temporary runway closure is the lighted X signal placed on or near the runway designation numbers. (See paragraph 2.18.2.1.2.)

2.18.2.1 **Closed Runways and Taxiways.**

2.18.2.1.1 Permanently Closed Runways.

For runways, obliterate the threshold marking, runway designation marking, and touchdown zone markings, and place an X at each end and at 1,000-foot (300 m) intervals. For a multiple runway environment, if the lighted X on a designated number will be located in the RSA of an adjacent active runway, locate the lighted X farther down the closed runway to clear the RSA of the active runway. In addition, the closed runway numbers located in the RSA of an active runway must be marked with a flat yellow X.

2.18.2.1.2 Temporarily Closed Runways.

For runways that have been temporarily closed, place an X at each end of the runway directly on or as near as practicable to the runway designation numbers. For a multiple runway environment, if the lighted X on a designated number will be located in the RSA of an adjacent active runway, locate the lighted X farther down the closed runway to clear the RSA of the active runway. In addition, the closed runway numbers located in the RSA of an active runway must be marked with a flat yellow X. See Figure 2-3. See also paragraph 2.18.3.3.

2.18.2.1.3 Partially Closed Runways and Displaced Thresholds.

When threshold markings are needed to identify the temporary beginning of the runway that is available for landing, the markings must comply with AC 150/5340-1. An X is not used on a partially closed runway or a runway with a displaced threshold. See paragraph 2.7.1.1 for the difference between partially closed runways and runways with displaced thresholds. Because of the temporary nature of threshold displacement due to construction, it is not necessary to re-adjust the existing runway centerline markings to meet standard spacing for a runway with a visual approach. Some of the requirements below may be waived in the cases of low-activity airports and/or short duration changes that are measured in days rather than weeks. Consider whether the presence of an airport traffic

control tower allows for the development of special procedures. Contact the appropriate FAA Airports Regional or District Office for assistance.

Figure 2-3. Markings for a Temporarily Closed Runway

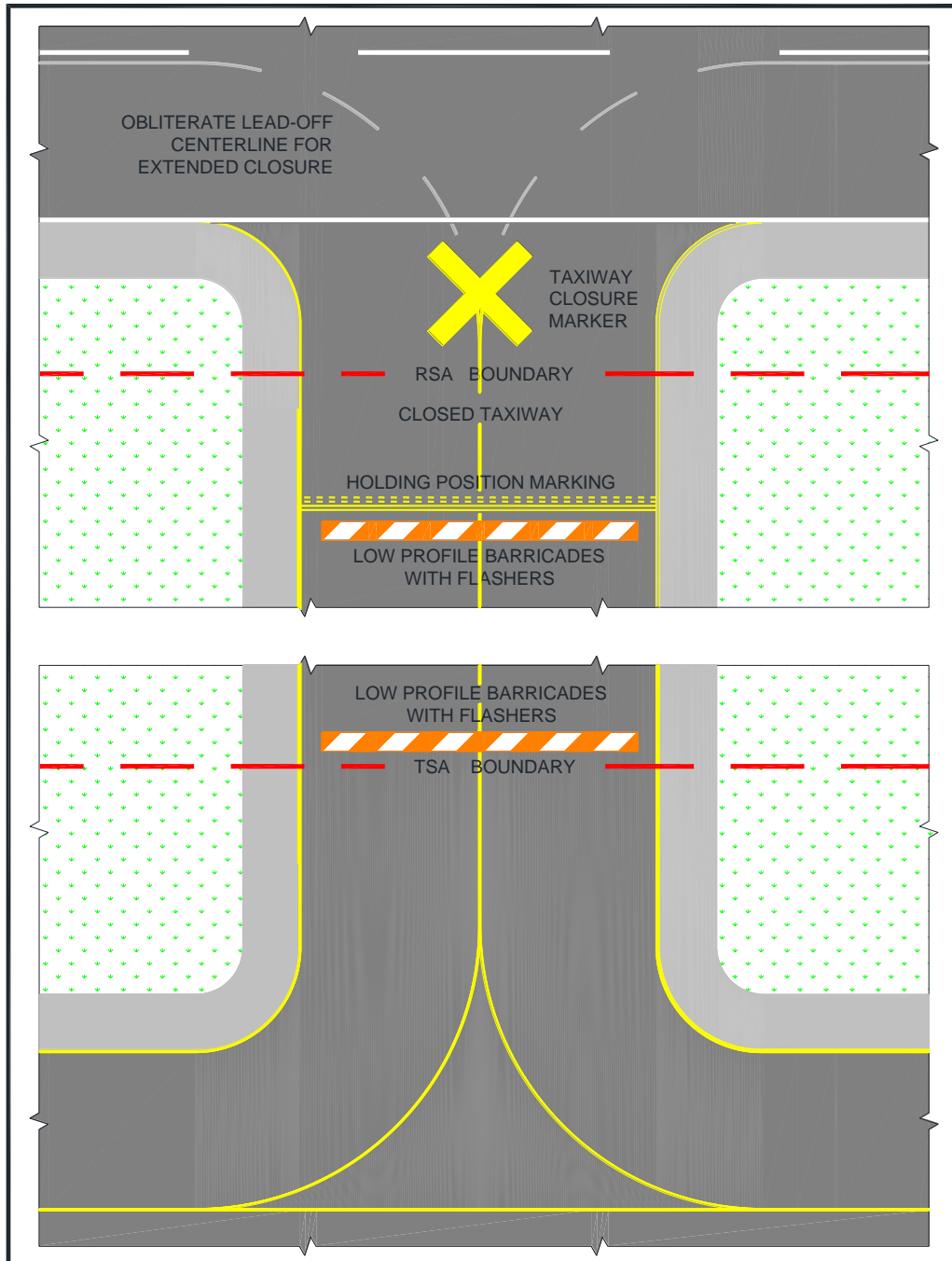


1. **Partially Closed Runways.** Pavement markings for temporary closed portions of the runway consist of a runway threshold bar, runway designation, and yellow chevrons to identify pavement areas that are unsuitable for takeoff or landing (see [AC 150/5340-1](#)). Obliterate or cover markings prior to the moved threshold. Existing touchdown zone markings beyond the moved threshold may remain in place. Obliterate aiming point markings. Issue appropriate NOTAMs regarding any nonstandard markings. See [Figure 2-4](#).
2. **Displaced Thresholds.** Pavement markings for a displaced threshold consist of a runway threshold bar, runway designation, and white arrowheads with and without arrow shafts. These markings are required to identify the portion of the runway before the displaced threshold to provide centerline guidance for pilots during approaches, takeoffs, and landing rollouts from the opposite direction. See [AC 150/5340-1](#). Obliterate markings prior to the displaced threshold. Existing touchdown zone markings beyond the displaced threshold may remain in place. Obliterate aiming point markings. Issue appropriate NOTAMs regarding any nonstandard markings. See [Figure 2-2](#).

2.18.2.1.4 Taxiways.

1. **Permanently Closed Taxiways.** *AC 150/5300-13 Airport Design*, notes that it is preferable to remove the pavement, but for pavement that is to remain, place an X at the entrance to both ends of the closed section. Obliterate taxiway centerline markings, including runway leadoff lines, leading to the closed taxiway. See [Figure 2-4](#).

Figure 2-4. Temporary Taxiway Closure



2. **Temporarily Closed Taxiways.** Place barricades outside the safety area of intersecting taxiways. For runway/taxiway intersections, place an X at the entrance to the closed taxiway from the runway. If the taxiway will be closed for an extended period, obliterate taxiway centerline markings, including runway leadoff lines and taxiway to taxiway turns, leading to the closed section. Always obliterate runway lead-off lines for high speed exits, regardless of the duration of the closure. If the centerline markings will be reused upon reopening the taxiway, it is preferable to paint over the marking. This will result in less damage to the pavement when the upper layer of paint is ultimately removed. See Figure 2-4.

2.18.2.1.5 Temporarily Closed Airport.

When the airport is closed temporarily, mark all the runways as closed.

- 2.18.2.2 If unable to paint temporary markings on the pavement, construct them from any of the following materials: fabric, colored plastic, painted sheets of plywood, or similar materials. They must be properly configured and appropriately secured to prevent movement by prop wash, jet blast, or other wind currents. Items used to secure such markings must be of a color similar to the marking.

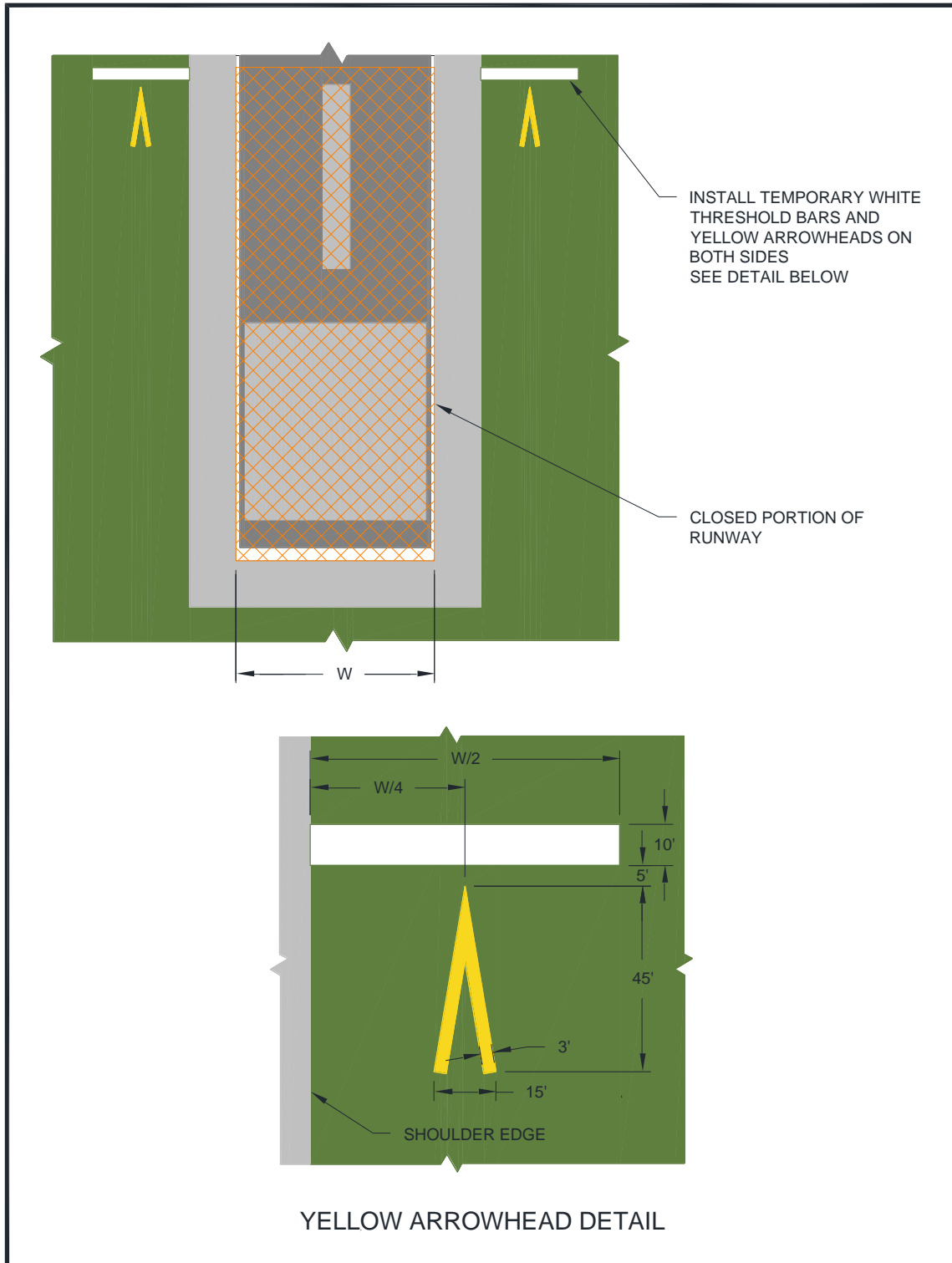
- 2.18.2.3 It may be necessary to remove or cover runway markings, including but not limited to, runway designation markings, threshold markings, centerline markings, edge stripes, touchdown zone markings and aiming point markings, depending on the length of construction and type of activity at the airport. When removing runway markings, apply the same treatment to areas between stripes or numbers, as the cleaned area will appear to pilots as a marking in the shape of the treated area.

- 2.18.2.4 If it is not possible to install threshold bars, chevrons, and arrows on the pavement, “temporary outboard white threshold bars and yellow arrowheads”, see Figure 2-5, may be used. Locate them outside of the runway pavement surface on both sides of the runway. The dimensions must be as shown in Figure 2-5. If the markings are not discernible on grass or snow, apply a black background with appropriate material over the ground to ensure they are clearly visible.

- 2.18.2.5 The application rate of paint to mark a short-term temporary runway and taxiway markings may deviate from the standard (see Item P-620, “Runway and Taxiway Painting,” in AC 150/5370-10), but the dimensions must meet the existing standards. When applying temporary markings at night, it is recommended that the fast curing, Type II paint be used to help offset the higher humidity and cooler temperatures often experienced at night. Diluting the paint will substantially increase cure time and is not recommended. Glass beads are not recommended for temporary markings. Striated markings may also be used for certain temporary markings. AC

150/5340-1, *Standards for Airport Markings*, has additional guidance on temporary markings.

Figure 2-5. Temporary Outboard White Threshold Bars and Yellow Arrowheads



2.18.3 Lighting and Visual NAVAIDs.

This paragraph refers to standard runway and taxiway lighting systems. See below for hazard lighting. Lighting installation must be in conformance with AC 150/5340-30, *Design and Installation Details for Airport Visual Aids*, and fixture design in conformance with AC 150/5345-50, *Specification for Portable Runway and Taxiway Lights*. When disconnecting runway and taxiway lighting fixtures, disconnect the associated isolation transformers. See AC 150/5340-26, *Maintenance of Airport Visual Aid Facilities*, for disconnect procedures and safety precautions. Alternately, cover the light fixture in such a way as to prevent light leakage. Avoid removing the lamp from energized fixtures because an excessive number of isolation transformers with open secondaries may damage the regulators and/or increase the current above its normal value. Secure, identify, and place any above ground temporary wiring in conduit to prevent electrocution and fire ignition sources. Maintain mandatory hold signs to operate normally in any situation where pilots or vehicle drivers could mistakenly be in that location. At towered airports certificated under Part 139, holding position signs are required to be illuminated on open taxiways crossing to closed or inactive runways. If the holding position sign is installed on the runway circuit for the closed runway, install a jumper to the taxiway circuit to provide power to the holding position sign for nighttime operations. Where it is not possible to maintain power to signs that would normally be operational, install barricades to exclude aircraft. Figure 2-1, Figure 2-2, Figure 2-3, and Figure 2-4 illustrate temporary changes to lighting and visual NAVAIDs.

2.18.3.1 **Permanently Closed Runways and Taxiways.**

For runways and taxiways that have been permanently closed, disconnect the lighting circuits.

2.18.3.2 **Temporarily Closed Runways and New Runways Not Yet Open to Air Traffic.**

If available, use a lighted X, both at night and during the day, placed at each end of the runway on or near the runway designation numbers facing the approach. (Note that the lighted X must be illuminated at all times that it is on a runway.) The use of a lighted X is required if night work requires runway lighting to be on. See AC 150/5345-55, *Specification for L-893, Lighted Visual Aid to Indicate Temporary Runway Closure*. For runways that have been temporarily closed, but for an extended period, and for those with pilot controlled lighting, disconnect the lighting circuits or secure switches to prevent inadvertent activation. For runways that will be opened periodically, coordinate procedures with the FAA air traffic manager or, at airports without an ATCT, the airport operator. Activate stop bars if available. Figure 2-6 shows a lighted X by day. Figure 2-7 shows a lighted X at night.

Figure 2-6. Lighted X in Daytime**Figure 2-7. Lighted X at Night**

2.18.3.3 **Partially Closed Runways and Displaced Thresholds.**

When a runway is partially closed, a portion of the pavement is unavailable for any aircraft operation, meaning taxiing and landing or taking off in either direction. A displaced threshold, by contrast, is put in place to ensure obstacle clearance by landing aircraft. The pavement prior to the displaced threshold is available for takeoff in the direction of the displacement, and for landing and takeoff in the opposite direction. Misunderstanding this difference and issuance of a subsequently inaccurate NOTAM can result in a hazardous situation. For both partially

closed runways and displaced thresholds, approach lighting systems at the affected end must be placed out of service.

- 2.18.3.3.1 Partially Closed Runways.
Disconnect edge and threshold lights on that part of the runway at and behind the threshold (that is, the portion of the runway that is closed). Alternately, cover the light fixtures in such a way as to prevent light leakage. See Figure 2-1.
- 2.18.3.3.2 Temporary Displaced Thresholds.
Edge lighting in the area of the displacement emits red light in the direction of approach and yellow light (white for visual runways) in the opposite direction. If the displacement is 700 feet or less, blank out centerline lights in the direction of approach or place the centerline lights out of service. If the displacement is over 700 feet, place the centerline lights out of service. See AC 150/5340-30 for details on lighting displaced thresholds. See Figure 2-2.
- 2.18.3.3.3 Temporary runway thresholds and runway ends must be lighted if the runway is lighted and it is the intended threshold for night landings or instrument meteorological conditions.
- 2.18.3.3.4 A temporary threshold on an unlighted runway may be marked by retroreflective, elevated markers in addition to markings noted in paragraph 2.18.2.1.3. Markers seen by aircraft on approach are green. Markers at the rollout end of the runway are red. At certificated airports, temporary elevated threshold markers must be mounted with a frangible fitting (see 14 CFR Part 139.309). At non-certificated airports, the temporary elevated threshold markings may either be mounted with a frangible fitting or be flexible. See AC 150/5345-39, *Specification for L-853, Runway and Taxiway Retroreflective Markers*.
- 2.18.3.3.5 Temporary threshold lights and runway end lights and related visual NAVAIDs are installed outboard of the edges of the full-strength pavement only when they cannot be installed on the pavement. They are installed with bases at grade level or as low as possible, but not more than 3 inch (7.6 cm) above ground. (The standard above ground height for airport lighting fixtures is 14 inches (35 cm)). When any portion of a base is above grade, place properly compacted fill around the base to minimize the rate of gradient change so aircraft can, in an emergency, cross at normal landing or takeoff speeds without incurring significant damage. See AC 150/5370-10.
- 2.18.3.3.6 Maintain threshold and edge lighting color and spacing standards as described in AC 150/5340-30. Battery powered, solar, or portable lights that meet the criteria in AC 150/5345-50 may be used. These systems are intended primarily for visual flight rules (VFR) aircraft operations but may

be used for instrument flight rules (IFR) aircraft operations, upon individual approval from the Flight Standards Division of the applicable FAA Regional Office.

- 2.18.3.3.7 When runway thresholds are temporarily displaced, reconfigure yellow lenses (caution zone), as necessary, and place the centerline lights out of service.
- 2.18.3.3.8 Relocate the Visual Glide Slope Indicator (VGSI), such as Visual Approach Slope Indicator (VASI) and Precision Approach Path Indicator (PAPI); other airport lights, such as Runway End Identifier Lights (REIL); and approach lights to identify the temporary threshold. Another option is to disable the VGSI or any equipment that would give misleading indications to pilots as to the new threshold location. Installation of temporary visual aids may be necessary to provide adequate guidance to pilots on approach to the affected runway. If the FAA owns and operates the VGSI, coordinate its installation or disabling with the local ATO/Technical Operations Office. Relocation of such visual aids will depend on the duration of the project and the benefits gained from the relocation, as this can result in great expense. See FAA JO 6850.2, *Visual Guidance Lighting Systems*, for installation criteria for FAA owned and operated NAVAIDs.
- 2.18.3.3.9 Issue a NOTAM to inform pilots of temporary lighting conditions.

2.18.3.4 **Temporarily Closed Taxiways.**

If possible, deactivate the taxiway lighting circuits. When deactivation is not possible (for example other taxiways on the same circuit are to remain open), cover the light fixture in a way as to prevent light leakage.

2.18.4 Signs.

To the extent possible, signs must be in conformance with AC 150/5345-44, *Specification for Runway and Taxiway Signs*, and AC 150/5340-18, *Standard for Airport Sign Systems*.

2.18.4.1 **Existing Signs.**

Runway exit signs are to be covered for closed runway exits. Outbound destination signs are to be covered for closed runways. Any time a sign does not serve its normal function or would provide conflicting information, it must be covered or removed to prevent misdirecting pilots. Note that information signs identifying a crossing taxiway continue to perform their normal function even if the crossing taxiway is closed. For long term construction projects, consider relocating signs, especially runway distance remaining signs.

2.18.4.2 **Temporary Signs.**

Orange construction signs comprise a message in black on an orange background. Orange construction signs may help pilots be aware of changed conditions. The airport operator may choose to introduce these signs as part of a movement area construction project to increase situational awareness when needed. Locate signs outside the taxiway safety limits and ahead of construction areas so pilots can take timely action. Use temporary signs judiciously, striking a balance between the need for information and the increase in pilot workload. When there is a concern of pilot “information overload,” the applicability of mandatory hold signs must take precedence over orange construction signs recommended during construction. Temporary signs must meet the standards for such signs in Engineering Brief 93, *Guidance for the Assembly and Installation of Temporary Orange Construction Signs*. Many criteria in AC 150/5345-44, *Specification for Runway and Taxiway Signs*, are referenced in the Engineering Brief. Permissible sign legends are:

1. CONSTRUCTION AHEAD,
2. CONSTRUCTION ON RAMP, and
3. RWY XX TAKEOFF RUN AVAILABLE XXX FT.

Phasing, supported by drawings and sign schedule, for the installation of orange construction signs must be included in the CSPP or SPCD.

2.18.4.2.1 Takeoff Run Available (TORA) signs.

Recommended: Where a runway has been shortened for takeoff, install orange TORA signs well before the hold lines, such as on a parallel taxiway prior to a turn to a runway hold position. See EB 93 for sign size and location.

2.18.4.2.2 Sign legends are shown in Figure F-1.

Note: See Figure E-1, Figure E-2, Figure E-3, Figure F-2, and Figure F-3 for examples of orange construction sign locations.

2.19 **Marking and Signs for Access Routes.**

The CSPP should indicate that pavement markings and signs for construction personnel will conform to AC 150/5340-18 and, to the extent practicable, with the Federal Highway Administration Manual on Uniform Traffic Control Devices (MUTCD) and/or State highway specifications. Signs adjacent to areas used by aircraft must comply with the frangibility requirements of AC 150/5220-23, *Frangible Connections*, which may require modification to size and height guidance in the MUTCD.

2.20 **Hazard Marking, Lighting and Signing.**

2.20.1 Hazard marking, lighting, and signing prevent pilots from entering areas closed to aircraft, and prevent construction personnel from entering areas open to aircraft. The CSPP must specify prominent, comprehensible warning indicators for any area affected by construction that is normally accessible to aircraft, personnel, or vehicles. Hazard marking and lighting must also be specified to identify open manholes, small areas under repair, stockpiled material, waste areas, and areas subject to jet blast. Also consider less obvious construction-related hazards and include markings to identify FAA, airport, and National Weather Service facilities cables and power lines; instrument landing system (ILS) critical areas; airport surfaces, such as RSA, OFA, and OFZ; and other sensitive areas to make it easier for contractor personnel to avoid these areas.

2.20.2 Equipment.

2.20.2.1 **Barricades.**

Low profile barricades, including traffic cones, (weighted or sturdily attached to the surface) are acceptable methods used to identify and define the limits of construction and hazardous areas on airports. Careful consideration must be given to selecting equipment that poses the least danger to aircraft but is sturdy enough to remain in place when subjected to typical winds, prop wash and jet blast. The spacing of barricades must be such that a breach is physically prevented barring a deliberate act. For example, if barricades are intended to exclude aircraft, gaps between barricades must be smaller than the wingspan of the smallest aircraft to be excluded; if barricades are intended to exclude vehicles, gaps between barricades must be smaller than the width of the excluded vehicles, generally 4 feet (1.2 meters). Provision must be made for ARFF access if necessary. If barricades are intended to exclude pedestrians, they must be continuously linked. Continuous linking may be accomplished through the use of ropes, securely attached to prevent FOD.

2.20.2.2 **Lights.**

Lights must be red, either steady burning or flashing, and must meet the luminance requirements of the State Highway Department. Batteries powering lights will last longer if lights flash. Lights must be mounted on barricades and spaced at no more than 10 feet (3 meters). Lights must be operated between sunset and sunrise and during periods of low visibility whenever the airport is open for operations. They may be operated by photocell, but this may require that the contractor turn them on manually during periods of low visibility during daytime hours.

2.20.2.3 **Supplement Barricades with Signs (for example) As Necessary.**

Examples are “No Entry” and “No Vehicles.” Be aware of the increased effects of wind and jet blast on barricades with attached signs.

2.20.2.4 **Air Operations Area – General.**

Barricades are not permitted in any active safety area or on the runway side of a runway hold line. Within a runway or taxiway object free area, and on aprons, use orange traffic cones, flashing or steady burning red lights as noted above, highly reflective collapsible barricades marked with diagonal, alternating orange and white stripes; and/or signs to separate all construction/maintenance areas from the movement area. Barricades may be supplemented with alternating orange and white flags at least 20 by 20 inch (50 by 50 cm) square and securely fastened to eliminate FOD. All barricades adjacent to any open runway or taxiway / taxilane safety area, or apron must be as low as possible to the ground, and no more than 18 inches high, exclusive of supplementary lights and flags. Barricades must be of low mass; easily collapsible upon contact with an aircraft or any of its components; and weighted or sturdily attached to the surface to prevent displacement from prop wash, jet blast, wing vortex, and other surface wind currents. If affixed to the surface, they must be frangible at grade level or as low as possible, but not to exceed 3 inch (7.6 cm) above the ground. [Figure 2-8](#) and [Figure 2-9](#) show sample barricades with proper coloring and flags.

Figure 2-8. Interlocking Barricades



Figure 2-9. Low Profile Barricades**2.20.2.5 Air Operations Area – Runway/Taxiway Intersections.**

Use highly reflective barricades with lights to close taxiways leading to closed runways. Evaluate all operating factors when determining how to mark temporary closures that can last from 10 to 15 minutes to a much longer period of time. However, even for closures of relatively short duration, close all taxiway/runway intersections with barricades. The use of traffic cones is appropriate for short duration closures.

2.20.2.6 Air Operations Area – Other.

Beyond runway and taxiway object free areas and aprons, barricades intended for construction vehicles and personnel may be many different shapes and made from various materials, including railroad ties, sawhorses, jersey barriers, or barrels.

2.20.2.7 Maintenance.

The construction specifications must include a provision requiring the contractor to have a person on call 24 hours a day for emergency maintenance of airport hazard lighting and barricades. The contractor must file the contact person's information with the airport operator. Lighting should be checked for proper operation at least once per day, preferably at dusk.

2.21 Work Zone Lighting for Nighttime Construction.

Lighting equipment must adequately illuminate the work area if the construction is to be performed during nighttime hours. Refer to [AC 150/5370-10](#) for minimum illumination levels for nighttime paving projects. Additionally, it is recommended that all support equipment, except haul trucks, be equipped with artificial illumination to safely

illuminate the area immediately surrounding their work areas. The lights should be positioned to provide the most natural color illumination and contrast with a minimum of shadows. The spacing must be determined by trial. Light towers should be positioned and adjusted to aim away from ATCT cabs and active runways to prevent blinding effects. Shielding may be necessary. Light towers should be removed from the construction site when the area is reopened to aircraft operations. Construction lighting units should be identified and generally located on the construction phasing plans in relationship to the ATCT and active runways and taxiways.

2.22 **Protection of Runway and Taxiway Safety Areas.**

Runway and taxiway safety areas, OFZs, OFAs, and approach surfaces are described in AC 150/5300-13. Protection of these areas includes limitations on the location and height of equipment and stockpiled material. An FAA airspace study may be required. Coordinate with the appropriate FAA Airports Regional or District Office if there is any doubt as to requirements or dimensions (see paragraph 2.13.5) as soon as the location and height of materials or equipment are known. The CSPP should include drawings showing all safety areas, object free areas, obstacle free zones and approach departure surfaces affected by construction.

2.22.1 Runway Safety Area (RSA).

A runway safety area is the defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway (see AC 150/5300-13). Construction activities within the existing RSA are subject to the following conditions:

- 2.22.1.1 No construction may occur within the existing RSA while the runway is open for aircraft operations. The RSA dimensions may be temporarily adjusted if the runway is restricted to aircraft operations requiring an RSA that is equal to the RSA width and length beyond the runway ends available during construction. (See AC 150/5300-13). The temporary use of declared distances and/or partial runway closures may provide the necessary RSA under certain circumstances. Coordinate with the appropriate FAA Airports Regional or District Office to have declared distances information published, and appropriate NOTAMs issued. See AC 150/5300-13 for guidance on the use of declared distances.
- 2.22.1.2 The airport operator must coordinate the adjustment of RSA dimensions as permitted above with the appropriate FAA Airports Regional or District Office and the local FAA air traffic manager and issue a NOTAM.
- 2.22.1.3 The CSPP and SPCD must provide procedures for ensuring adequate distance for protection from blasting operations, if required by operational considerations.

2.22.1.4 Excavations.

2.22.1.4.1 Open trenches or excavations are not permitted within the RSA while the runway is open. Backfill trenches before the runway is opened. If backfilling excavations before the runway must be opened is impracticable, cover the excavations appropriately. Covering for open trenches must be designed to allow the safe operation of the heaviest aircraft operating on the runway across the trench without damage to the aircraft.

2.22.1.4.2 Construction contractors must prominently mark open trenches and excavations at the construction site with red or orange flags, as approved by the airport operator, and light them with red lights during hours of restricted visibility or darkness.

2.22.1.5 Erosion Control.

Soil erosion must be controlled to maintain RSA standards, that is, the RSA must be cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations, and capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and fire fighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft.

2.22.2 Runway Object Free Area (ROFA).

Construction, including excavations, may be permitted in the ROFA. However, equipment must be removed from the ROFA when not in use, and material should not be stockpiled in the ROFA if not necessary. Stockpiling material in the OFA requires submittal of a 7460-1 form and justification provided to the appropriate FAA Airports Regional or District Office for approval.

2.22.3 Taxiway Safety Area (TSA).

2.22.3.1 A taxiway safety area is a defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway. (See AC 150/5300-13.) Since the width of the TSA is equal to the wingspan of the design aircraft, no construction may occur within the TSA while the taxiway is open for aircraft operations. The TSA dimensions may be temporarily adjusted if the taxiway is restricted to aircraft operations requiring a TSA that is equal to the TSA width available during construction. Give special consideration to TSA dimensions at taxiway turns and intersections. (see AC 150/5300-13).

2.22.3.2 The airport operator must coordinate the adjustment of the TSA width as permitted above with the appropriate FAA Airports Regional or District Office and the FAA air traffic manager and issue a NOTAM.

2.22.3.3 The CSPP and SPCD must provide procedures for ensuring adequate distance for protection from blasting operations.

2.22.3.4 **Excavations.**

1. Curves. Open trenches or excavations are not permitted within the TSA while the taxiway is open. Trenches should be backfilled before the taxiway is opened. If backfilling excavations before the taxiway must be opened is impracticable, cover the excavations appropriately. Covering for open trenches must be designed to allow the safe operation of the heaviest aircraft operating on the taxiway across the trench without damage to the aircraft.
2. Straight Sections. Open trenches or excavations are not permitted within the TSA while the taxiway is open for unrestricted aircraft operations. Trenches should be backfilled before the taxiway is opened. If backfilling excavations before the taxiway must be opened is impracticable, cover the excavations to allow the safe passage of ARFF equipment and of the heaviest aircraft operating on the taxiway across the trench without causing damage to the equipment or aircraft. In rare circumstances where the section of taxiway is indispensable for aircraft movement, open trenches or excavations may be permitted in the TSA while the taxiway is open to aircraft operations, subject to the following restrictions:
 - a. Taxiing speed is limited to 10 mph.
 - b. Appropriate NOTAMs are issued.
 - c. Marking and lighting meeting the provisions of paragraphs 2.18 and 2.20 are implemented.
 - d. Low mass, low-profile lighted barricades are installed.
 - e. Appropriate temporary orange construction signs are installed.
3. Construction contractors must prominently mark open trenches and excavations at the construction site with red or orange flags, as approved by the airport operator, and light them with red lights during hours of restricted visibility or darkness.

2.22.3.5 **Erosion control.**

Soil erosion must be controlled to maintain TSA standards, that is, the TSA must be cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations, and capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft.

2.22.4 Taxiway Object Free Area (TOFA).

Unlike the Runway Object Free Area, aircraft wings regularly penetrate the taxiway object free area during normal operations. Thus, the restrictions are more stringent. Except as provided below, no construction may occur within the taxiway object free area while the taxiway is open for aircraft operations.

- 2.22.4.1 The taxiway object free area dimensions may be temporarily adjusted if the taxiway is restricted to aircraft operations requiring a taxiway object free area that is equal to the taxiway object free area width available. Give special consideration to TOFA dimensions at taxiway turns and intersections.
- 2.22.4.2 Offset taxiway centerline and edge pavement markings (do not use glass beads) may be used as a temporary measure to provide the required taxiway object free area. Where offset taxiway pavement markings are provided, centerline lighting, centerline reflectors, or taxiway edge reflectors are required. Existing lighting that does not coincide with the temporary markings must be taken out of service.
- 2.22.4.3 Construction activity, including open excavations, may be accomplished without adjusting the width of the taxiway object free area, subject to the following restrictions:
 - 2.22.4.3.1 Taxiing speed is limited to 10 mph.
 - 2.22.4.3.2 NOTAMs issued advising taxiing pilots of hazard and recommending reduced taxiing speeds on the taxiway.
 - 2.22.4.3.3 Marking and lighting meeting the provisions of paragraphs 2.18 and 2.20 are implemented.
 - 2.22.4.3.4 If desired, appropriate orange construction signs are installed. See paragraph 2.18.4.2 and Appendix F.
 - 2.22.4.3.5 Five-foot clearance is maintained between equipment and materials and any part of an aircraft (includes wingtip overhang). If such clearance can only be maintained if an aircraft does not have full use of the entire taxiway width (with its main landing gear at the edge of the usable pavement), then it will be necessary to move personnel and equipment for the passage of that aircraft.
 - 2.22.4.3.6 Flaggers furnished by the contractor must be used to direct and control construction equipment and personnel to a pre-established setback distance for safe passage of aircraft, and airline and/or airport personnel. Flaggers must also be used to direct taxiing aircraft. Due to liability issues, the airport operator should require airlines to provide flaggers for directing taxiing aircraft.

2.22.5 Obstacle Free Zone (OFZ).

In general, personnel, material, and/or equipment may not penetrate the OFZ while the runway is open for aircraft operations. If a penetration to the OFZ is necessary, it may be possible to continue aircraft operations through operational restrictions. Coordinate with the FAA through the appropriate FAA Airports Regional or District Office.

2.22.6 Runway Approach/Departure Areas and Clearways.

All personnel, materials, and/or equipment must remain clear of the applicable threshold siting surfaces, as defined in AC 150/5300-13. Objects that do not penetrate these surfaces may still be obstructions to air navigation and may affect standard instrument approach procedures. Coordinate with the FAA through the appropriate FAA Airports Regional or District Office.

2.22.6.1 Construction activity in a runway approach/departure area may result in the need to partially close a runway or displace the existing runway threshold. Partial runway closure, displacement of the runway threshold, as well as closure of the complete runway and other portions of the movement area also require coordination through the airport operator with the appropriate FAA air traffic manager (FSS if non-towered) and ATO/Technical Operations (for affected NAVAIDS) and airport users.

2.22.6.2 **Caution About Partial Runway Closures.**

When filing a NOTAM for a partial runway closure, clearly state that the portion of pavement located prior to the threshold is not available for landing and departing traffic. In this case, the threshold has been moved for both landing and takeoff purposes (this is different than a displaced threshold). There may be situations where the portion of closed runway is available for taxiing only. If so, the NOTAM must reflect this condition).

2.22.6.3 **Caution About Displaced Thresholds.**

Implementation of a displaced threshold affects runway length available for aircraft landing over the displacement. Depending on the reason for the displacement (to provide obstruction clearance or RSA), such a displacement may also require an adjustment in the landing distance available and accelerate-stop distance available in the opposite direction. If project scope includes personnel, equipment, excavation, or other work within the existing RSA of any usable runway end, do not implement a displaced threshold unless arrivals and departures toward the construction activity are prohibited. Instead, implement a partial closure.

2.23 **Other Limitations on Construction.**

The CSPP must specify any other limitations on construction, including but not limited to:

2.23.1 Prohibitions.

- 2.23.1.1 No use of tall equipment (cranes, concrete pumps, and so on) unless a 7460-1 determination letter is issued for such equipment.
- 2.23.1.2 No use of open flame welding or torches unless fire safety precautions are provided and the airport operator has approved their use.
- 2.23.1.3 No use of electrical blasting caps on or within 1,000 feet (300 meters) of the airport property. See AC 150/5370-10.

2.23.2 Restrictions.

- 2.23.2.1 Construction suspension required during specific airport operations.
- 2.23.2.2 Areas that cannot be worked on simultaneously.
- 2.23.2.3 Day or night construction restrictions.
- 2.23.2.4 Seasonal construction restrictions.
- 2.23.2.5 Temporary signs not approved by the airport operator.
- 2.23.2.6 Grades changes that could result in unplanned effects on NAVAIDs.

CHAPTER 3. GUIDELINES FOR WRITING A CSPP

3.1 **General Requirements.**

The CSPP is a standalone document written to correspond with the subjects outlined in paragraph 2.4. The CSPP is organized by numbered sections corresponding to each subject listed in paragraph 2.4, and described in detail in paragraphs 2.5 - 2.23. Each section number and title in the CSPP matches the corresponding subject outlined in paragraph 2.4 (for example, 1. Coordination, 2. Phasing, 3. Areas and Operations Affected by the Construction Activity, and so on). With the exception of the project scope of work outlined in Section 2. Phasing, only subjects specific to operational safety during construction should be addressed.

3.2 **Applicability of Subjects.**

Each section should, to the extent practical, focus on the specific subject. Where an overlapping requirement spans several sections, the requirement should be explained in detail in the most applicable section. A reference to that section should be included in all other sections where the requirement may apply. For example, the requirement to protect existing underground FAA ILS cables during trenching operations could be considered FAA ATO coordination (Coordination, paragraph 2.5.3), an area and operation affected by the construction activity (Areas and Operations Affected by the Construction Activity, paragraph 2.7.1.4), a protection of a NAVAID (Protection of Navigational Aids (NAVAIDs), paragraph 2.8), or a notification to the FAA of construction activities (Notification of Construction Activities, paragraph 2.13.5.3.2). However, it is more specifically an underground utility requirement (Underground Utilities, paragraph 2.15). The procedure for protecting underground ILS cables during trenching operations should therefore be described in 2.4.2.11: “The contractor must coordinate with the local FAA System Support Center (SSC) to mark existing ILS cable routes along Runway 17-35. The ILS cables will be located by hand digging whenever the trenching operation moves within 10 feet of the cable markings.” All other applicable sections should include a reference to 2.4.2.11: “ILS cables shall be identified and protected as described in 2.4.2.11” or “See 2.4.2.11 for ILS cable identification and protection requirements.” Thus, the CSPP should be considered as a whole, with no need to duplicate responses to related issues.

3.3 **Graphical Representations.**

Construction safety drawings should be included in the CSPP as attachments. When other graphical representations will aid in supporting written statements, the drawings, diagrams, and/or photographs should also be attached to the CSPP. References should be made in the CSPP to each graphical attachment and may be made in multiple sections.

3.4 **Reference Documents.**

The CSPP must not incorporate a document by reference unless reproduction of the material in that document is prohibited. In that case, either copies of or a source for the referenced document must be provided to the contractor. Where this AC recommends references (e.g. as in paragraph 3.9) the intent is to include a reference to the corresponding section in the CSPP, not to this Advisory Circular.

3.5 **Restrictions.**

The CSPP should not be considered as a project design review document. The CSPP should also avoid mention of permanent (“as-built”) features such as pavements, markings, signs, and lighting, except when such features are intended to aid in maintaining operational safety during the construction.

3.6 **Coordination.**

Include in this section a detailed description of conferences and meetings to be held both before and during the project. Include appropriate information from AC 150/5370-12. Discuss coordination procedures and schedules for each required FAA ATO Technical Operations shutdown and restart and all required flight inspections.

3.7 **Phasing.**

Include in this section a detailed scope of work description for the project as a whole and each phase of work covered by the CSPP. This includes all locations and durations of the work proposed. Attach drawings to graphically support the written scope of work. Detail in this section the sequenced phases of the proposed construction. Include a reference to paragraph 3.8, as appropriate.

3.8 **Areas and Operations Affected by Construction.**

Focus in this section on identifying the areas and operations affected by the construction. Describe corresponding mitigation that is not covered in detail elsewhere in the CSPP. Include references to paragraphs below as appropriate. Attach drawings as necessary to graphically describe affected areas and mechanisms proposed. See Appendix F for sample operational effects tables and figures.

3.9 **NAVAID Protection.**

List in this section all NAVAID facilities that will be affected by the construction. Identify NAVAID facilities that will be placed out of service at any time prior to or during construction activities. Identify individuals responsible for coordinating each shutdown and when each facility will be out of service. Include a reference to paragraph 3.6 for FAA ATO NAVAID shutdown, restart, and flight inspection coordination. Outline in detail procedures to protect each NAVAID facility remaining in service from interference by construction activities. Include a reference to paragraph 3.14 for the

issuance of NOTAMs as required. Include a reference to paragraph 3.16 for the protection of underground cables and piping serving NAVAIDs. If temporary visual aids are proposed to replace or supplement existing facilities, include a reference to paragraph 3.19. Attach drawings to graphically indicate the affected NAVAIDs and the corresponding critical areas.

3.10 **Contractor Access.**

This will necessarily be the most extensive section of the CSPP. Provide sufficient detail so that a contractor not experienced in working on airports will understand the unique restrictions such work will require. Due to this extent, it should be broken down into subsections as described below:

3.10.1 Location of Stockpiled Construction Materials.

Describe in this section specific locations for stockpiling material. Note any height restrictions on stockpiles. Include a reference to paragraph 3.21 for hazard marking and lighting devices used to identify stockpiles. Include a reference to paragraph 3.11 for provisions to prevent stockpile material from becoming wildlife attractants. Include a reference to paragraph 3.12 for provisions to prevent stockpile material from becoming FOD. Attach drawings to graphically indicate the stockpile locations.

3.10.2 Vehicle and Pedestrian Operations.

While there are many items to be addressed in this major subsection of the CSPP, all are concerned with one main issue: keeping people and vehicles from areas of the airport where they don't belong. This includes preventing unauthorized entry to the AOA and preventing the improper movement of pedestrians or vehicles on the airport. In this section, focus on mechanisms to prevent construction vehicles and workers traveling to and from the worksite from unauthorized entry into movement areas. Specify locations of parking for both employee vehicles and construction equipment, and routes for access and haul roads. In most cases, this will best be accomplished by attaching a drawing. Quote from AC 150/5210-5 specific requirements for contractor vehicles rather than referring to the AC as a whole, and include special requirements for identifying HAZMAT vehicles. Quote from, rather than incorporate by reference, AC 150/5210-20 as appropriate to address the airport's rules for ground vehicle operations, including its training program. Discuss the airport's recordkeeping system listing authorized vehicle operators.

3.10.3 Two-Way Radio Communications.

Include a special section to identify all individuals who are required to maintain communications with Air Traffic (AT) at airports with active towers, or monitor CTAF at airports without or with closed ATCT. Include training requirements for all individuals required to communicate with AT. Individuals required to monitor AT frequencies should also be identified. If construction employees are also required to communicate by radio with Airport Operations, this procedure should be described in detail. Usage of vehicle mounted radios and/or portable radios should be addressed. Communication procedures for the event of disabled radio communication (that is, light

signals, telephone numbers, others) must be included. All radio frequencies should be identified (Tower, Ground Control, CTAF, UNICOM, ATIS, and so on).

3.10.4 Airport Security.

Address security as it applies to vehicle and pedestrian operations. Discuss TSA requirements, security badging requirements, perimeter fence integrity, gate security, and other needs. Attach drawings to graphically indicate secured and/or Security Identification Display Areas (SIDA), perimeter fencing, and available access points.

3.11 **Wildlife Management.**

Discuss in this section wildlife management procedures. Describe the maintenance of existing wildlife mitigation devices, such as perimeter fences, and procedures to limit wildlife attractants. Include procedures to notify Airport Operations of wildlife encounters. Include a reference to paragraph 3.10 for security (wildlife) fence integrity maintenance as required.

3.12 **FOD Management.**

In this section, discuss methods to control and monitor FOD: worksite housekeeping, ground vehicle tire inspections, runway sweeps, and so on. Include a reference to paragraph 3.15 for inspection requirements as required.

3.13 **HAZMAT Management.**

Describe in this section HAZMAT management procedures: fuel deliveries, spill recovery procedures, Safety Data Sheet (SDS), Material Safety Data Sheet (MSDS) or Product Safety Data Sheet (PSDS) availability, and other considerations. Any specific airport HAZMAT restrictions should also be identified. Include a reference to paragraph 3.10 for HAZMAT vehicle identification requirements. Quote from, rather than incorporate by reference, AC 150/5320-15.

3.14 **Notification of Construction Activities.**

List in this section the names and telephone numbers of points of contact for all parties affected by the construction project. We recommend a single list that includes all telephone numbers required under this section. Include emergency notification procedures for all representatives of all parties potentially impacted by the construction. Identify individual representatives – and at least one alternate – for each party. List both on-duty and off-duty contact information for each individual, including individuals responsible for emergency maintenance of airport construction hazard lighting and barricades. Describe procedures to coordinate immediate response to events that might adversely affect the operational safety of the airport (such as interrupted NAVAID service). Explain requirements for and the procedures for the issuance of Notices to Airmen (NOTAMs), notification to FAA required by 14 CFR Part 77 and Part 157 and in the event of affected NAVAIDs. For NOTAMs, identify an individual, and at least one alternate, responsible for issuing and cancelling each specific type of Notice to

Airmen (NOTAM) required. Detail notification methods for police, fire fighting, and medical emergencies. This may include 911, but should also include direct phone numbers of local police departments and nearby hospitals. Identify the E911 address of the airport and the emergency access route via haul roads to the construction site. Require the contractor to have this information available to all workers. The local Poison Control number should be listed. Procedures regarding notification of Airport Operations and/or the ARFF Department of such emergencies should be identified, as applicable. If airport radio communications are identified as a means of emergency notification, include a reference to paragraph 3.10. Differentiate between emergency and nonemergency notification of ARFF personnel, the latter including activities that affect ARFF water supplies and access roads. Identify the primary ARFF contact person and at least one alternate. If notification is to be made through Airport Operations, then detail this procedure. Include a method of confirmation from the ARFF department.

3.15 Inspection Requirements.

Describe in this section inspection requirements to ensure airfield safety compliance. Include a requirement for routine inspections by the resident engineer (RE) or other airport operator's representative and the construction contractors. If the engineering consultants and/or contractors have a Safety Officer who will conduct such inspections, identify this individual. Describe procedures for special inspections, such as those required to reopen areas for aircraft operations. Part 139 requires daily airfield inspections at certificated airports, but these may need to be more frequent when construction is in progress. Discuss the role of such inspections on areas under construction. Include a requirement to immediately remedy any deficiencies, whether caused by negligence, oversight, or project scope change.

3.16 Underground Utilities.

Explain how existing underground utilities will be located and protected. Identify each utility owner and include contact information for each company/agency in the master list. Address emergency response procedures for damaged or disrupted utilities. Include a reference to paragraph 3.14 for notification of utility owners of accidental utility disruption as required.

3.17 Penalties.

Describe in this section specific penalties imposed for noncompliance with airport rules and regulations, including the CSPP: SIDA violations, VPD, and others.

3.18 Special Conditions.

Identify any special conditions that may trigger specific safety mitigation actions outlined in this CSPP: low visibility operations, snow removal, aircraft in distress, aircraft accident, security breach, VPD, and other activities requiring construction suspension/resumption. Include a reference to paragraph 3.10 for compliance with airport safety and security measures and for radio communications as required. Include

a reference to paragraph 3.14 for emergency notification of all involved parties, including police/security, ARFF, and medical services.

3.19 Runway and Taxiway Visual Aids.

Include marking, lighting, signs, and visual NAVAIDS. Detail temporary runway and taxiway marking, lighting, signs, and visual NAVAIDS required for the construction. Discuss existing marking, lighting, signs, and visual NAVAIDS that are temporarily, altered, obliterated, or shut down. Consider non-federal facilities and address requirements for reimbursable agreements necessary for alteration of FAA facilities and for necessary flight checks. Identify temporary TORA signs or runway distance remaining signs if appropriate. Identify required temporary visual NAVAIDS such as REIL or PAPI. Quote from, rather than incorporate by reference, AC 150/5340-1, Standards for Airport Markings; AC 150/5340-18, Standards for Airport Sign Systems; and AC 150/5340-30, as required. Attach drawings to graphically indicate proposed marking, lighting, signs, and visual NAVAIDS.

3.20 Marking and Signs for Access Routes.

Detail plans for marking and signs for vehicle access routes. To the extent possible, signs should be in conformance with the Federal Highway Administration MUTCD and/or State highway specifications, not hand lettered. Detail any modifications to the guidance in the MUTCD necessary to meet frangibility/height requirements.

3.21 Hazard Marking and Lighting.

Specify all marking and lighting equipment, including when and where each type of device is to be used. Specify maximum gaps between barricades and the maximum spacing of hazard lighting. Identify one individual and at least one alternate responsible for maintenance of hazard marking and lighting equipment in the master telephone list. Include a reference to paragraph 3.14. Attach drawings to graphically indicate the placement of hazard marking and lighting equipment.

3.22 Work Zone Lighting for Nighttime Construction.

If work is to be conducted at night, specify all lighting equipment, including when and where each type of device is to be used. Indicate the direction lights are to be aimed and any directions that aiming of lights is prohibited. Specify any shielding necessary in instances where aiming is not sufficient to prevent interference with air traffic control and aircraft operations. Attach drawings to graphically indicate the placement and aiming of lighting equipment. Where the plan only indicates directions that aiming of lights is prohibited, the placement and positioning of portable lights must be proposed by the Contractor and approved by the airport operator's representative each time lights are relocated or repositioned.

3.23 Protection of Runway and Taxiway Safety Areas.

This section should focus exclusively on procedures for protecting all safety areas, including those altered by the construction: methods of demarcation, limit of access, movement within safety areas, stockpiling and trenching restrictions, and so on. Reference AC 150/5300-13, as required. Include a reference to paragraph 3.10 for procedures regarding vehicle and personnel movement within safety areas. Include a reference to paragraph 3.10 for material stockpile restrictions as required. Detail requirements for trenching, excavations, and backfill. Include a reference to paragraph 3.21 for hazard marking and lighting devices used to identify open excavations as required. If runway and taxiway closures are proposed to protect safety areas, or if temporary displaced thresholds and/or revised declared distances are used to provide the required Runway Safety Area, include a reference to paragraphs 3.14 and 3.19. Detail procedures for protecting the runway OFZ, runway OFA, taxiway OFA and runway approach surfaces including those altered by the construction: methods of demarcation, limit of cranes, storage of equipment, and so on. Quote from, rather than incorporate by reference, AC 150/5300-13, as required. Include a reference to paragraph 3.24 for height (i.e., crane) restrictions as required. One way to address the height of equipment that will move during the project is to establish a three-dimensional “box” within which equipment will be confined that can be studied as a single object. Attach drawings to graphically indicate the safety area, OFZ, and OFA boundaries.

3.24 Other Limitations on Construction.

This section should describe what limitations must be applied to each area of work and when each limitation will be applied: limitations due to airport operations, height (i.e., crane) restrictions, areas which cannot be worked at simultaneously, day/night work restrictions, winter construction, and other limitations. Include a reference to paragraph 3.7 for project phasing requirements based on construction limitations as required.

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APPENDIX A. RELATED READING MATERIAL

Obtain the latest version of the following free publications from the FAA on its Web site at <http://www.faa.gov/airports/>.

Table A-1. FAA Publications

Number	Title and Description
<u>AC 150/5200-28</u>	<i>Notices to Airmen (NOTAMs) for Airport Operators</i> Guidance for using the NOTAM System in airport reporting.
<u>AC 150/5200-30</u>	<i>Airport Field Condition Assessments and Winter Operations Safety</i> Guidance for airport owners/operators on the development of an acceptable airport snow and ice control program and on appropriate field condition reporting procedures.
<u>AC 150/5200-33</u>	<i>Hazardous Wildlife Attractants On or Near Airports</i> Guidance on locating certain land uses that might attract hazardous wildlife to public-use airports.
<u>AC 150/5210-5</u>	<i>Painting, Marking, and Lighting of Vehicles Used on an Airport</i> Guidance, specifications, and standards for painting, marking, and lighting vehicles operating in the airport air operations areas.
<u>AC 150/5210-20</u>	<i>Ground Vehicle Operations to include Taxiing or Towing an Aircraft on Airports</i> Guidance to airport operators on developing ground vehicle operation training programs.
<u>AC 150/5300-13</u>	<i>Airport Design</i> FAA standards and recommendations for airport design. Establishes approach visibility minimums as an airport design parameter, and contains the Object Free area and the obstacle free-zone criteria.
<u>AC 150/5210-24</u>	<i>Airport Foreign Object Debris (FOD) Management</i> Guidance for developing and managing an airport foreign object debris (FOD) program

Number	Title and Description
<u>AC 150/5320-15</u>	<i>Management of Airport Industrial Waste</i> Basic information on the characteristics, management, and regulations of industrial wastes generated at airports. Guidance for developing a Storm Water Pollution Prevention Plan (SWPPP) that applies best management practices to eliminate, prevent, or reduce pollutants in storm water runoff with particular airport industrial activities.
<u>AC 150/5340-1</u>	<i>Standards for Airport Markings</i> FAA standards for the siting and installation of signs on airport runways and taxiways.
<u>AC 150/5340-18</u>	<i>Standards for Airport Sign Systems</i> FAA standards for the siting and installation of signs on airport runways and taxiways.
<u>AC 150/5345-28</u>	<i>Precision Approach Path Indicator (PAPI) Systems</i> FAA standards for PAPI systems, which provide pilots with visual glide slope guidance during approach for landing.
<u>AC 150/5340-30</u>	<i>Design and Installation Details for Airport Visual Aids</i> Guidance and recommendations on the installation of airport visual aids.
<u>AC 150/5345-39</u>	<i>Specification for L-853, Runway and Taxiway Retroreflective Markers</i>
<u>AC 150/5345-44</u>	<i>Specification for Runway and Taxiway Signs</i> FAA specifications for unlighted and lighted signs for taxiways and runways.
<u>AC 150/5345-53</u>	<i>Airport Lighting Equipment Certification Program</i> Details on the Airport Lighting Equipment Certification Program (ALECP).
<u>AC 150/5345-50</u>	<i>Specification for Portable Runway and Taxiway Lights</i> FAA standards for portable runway and taxiway lights and runway end identifier lights for temporary use to permit continued aircraft operations while all or part of a runway lighting system is inoperative.
<u>AC 150/5345-55</u>	<i>Specification for L-893, Lighted Visual Aid to Indicate Temporary Runway Closure</i>

Number	Title and Description
<u>AC 150/5370-10</u>	<i>Standards for Specifying Construction of Airports</i> Standards for construction of airports, including earthwork, drainage, paving, turfing, lighting, and incidental construction.
<u>AC 150/5370-12</u>	<i>Quality Management for Federally Funded Airport Construction Projects</i>
EB 93	<i>Guidance for the Assembly and Installation of Temporary Orange Construction Signs</i>
FAA Order 5200.11	<u>FAA Airports (ARP) Safety Management System (SMS)</u> Basics for implementing SMS within ARP. Includes roles and responsibilities of ARP management and staff as well as other FAA lines of business that contribute to the ARP SMS.
FAA Certalert 98-05	<i>Grasses Attractive to Hazardous Wildlife</i> Guidance on grass management and seed selection.
FAA Form 7460-1	<u>Notice of Proposed Construction or Alteration</u>
FAA Form 7480-1	<u>Notice of Landing Area Proposal</u>
FAA Form 6000.26	National NAS Strategic Interruption Service Level Agreement, Strategic Events Coordination, Airport Sponsor Form

Obtain the latest version of the following free publications from the Electronic Code of Federal Regulations at <http://www.ecfr.gov/>.

Table A-2. Code of Federal Regulation

Number	Title
Title 14 CFR Part 77	Safe, Efficient Use and Preservation of the Navigable Airspace
Title 14 CFR Part 139	Certification of Airports
Title 49 CFR Part 1542	Airport Security

Obtain the latest version of the Manual on Uniform Traffic Control Devices from the Federal Highway Administration at <http://mutcd.fhwa.dot.gov/>.

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APPENDIX B. TERMS AND ACRONYMS**Table B-1. Terms and Acronyms**

Term	Definition
Form 7460-1	Notice of Proposed Construction or Alteration. For on-airport projects, the form submitted to the FAA regional or airports division office as formal written notification of any kind of construction or alteration of objects that affect navigable airspace, as defined in 14 CFR Part 77, <i>Safe, Efficient Use, and Preservation of the Navigable Airspace</i> . (See guidance available on the FAA web site at https://oeaaa.faa.gov .) The form may be downloaded at http://www.faa.gov/airports/resources/forms/ , or filed electronically at: https://oeaaa.faa.gov .
Form 7480-1	Notice of Landing Area Proposal. Form submitted to the FAA Airports Regional Division Office or Airports District Office as formal written notification whenever a project without an airport layout plan on file with the FAA involves the construction of a new airport; the construction, realigning, altering, activating, or abandoning of a runway, landing strip, or associated taxiway; or the deactivation or abandoning of an entire airport The form may be downloaded at http://www.faa.gov/airports/resources/forms/ .
Form 6000-26	Airport Sponsor Strategic Event Submission Form
AC	Advisory Circular
ACSI	Airport Certification Safety Inspector
ADG	Airplane Design Group
AIP	Airport Improvement Program
ALECP	Airport Lighting Equipment Certification Program
ANG	Air National Guard
AOA	Air Operations Area, as defined in 14 CFR Part 107. Means a portion of an airport, specified in the airport security program, in which security measures are carried out. This area includes aircraft movement areas, aircraft parking areas, loading ramps, and safety areas, and any adjacent areas (such as general aviation areas) that are not separated by adequate security systems, measures, or procedures. This area does not include the secured area of the airport terminal building.
ARFF	Aircraft Rescue and Fire Fighting
ARP	FAA Office of Airports
ASDA	Accelerate-Stop Distance Available
AT	Air Traffic
ATCT	Airport Traffic Control Tower
ATIS	Automatic Terminal Information Service
ATO	Air Traffic Organization
Certificated Airport	An airport that has been issued an Airport Operating Certificate by the FAA under

Term	Definition
	the authority of 14 CFR Part 139, <i>Certification of Airports</i> .
CFR	Code of Federal Regulations
Construction	The presence of construction-related personnel, equipment, and materials in any location that could infringe upon the movement of aircraft.
CSPP	Construction Safety and Phasing Plan. The overall plan for safety and phasing of a construction project developed by the airport operator, or developed by the airport operator's consultant and approved by the airport operator. It is included in the invitation for bids and becomes part of the project specifications.
CTAF	Common Traffic Advisory Frequency
Displaced Threshold	A threshold that is located at a point on the runway other than the designated beginning of the runway. The portion of pavement behind a displaced threshold is available for takeoffs in either direction or landing from the opposite direction.
DOT	Department of Transportation
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FOD	Foreign Object Debris/Damage
FSS	Flight Service Station
GA	General Aviation
HAZMAT	Hazardous Materials
HMA	Hot Mix Asphalt
IAP	Instrument Approach Procedures
IFR	Instrument Flight Rules
ILS	Instrument Landing System
LDA	Landing Distance Available
LOC	Localizer antenna array
Movement Area	The runways, taxiways, and other areas of an airport that are used for taxiing or hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading aprons and aircraft parking areas (reference 14 CFR Part 139).
MSDS	Material Safety Data Sheet
MUTCD	Manual on Uniform Traffic Control Devices
NAVAID	Navigation Aid
NAVAID Critical Area	An area of defined shape and size associated with a NAVAID that must remain clear and graded to avoid interference with the electronic signal.
Non-Movement Area	The area inside the airport security fence exclusive of the Movement Area. It is important to note that the non-movement area includes pavement traversed by aircraft.

Term	Definition
NOTAM	Notices to Airmen
Obstruction	Any object/obstacle exceeding the obstruction standards specified by 14 CFR Part 77, subpart C.
OCC	Operations Control Center
OE / AAA	Obstruction Evaluation / Airport Airspace Analysis
OFA	Object Free Area. An area on the ground centered on the runway, taxiway, or taxi lane centerline provided to enhance safety of aircraft operations by having the area free of objects except for those objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes. (See AC 150/5300-13 for additional guidance on OFA standards and wingtip clearance criteria.)
OFZ	Obstacle Free Zone. The airspace below 150 ft (45 m) above the established airport elevation and along the runway and extended runway centerline that is required to be clear of all objects, except for frangible visual NAVAIDs that need to be located in the OFZ because of their function, in order to provide clearance protection for aircraft landing or taking off from the runway and for missed approaches. The OFZ is subdivided as follows: Runway OFZ, Inner Approach OFZ, Inner Transitional OFZ, and Precision OFZ. Refer to AC 150/5300-13 for guidance on OFZ.
OSHA	Occupational Safety and Health Administration
OTS	Out of Service
P&R	Planning and Requirements Group
NPI	NAS Planning & Integration
PAPI	Precision Approach Path Indicator
PFC	Passenger Facility Charge
PLASI	Pulse Light Approach Slope Indicator
Project Proposal Summary	A clear and concise description of the proposed project or change that is the object of Safety Risk Management.
RA	Reimbursable Agreement
RE	Resident Engineer
REIL	Runway End Identifier Lights
RNAV	Area Navigation
ROFA	Runway Object Free Area
RSA	Runway Safety Area. A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway, in accordance with AC 150/5300-13 .
SDS	Safety Data Sheet
SIDA	Security Identification Display Area
SMS	Safety Management System

Term	Definition
SPCD	Safety Plan Compliance Document. Details developed and submitted by a contractor to the airport operator for approval providing details on how the performance of a construction project will comply with the CSPP.
SRM	Safety Risk Management
SSC	System Support Center
Taxiway Safety Area	A defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway, in accordance with AC 150/5300-13 .
TDG	Taxiway Design Group
Temporary	Any condition that is not intended to be permanent.
Temporary Runway End	The beginning of that portion of the runway available for landing and taking off in one direction, and for landing in the other direction. Note the difference from a displaced threshold.
Threshold	The beginning of that portion of the runway available for landing. In some instances, the landing threshold may be displaced.
TODA	Takeoff Distance Available
TOFA	Taxiway Object Free Area
TORA	Takeoff Run Available. The length of the runway less any length of runway unavailable and/or unsuitable for takeoff run computations. See AC 150/5300-13 for guidance on declared distances.
TSA	Taxiway Safety Area, or Transportation Security Administration
UNICOM	A radio communications system of a type used at small airports.
VASI	Visual Approach Slope Indicator
VGSI	Visual Glide Slope Indicator. A device that provides a visual glide slope indicator to landing pilots. These systems include precision approach path indicator (PAPI), visual approach slope indicator (VASI), and pulse light approach slope indicator (PLASI).
VFR	Visual Flight Rules
VOR	Very High Frequency Omnidirectional Radio Range
VPD	Vehicle / Pedestrian Deviation

APPENDIX C. SAFETY AND PHASING PLAN CHECKLIST

This appendix is keyed to Chapter 2. In the electronic version of this AC, clicking on the paragraph designation in the Reference column will access the applicable paragraph. There may be instances where the CSPP requires provisions that are not covered by the list in this appendix.

This checklist is intended as an aid, not a required submittal.

Table C-1. CSPP Checklist

Coordination	Reference	Addressed?			Remarks
		Yes	No	NA	
General Considerations					
Requirements for predesign, prebid, and preconstruction conferences to introduce the subject of airport operational safety during construction are specified.	<u>2.5</u>				
Operational safety is a standing agenda item for construction progress meetings.	<u>2.5</u>				
Scheduling of the construction phases is properly addressed.	<u>2.6</u>				
Any formal agreements are established.	<u>2.5.3</u>				
Areas and Operations Affected by Construction Activity					
Drawings showing affected areas are included.	<u>2.7.1</u>				
Closed or partially closed runways, taxiways, and aprons are depicted on drawings.	<u>2.7.1.1</u>				
Access routes used by ARFF vehicles affected by the project are addressed.	<u>2.7.1.2</u>				
Access routes used by airport and airline support vehicles affected by the project are addressed.	<u>2.7.1.3</u>				
Underground utilities, including water supplies for firefighting and drainage.	<u>2.7.1.4</u>				

Coordination	Reference	Addressed?			Remarks
		Yes	No	NA	
Approach/departure surfaces affected by heights of temporary objects are addressed.	<u>2.7.1.5</u>				
Construction areas, storage areas, and access routes near runways, taxiways, aprons, or helipads are properly depicted on drawings.	<u>2.7.1</u>				
Temporary changes to taxi operations are addressed.	<u>2.7.2.1</u>				
Detours for ARFF and other airport vehicles are identified.	<u>2.7.2.2</u>				
Maintenance of essential utilities and underground infrastructure is addressed.	<u>2.7.2.3</u>				
Temporary changes to air traffic control procedures are addressed.	<u>2.7.2.4</u>				
NAVAIDs					
Critical areas for NAVAIDs are depicted on drawings.	<u>2.8</u>				
Effects of construction activity on the performance of NAVAIDs, including unanticipated power outages, are addressed.	<u>2.8</u>				
Protection of NAVAID facilities is addressed.	<u>2.8</u>				
The required distance and direction from each NAVAID to any construction activity is depicted on drawings.	<u>2.8</u>				
Procedures for coordination with FAA ATO/Technical Operations, including identification of points of contact, are included.	<u>2.8, 2.13.1, 2.13.5.3.1, 2.18.1</u>				
Contractor Access					
The CSPP addresses areas to which contractor will have access and how	<u>2.9</u>				

Coordination	Reference	Addressed?			Remarks
		Yes	No	NA	
the areas will be accessed.					
The application of 49 CFR Part 1542 Airport Security, where appropriate, is addressed.	<u>2.9</u>				
The location of stockpiled construction materials is depicted on drawings.	<u>2.9.1</u>				
The requirement for stockpiles in the ROFA to be approved by FAA is included.	<u>2.9.1</u>				
Requirements for proper stockpiling of materials are included.	<u>2.9.1</u>				
Construction site parking is addressed.	<u>2.9.2.1</u>				
Construction equipment parking is addressed.	<u>2.9.2.2</u>				
Access and haul roads are addressed.	<u>2.9.2.3</u>				
A requirement for marking and lighting of vehicles to comply with <i>AC 150/5210-5, Painting, Marking and Lighting of Vehicles Used on an Airport</i> , is included.	<u>2.9.2.4</u>				
Proper vehicle operations, including requirements for escorts, are described.	<u>2.9.2.5, 2.9.2.6</u>				
Training requirements for vehicle drivers are addressed.	<u>2.9.2.7</u>				
Two-way radio communications procedures are described.	<u>2.9.2.9</u>				
Maintenance of the secured area of the airport is addressed.	<u>2.9.2.10</u>				
Wildlife Management					
The airport operator's wildlife management procedures are addressed.	<u>2.10</u>				

Coordination	Reference	Addressed?			Remarks
		Yes	No	NA	
Foreign Object Debris Management					
The airport operator's FOD management procedures are addressed.	<u>2.11</u>				
Hazardous Materials Management					
The airport operator's hazardous materials management procedures are addressed.	<u>2.12</u>				
Notification of Construction Activities					
Procedures for the immediate notification of airport user and local FAA of any conditions adversely affecting the operational safety of the airport are detailed.	<u>2.13</u>				
Maintenance of a list by the airport operator of the responsible representatives/points of contact for all involved parties and procedures for contacting them 24 hours a day, seven days a week is specified.	<u>2.13.1</u>				
A list of local ATO/Technical Operations personnel is included.	<u>2.13.1</u>				
A list of ATCT managers on duty is included.	<u>2.13.1</u>				
A list of authorized representatives to the OCC is included.	<u>2.13.2</u>				
Procedures for coordinating, issuing, maintaining and cancelling by the airport operator of NOTAMS about airport conditions resulting from construction are included.	<u>2.8, 2.13.2, 2.18.3.3.9</u>				
Provision of information on closed or hazardous conditions on airport movement areas by the airport operator to the OCC is specified.	<u>2.13.2</u>				
Emergency notification procedures for medical, fire fighting, and police	<u>2.13.3</u>				

Coordination	Reference	Addressed?			Remarks
		Yes	No	NA	
response are addressed.					
Coordination with ARFF personnel for non-emergency issues is addressed.	<u>2.13.4</u>				
Notification to the FAA under 14 CFR parts 77 and 157 is addressed.	<u>2.13.5</u>				
Reimbursable agreements for flight checks and/or design and construction for FAA owned NAVAIDs are addressed.	<u>2.13.5.3.2</u>				
Inspection Requirements					
Daily and interim inspections by both the airport operator and contractor are specified.	<u>2.14.1, 2.14.2</u>				
Final inspections at certificated airports are specified when required.	<u>2.14.3</u>				
Underground Utilities					
Procedures for protecting existing underground facilities in excavation areas are described.	<u>2.15</u>				
Penalties					
Penalty provisions for noncompliance with airport rules and regulations and the safety plans are detailed.	<u>2.16</u>				
Special Conditions					
Any special conditions that affect the operation of the airport or require the activation of any special procedures are addressed.	<u>2.17</u>				
Runway and Taxiway Visual Aids - Marking, Lighting, Signs, and Visual NAVAIDs					
The proper securing of temporary airport markings, lighting, signs, and visual NAVAIDs is addressed.	<u>2.18.1</u>				
Frangibility of airport markings, lighting, signs, and visual NAVAIDs is specified.	<u>2.18.1, 2.18.3, 2.18.4.2, 2.20.2.4</u>				

Coordination	Reference	Addressed?			Remarks
		Yes	No	NA	
The requirement for markings to be in compliance with <u>AC 150/5340-1</u> , <i>Standards for Airport Markings</i> , is specified.	<u>2.18.2</u>				
Detailed specifications for materials and methods for temporary markings are provided.	<u>2.18.2</u>				
The requirement for lighting to conform to <u>AC 150/5340-30</u> , <i>Design and Installation Details for Airport Visual Aids</i> ; <u>AC 150/5345-50</u> , <i>Specification for Portable Runway and Taxiway Lights</i> ; and <u>AC 150/5345-53</u> , <i>Airport Lighting Certification Program</i> , is specified.	<u>2.18.3</u>				
The use of a lighted X is specified where appropriate.	<u>2.18.2.1.2</u> , <u>2.18.3.2</u>				
The requirement for signs to conform to <u>AC 150/5345-44</u> , <i>Specification for Runway and Taxiway Signs</i> ; <u>AC 150/5340-18</u> , <i>Standards for Airport Sign Systems</i> ; and <u>AC 150/5345-53</u> , <i>Airport Lighting Certification Program</i> , is specified.	<u>2.18.4</u>				
Marking and Signs For Access Routes					
The CSPP specifies that pavement markings and signs intended for construction personnel should conform to <u>AC 150/5340-18</u> and, to the extent practicable, with the MUTCD and/or State highway specifications.	<u>2.18.4.2</u>				
Hazard Marking and Lighting					
Prominent, comprehensible warning indicators for any area affected by construction that is normally accessible to aircraft, personnel, or vehicles are specified.	<u>2.20.1</u>				

Coordination	Reference	Addressed?			Remarks
		Yes	No	NA	
Hazard marking and lighting are specified to identify open manholes, small areas under repair, stockpiled material, and waste areas.	<u>2.20.1</u>				
The CSPP considers less obvious construction-related hazards.	<u>2.20.1</u>				
Equipment that poses the least danger to aircraft but is sturdy enough to remain in place when subjected to typical winds, prop wash and jet blast is specified.	<u>2.20.2.1</u>				
The spacing of barricades is specified such that a breach is physically prevented barring a deliberate act.	<u>2.20.2.1</u>				
Red lights meeting the luminance requirements of the State Highway Department are specified.	<u>2.20.2.2</u>				
Barricades, temporary markers, and other objects placed and left in areas adjacent to any open runway, taxiway, taxi lane, or apron are specified to be as low as possible to the ground, and no more than 18 inch high.	<u>2.20.2.3</u>				
Barricades are specified to indicate construction locations in which no part of an aircraft may enter.	<u>2.20.2.3</u>				
Highly reflective barriers with lights are specified to barricade taxiways leading to closed runways.	<u>2.20.2.5</u>				
Markings for temporary closures are specified.	<u>2.20.2.5</u>				
The provision of a contractor's representative on call 24 hours a day for emergency maintenance of airport hazard lighting and barricades is specified.	<u>2.20.2.7</u>				

Coordination	Reference	Addressed?			Remarks
		Yes	No	NA	
Work Zone Lighting for Nighttime Construction					
If work is to be conducted at night, the CSPP identifies construction lighting units and their general locations and aiming in relationship to the ATCT and active runways and taxiways.	<u>2.21</u>				
Protection of Runway and Taxiway Safety Areas					
The CSPP clearly states that no construction may occur within a safety area while the associated runway or taxiway is open for aircraft operations.	<u>2.22.1.1,</u> <u>2.22.3.1</u>				
The CSPP specifies that the airport operator coordinates the adjustment of RSA or TSA dimensions with the ATCT and the appropriate FAA Airports Regional or District Office and issues a local NOTAM.	<u>2.22.1.2,</u> <u>2.22.3.2</u>				
Procedures for ensuring adequate distance for protection from blasting operations, if required by operational considerations, are detailed.	<u>2.22.3.3</u>				
The CSPP specifies that open trenches or excavations are not permitted within a safety area while the associated runway or taxiway is open, subject to approved exceptions.	<u>2.22.1.4</u>				
Appropriate covering of excavations in the RSA or TSA that cannot be backfilled before the associated runway or taxiway is open is detailed.	<u>2.22.1.4</u>				
The CSPP includes provisions for prominent marking of open trenches and excavations at the construction site.	<u>2.22.1.4</u>				
Grading and soil erosion control to maintain RSA/TSA standards are	<u>2.22.3.5</u>				

Coordination	Reference	Addressed?			Remarks
		Yes	No	NA	
addressed.					
The CSPP specifies that equipment is to be removed from the ROFA when not in use.	<u>2.22.2</u>				
The CSPP clearly states that no construction may occur within a taxiway safety area while the taxiway is open for aircraft operations.	<u>2.22.3</u>				
Appropriate details are specified for any construction work to be accomplished in a taxiway object free area.	<u>2.22.4</u>				
Measures to ensure that personnel, material, and/or equipment do not penetrate the OFZ or threshold siting surfaces while the runway is open for aircraft operations are included.	<u>2.22.4.3.6</u>				
Provisions for protection of runway approach/departure areas and clearways are included.	<u>2.22.6</u>				
Other Limitations on Construction					
The CSPP prohibits the use of open flame welding or torches unless adequate fire safety precautions are provided and the airport operator has approved their use.	<u>2.23.1.2</u>				
The CSPP prohibits the use of electrical blasting caps on or within 1,000 ft (300 m) of the airport property.	<u>2.23.1.3</u>				

APPENDIX D. CONSTRUCTION PROJECT DAILY SAFETY INSPECTION CHECKLIST

The situations identified below are potentially hazardous conditions that may occur during airport construction projects. Safety area encroachments, unauthorized and improper ground vehicle operations, and unmarked or uncovered holes and trenches near aircraft operating surfaces pose the most prevalent threats to airport operational safety during airport construction projects. The list below is one tool that the airport operator or contractor may use to aid in identifying and correcting potentially hazardous conditions. It should be customized as appropriate for each project including information such as the date, time and name of the person conducting the inspection.

Table D-1. Potentially Hazardous Conditions

Item	Action Required (Describe)	No Action Required (Check)
Excavation adjacent to runways, taxiways, and aprons improperly backfilled.		
Mounds of earth, construction materials, temporary structures, and other obstacles near any open runway, taxiway, or taxi lane; in the related Object Free area and aircraft approach or departure areas/zones; or obstructing any sign or marking.		
Runway resurfacing projects resulting in lips exceeding 3 inch (7.6 cm) from pavement edges and ends.		
Heavy equipment (stationary or mobile) operating or idle near AOA, in runway approaches and departures areas, or in OFZ.		
Equipment or material near NAVAIDs that may degrade or impair radiated signals and/or the monitoring of navigation and visual aids. Unauthorized or improper vehicle operations in localizer or glide slope critical areas, resulting in electronic interference and/or facility shutdown.		
Tall and especially relatively low visibility units (that is, equipment with slim profiles) — cranes, drills, and similar objects — located in critical areas, such as OFZ and		

Item	Action Required (Describe)	No Action Required (Check)
approach zones.		
Improperly positioned or malfunctioning lights or unlighted airport hazards, such as holes or excavations, on any apron, open taxiway, or open taxi lane or in a related safety, approach, or departure area.		
Obstacles, loose pavement, trash, and other debris on or near AOA. Construction debris (gravel, sand, mud, paving materials) on airport pavements may result in aircraft propeller, turbine engine, or tire damage. Also, loose materials may blow about, potentially causing personal injury or equipment damage.		
Inappropriate or poorly maintained fencing during construction intended to deter human and animal intrusions into the AOA. Fencing and other markings that are inadequate to separate construction areas from open AOA create aviation hazards.		
Improper or inadequate marking or lighting of runways (especially thresholds that have been displaced or runways that have been closed) and taxiways that could cause pilot confusion and provide a potential for a runway incursion. Inadequate or improper methods of marking, barricading, and lighting of temporarily closed portions of AOA create aviation hazards.		
Wildlife attractants — such as trash (food scraps not collected from construction personnel activity), grass seeds, tall grass, or standing water — on or near airports.		
Obliterated or faded temporary markings on active operational areas.		
Misleading or malfunctioning obstruction lights. Unlighted or unmarked obstructions in the approach to any open runway pose aviation hazards.		

Item	Action Required (Describe)	No Action Required (Check)
Failure to issue, update, or cancel NOTAMs about airport or runway closures or other construction related airport conditions.		
Failure to mark and identify utilities or power cables. Damage to utilities and power cables during construction activity can result in the loss of runway / taxiway lighting; loss of navigation, visual, or approach aids; disruption of weather reporting services; and/or loss of communications.		
Restrictions on ARFF access from fire stations to the runway / taxiway system or airport buildings.		
Lack of radio communications with construction vehicles in airport movement areas.		
Objects, regardless of whether they are marked or flagged, or activities anywhere on or near an airport that could be distracting, confusing, or alarming to pilots during aircraft operations.		
Water, snow, dirt, debris, or other contaminants that temporarily obscure or derogate the visibility of runway/taxiway marking, lighting, and pavement edges. Any condition or factor that obscures or diminishes the visibility of areas under construction.		
Spillage from vehicles (gasoline, diesel fuel, oil) on active pavement areas, such as runways, taxiways, aprons, and airport roadways.		
Failure to maintain drainage system integrity during construction (for example, no temporary drainage provided when working on a drainage system).		

Item	Action Required (Describe)	No Action Required (Check)
Failure to provide for proper electrical lockout and tagging procedures. At larger airports with multiple maintenance shifts/workers, construction contractors should make provisions for coordinating work on circuits.		
Failure to control dust. Consider limiting the amount of area from which the contractor is allowed to strip turf.		
Exposed wiring that creates an electrocution or fire ignition hazard. Identify and secure wiring, and place it in conduit or bury it.		
Site burning, which can cause possible obscuration.		
Construction work taking place outside of designated work areas and out of phase.		

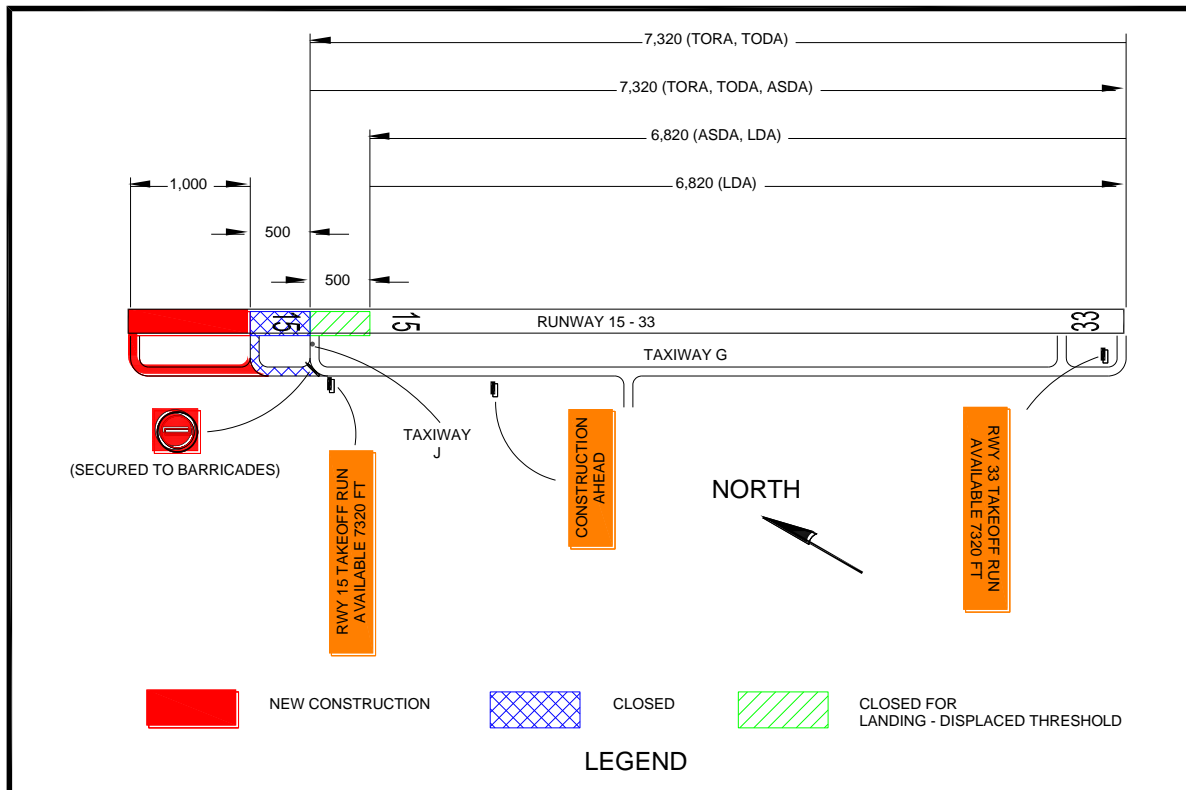
APPENDIX E. SAMPLE OPERATIONAL EFFECTS TABLE

E.1 Project Description.

Runway 15-33 is currently 7820 feet long, with a 500 foot stopway on the north end. This project will remove the stopway and extend the runway 1000 feet to the north and 500 feet to the south. Finally, the existing portion of the runway will be repaved. The runway 33 glide slope will be relocated. The new runway 33 localizer has already been installed by FAA Technical Operations and only needs to be switched on. Runway 15 is currently served only by a localizer, which will remain in operation as it will be beyond the future RSA. Appropriate NOTAMS will be issued throughout the project.

E.1.1 During Phase I, the runway 15 threshold will be displaced 1000 feet to keep construction equipment below the approach surface. The start of runway 15 takeoff and the departure end of runway 33 will also be moved 500 feet to protect workers from jet blast. Declared distances for runway 33 will be adjusted to provide the required RSA and applicable departure surface. Excavation near Taxiway G will require its ADG to be reduced from IV to III. See Figure E-1.

Figure E-1. Phase I Example

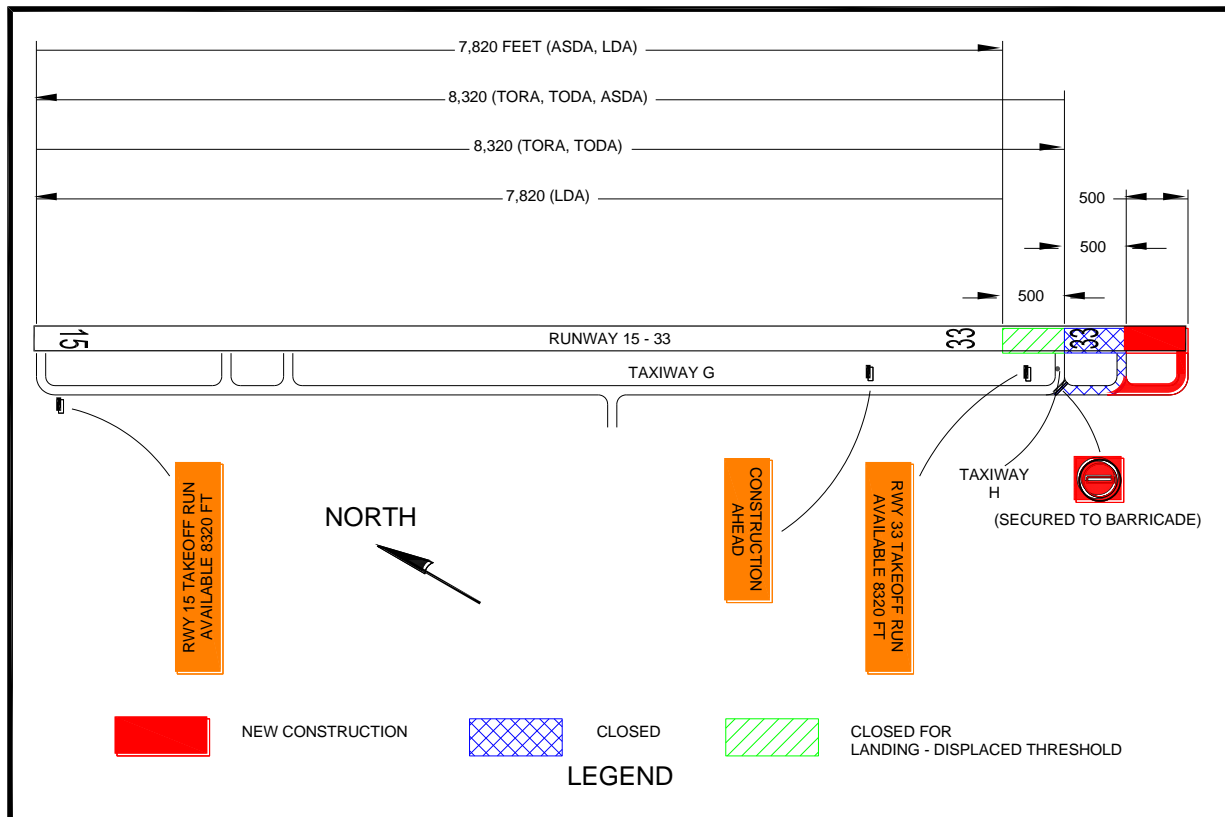


Note 1: Where hold signs are installed on both sides of a taxiway, install the TORA sign on the left side of the taxiway before the final turn to the runway intersection.

Note 2: Based on the declared distances for Runway 33 departures, the maximum equipment height in the construction area is 12.5 feet (500/40 = 12.5).

E.2 During Phase II, the runway 33 threshold will be displaced 1000 feet to keep construction equipment below the approach surface. The start of runway 33 takeoff and the departure end of runway 15 will also be moved 500 feet to protect workers from jet blast. Declared distances for runway 15 will be adjusted to provide the required RSA and applicable departure surface. See Figure E-2.

Figure E-2. Phase II Example



Note 1: Where hold signs are installed on both sides of a taxiway, install the TORA sign on the left side of the taxiway before the final turn to the runway intersection.

Note 2: Based on the declared distances for Runway 15 departures, the maximum equipment height in the construction area is 12.5 feet ($500/40 = 12.5$).

- E.3 During Phase III, the existing portion of the runway will be repaved with Hot Mix Asphalt (HMA) and the runway 33 glide slope will be relocated. Construction will be accomplished between the hours of 8:00 pm and 5:00 am, during which the runway will be closed to operations.

Figure E-3. Phase III Example

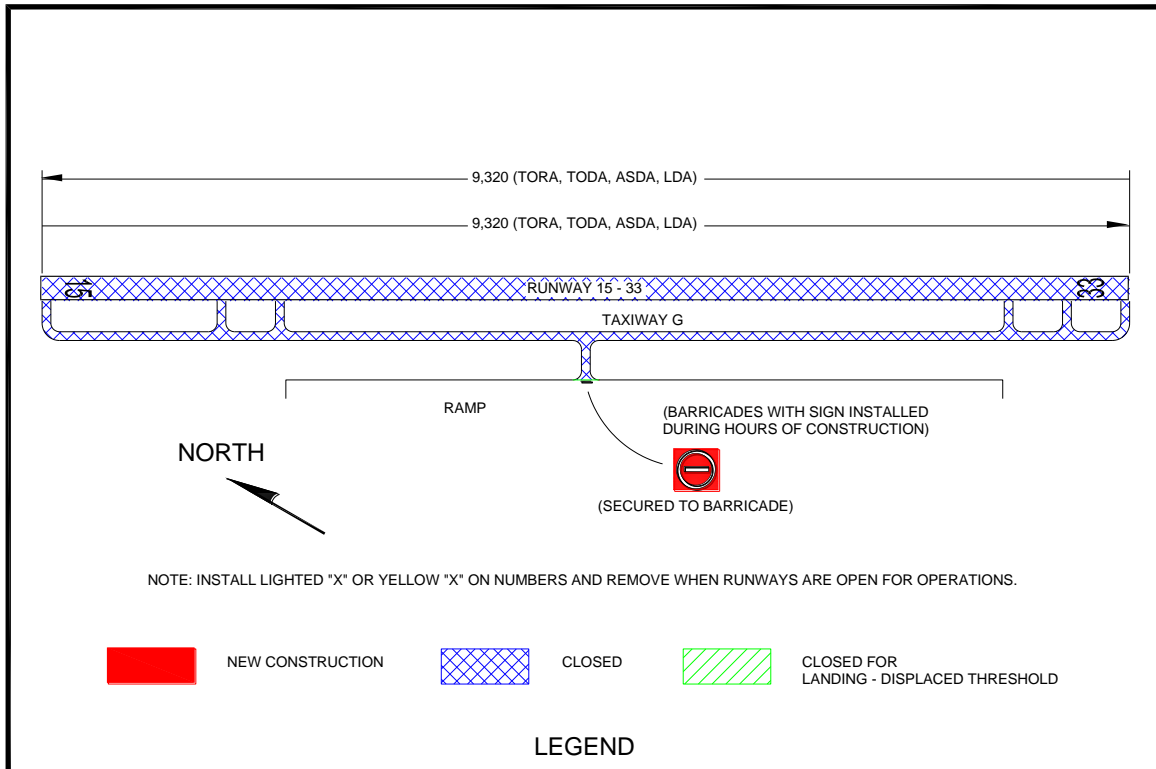


Table E-1. Operational Effects Table

Project	Runway 15-33 Extension and Repaving			
Phase	Normal (Existing)	Phase I: Extend Runway 15 End	Phase II: Extend Runway 33 End	Phase III: Repave Runway
Scope of Work	N/A	Extend Runway 15-33 1,000 ft on north end with Hot Mix Asphaltic Concrete (HMA).	Extend Runway 15-33 500 ft on south end with Hot Mix Asphaltic Concrete (HMA).	Repave existing runway with HMA Relocate Runway 33 Glide Slope
Effects of Construction Operations	N/A	Existing North 500 ft closed	Existing South 500 ft closed	Runway closed between 8:00 pm and 5:00 am Edge lighting out of service
Construction Phase	N/A	Phase I (Anticipated)	Phase II (Anticipated)	Phase III (Anticipated)
Runway 15 Average Aircraft Operations	Carrier: 52 /day GA: 26 /day Military: 11 /day	Carrier: 40 /day GA: 26 /day Military: 0 /day	Carrier: 45 /day GA: 26 /day Military: 5 /day	Carrier: 45 / day GA: 20 / day Military: 0 /day
Runway 33 Average Aircraft Operations	Carrier: 40 /day GA: 18 /day Military: 10 /day	Carrier: 30 /day GA: 18 /day Military: 0 /day	Carrier: 25 /day GA: 18 /day Military: 5 /day	Carrier: 20 /day GA: 5 /day Military: 0 /day
Runway 15-33 Aircraft Category	C-IV	C-IV	C-IV	C-IV
Runway 15 Approach Visibility Minimums	1 mile	1 mile	1 mile	1 mile
Runway 33 Approach Visibility Minimums	$\frac{3}{4}$ mile	$\frac{3}{4}$ mile	$\frac{3}{4}$ mile	1 mile

Note: Proper coordination with Flight Procedures group is necessary to maintain instrument approach procedures during construction.

Project		Runway 15-33 Extension and Repaving			
Phase		Normal (Existing)	Phase I: Extend Runway 15 End	Phase II: Extend Runway 33 End	Phase III: Repave Runway
Runway 15 Declared Distances	TORA	7,820	7,320	8,320	9,320
	TODA	7,820	7,320	8,320	9,320
	ASDA	7,820	7,320	7,820	9,320
	LDA	7,820	6,820	7,820	9,320
Runway 33 Declared Distances	TORA	7,820	7,320	8,320	9,320
	TODA	7,820	7,320	8,320	9,320
	ASDA	8,320	6,820	8,320	9,320
	LDA	7,820	6,820	7,820	9,320
Runway 15 Approach Procedures		LOC only	LOC only	LOC only	LOC only
		RNAV	RNAV	RNAV	RNAV
		VOR	VOR	VOR	VOR
Runway 33 Approach Procedures		ILS	ILS	ILS	LOC only
		RNAV	RNAV	RNAV	RNAV
		VOR	VOR	VOR	VOR
Runway 15 NAVAIDs		LOC	LOC	LOC	LOC
Runway 33 NAVAIDs		ILS, MALSR	ILS, MALSR	ILS, MALSR	LOC, MALSR
Taxiway G ADG		IV	III	IV	IV
Taxiway G TDG		4	4	4	4
ATCT (hours open)		24 hours	24 hours	24 hours	0500 - 2000
ARFF Index		D	D	D	D

Project	Runway 15-33 Extension and Repaving			
Phase	Normal (Existing)	Phase I: Extend Runway 15 End	Phase II: Extend Runway 33 End	Phase III: Repave Runway
Special Conditions	Air National Guard (ANG) military operations	All military aircraft relocated to alternate ANG Base	Some large military aircraft relocated to alternate ANG Base	All military aircraft relocated to alternate ANG Base
Information for NOTAMs		Refer above for applicable declared distances. Taxiway G limited to 118 ft wingspan	Refer above for applicable declared distances.	Refer above for applicable declared distances. Airport closed 2000 – 0500. Runway 15 glide slope OTS.

Note: This table is one example. It may be advantageous to develop a separate table for each project phase and/or to address the operational status of the associated NAVAIDs per construction phase.

Complete the following chart for each phase to determine the area that must be protected along the runway and taxiway edges:

Table E-2. Runway and Taxiway Edge Protection

Runway/Taxiway	Aircraft Approach Category* A, B, C, or D	Airplane Design Group* I, II, III, or IV	Safety Area Width in Feet Divided by 2*

*See AC 150/5300-13 to complete the chart for a specific runway/taxiway.

Complete the following chart for each phase to determine the area that must be protected before the runway threshold:

Table E-3. Protection Prior to Runway Threshold

Runway End Number	Airplane Design Group* I, II, III, or IV	Aircraft Approach Category* A, B, C, or D	Minimum Safety Area Prior to the Threshold*	Minimum Distance to Threshold Based on Required Approach Slope*	
				ft	: 1
			ft	ft	: 1
			ft	ft	: 1
			ft	ft	: 1
			ft	ft	: 1

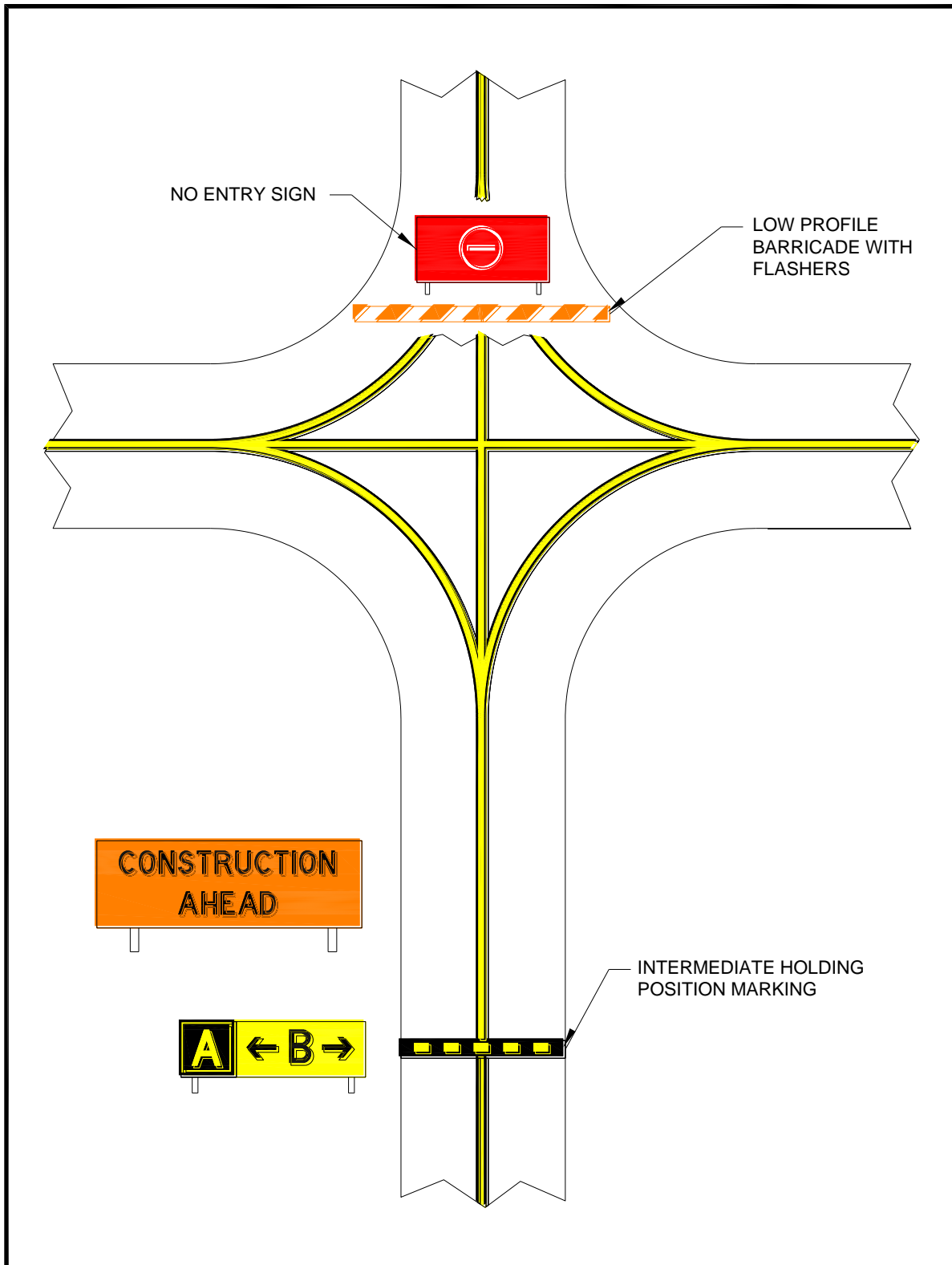
*See AC 150/5300-13 to complete the chart for a specific runway.

APPENDIX F. ORANGE CONSTRUCTION SIGNS

Figure F-1. Approved Sign Legends

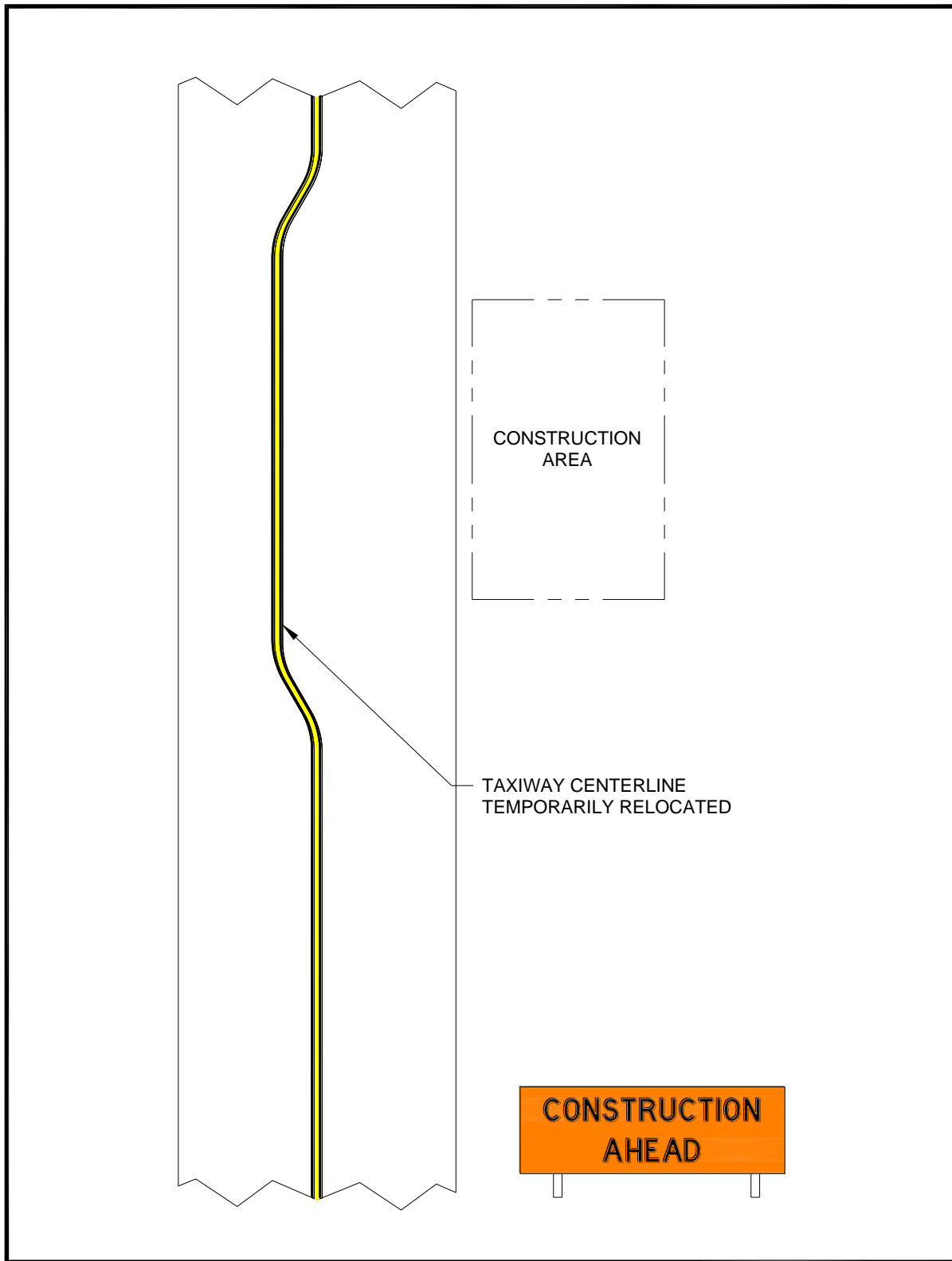


Figure F-2. Orange Construction Sign Example 1



Note: For proper placement of signs, refer to EB 93.

Figure F-3. Orange Construction Sign Example 2



Note: For proper placement of signs, refer to EB 93.

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Advisory Circular Feedback

If you find an error in this AC, have recommendations for improving it, or have suggestions for new items/subjects to be added, you may let us know by (1) mailing this form to Manager, Airport Engineering Division, Federal Aviation Administration ATTN: AAS-100, 800 Independence Avenue SW, Washington DC 20591 or (2) faxing it to the attention of the Office of Airport Safety and Standards at (202) 267-5383.

Subject: AC 150/5370-2G

Date: _____

Please check all appropriate line items:

An error (procedural or typographical) has been noted in paragraph _____ on page _____.

Recommend paragraph _____ on page _____ be changed as follows:

In a future change to this AC, please cover the following subject:
(Briefly describe what you want added.)

Other comments:

I would like to discuss the above. Please contact me at (phone number, email address).

Submitted by: _____

Date: _____

APPENDIX B

FAAAC 150/5210-5D

PAINING, MARKING, AND LIGHTING OF VEHICLES USED ON AIRPORTS



U.S. Department
of Transportation

Federal Aviation
Administration

Advisory Circular

Subject: Painting, Marking, and Lighting of
Vehicles Used on an Airport

Date: April 1, 2010

AC No: AC 150/5210-5D

Initiated by: AAS-100

Change:

1. **PURPOSE.** This advisory circular (AC) provides guidance, specifications, and standards for painting, marking, and lighting of vehicles operating in the airport air operations area (AOA). The approved lights, colors, and markings herein assure the conspicuity of vehicles operating in the AOA from both the ground and the air.

2. **CANCELLATION.** This AC cancels AC 150/5210-5C, Painting, Marking, and Lighting of Vehicles Used on an Airport, dated August 31, 2007.

3. **APPLICATION.** The Federal Aviation Administration (FAA) recommends the guidelines and standards in this Advisory Circular for vehicles operating in the airport AOA. In general, use of this AC is not mandatory. *However*, use of this AC is mandatory for vehicles funded with federal grant monies through the Airport Improvement Program (AIP) and/or with revenue from the Passenger Facility Charges (PFC) Program. See Grant Assurance No. 34, "Policies, Standards, and Specifications," and PFC Assurance No. 9, "Standard and Specifications."

Vehicles covered by this AC that do not meet this standard may be used until the vehicle is repainted or replaced, but no later than **December 31, 2010**.

4. **PRINCIPAL CHANGES.** This AC contains new specifications and recommendations for the painting, marking, and lighting of Towbarless Tow Vehicles (TLTVs).

5. **METRIC UNITS.** To promote an orderly transition to metric units, this AC includes both English and metric dimensions. The metric conversions may not be exact equivalents, and until there is an official changeover to the metric system, the English dimensions will govern.

6. **COMMENTS OR SUGGESTIONS** for improvements to this AC should be sent to:

Manager, Airport Engineering Division
Federal Aviation Administration
ATTN: AAS-100
800 Independence Avenue, S.W.
Washington, DC 20591

Michael J. O'Donnell
Director of Airport Safety and Standards

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PAINTING, MARKING, AND LIGHTING OF VEHICLES USED ON AN AIRPORT

1. SOURCES OF APPLICABLE DOCUMENTS.

- a.** American National Standards Institute, Inc. (ANSI), 25 West 43rd St. 4th Floor, New York, NY 10036. Website: www.ansi.org
- b.** American Society for Testing & Materials (ASTM), ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959. Website: www.astm.org
- c.** The National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, Massachusetts 02169-7471. Website: www.nfpa.org
- d.** The U. S. General Services Administration (GSA), Centralized Mailing List Services, 501 West Felix Street, Whse 9, South End P.O. Box 6477, Fort Worth, Texas 76115-6477. Website: www.gsa.gov
- e.** The Superintendent of Documents, U.S. Government Printing Office, 732 North Capitol St. NW, Washington, DC 20401.
- f.** Society of Automotive Engineers, Inc. (SAE), 400 Commonwealth Drive, Warrendale, PA 15096-0001. Website: www.sae.org
- g.** FAA Advisory Circulars: U.S. Department of Transportation, Subsequent Distribution Office, Ardmore East Business Center, 3341 Q 75th Ave., Landover, MD 20785. Website: www.faa.gov
- h.** FAA Engineering Briefs: www.faa.gov/airports/engineering/engineering_briefs/

2. DEFINITIONS. The following definitions apply in this AC:

- a. Vehicle** – All conveyances, except aircraft, used on the ground to transport persons, cargo, equipment or those required to perform maintenance, construction, service, and security duties.
- b. Air Operations Area (AOA)** – The portion of airport that encompasses the landing, take off, taxiing, and parking areas for aircraft.
- c. Airport Emergency Vehicles** – Vehicles that are authorized in the AOA for emergency purposes (e.g., ambulances, aircraft rescue and fire fighting (ARFF) vehicles and emergency response vehicles) as authorized by the airport traffic control tower (ATCT) or an authorized on-site accident/incident commander.
- d. Airport Operations Vehicles** – Vehicles routinely used by airport operations personnel for airport inspection and duties associated with airfield operations (such as airfield condition reporting and Incident Command) on the AOA and Movement Area.
- e. Airport Security Vehicles** – Vehicles that are authorized in the AOA for security purposes, as needed (e.g. police cars).

- f. Airfield Service Vehicles** – Vehicles that are routinely used in the AOA for airfield service, maintenance, or construction (e.g. snow blowers, snowplows, maintenance trucks, and tractors).
- g. Aircraft Support Vehicles** – Vehicles that are routinely used in the AOA to support aircraft operations (e.g. aircraft pushback tractors, baggage/cargo tractors or trucks, air conditioning and aviation fuel trucks). These vehicles are typically owned by airlines, vendors, or contractors and are not eligible for Federal funding.
- h. Reduced Visibility** – Prevailing visibility is less than one statute mile (1609 meters) and/or the runway visual range (RVR) is less than 6,000 feet (1830 meters).
- i. Movement Area** – The runways, taxiways, and other areas of an airport/heliport that are used for taxiing/hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and parking areas. At those airports/heliports with an operating airport traffic control tower (ATCT), specific approval for entry onto the movement area must be obtained from air traffic control (ATC).
- j. Other Vehicles** – Vehicles that are not routinely authorized in the AOA (e.g. construction vehicles). These vehicles are typically owned by airlines, vendors, or contractors and are not eligible for Federal funding.
- k. Peak Intensity** – Peak intensity, for purposes of this document, means the maximum magnitude of luminescence as measured in candela.
- l. Towbarless Tow Vehicle (TLTV)** – a type of aircraft support vehicle whose main purpose is to tow aircraft in the AOA by way of nose gear capture.

3. VEHICLE PAINTING.

NOTE: *Airport vehicle paint and markings are a safety of flight requirement. The approved colors/markings herein assure conspicuity of vehicles operating in the AOA from both the ground and air.*

a. Airport Emergency Vehicles.

(1) Ambulances. Ambulance vehicles are painted per the most current version of Federal Specification KKK-A-1822, *Federal Specification for the Star-of-Life Ambulance*. Ambulances are not considered vehicles routinely operating on the AOA.

(2) Aircraft Rescue and Fire Fighting (ARFF) Vehicles. Yellowish-green is the vehicle color standard. Color specifications are per Appendix A.

NOTE: *A yellowish-green color provides optimum visibility during all light levels encountered during a 24-hour day and under variations of light that result from weather and seasonal changes.*

b. Airport Operations Vehicles. Airport operations vehicles may be painted in colors designated by the airport operator. The characteristics must be coordinated with the respective ATCT and identified in the tower letter of agreement.

c. Airport Security Vehicles. Comply with specific state or local requirements.

d. Airfield Service Vehicles. Chrome yellow is the vehicle color standard. Color specifications are per Appendix A. When vehicles are equipped with bumper bars 8 inches (200 mm) or more in depth, the bars must be painted in alternate stripes 4 inches (100 mm) in width of chrome yellow and black inclined 45° to the vertical.

e. Aircraft Support Vehicles.

(1) Any color or combination of colors other than yellowish-green or chrome yellow. The bumper bar paint scheme in paragraph 3.d (of alternating chrome yellow and black stripe) is recommended.

(2) **TLTVs.** International orange is the vehicle color standard. Retroreflective tape covering more than 25 percent of the vehicle's vertical surfaces may be used as a temporary measure to meet this standard prior to scheduled vehicle painting.

f. Other Vehicles. Any color or combination of colors other than solid black or white.

4. VEHICLE MARKING.

a. Airport Emergency Vehicles.

(1) **Ambulances.** Ambulances are marked per the most current version of Federal Specification KKK-A-1822.

(2) **ARFF Vehicles.** Emergency rescue and fire fighting vehicles are marked with the letters "ARFF," "Fire," or "Rescue" and in accordance with 4.c.(1)-(5) of this AC.

b. Airport Operations Vehicles. Airport operations vehicles may be marked as designated by the airport operator. Marking must be coordinated with the respective ATCT and identified in the tower letter of agreement.

c. Airfield Service Vehicles and Aircraft Support Vehicles.

(1) Airport operator owned vehicles must display an identification number on each side and on the roof (the hood should be used if the vehicle has no roof).

(2) Side numbers will be a minimum of 16 inches (410 mm) in height and conspicuously located.

(3) Roof numbers will be a minimum of 24 inches (610 mm) in height and affixed with their bases toward the front of the vehicle. The identification numbers should provide sharp color contrast to the vehicle color.

(4) In addition to the identification numbers, airport operator-owned vehicles must display either the name of the airport and/or the airport insignia.

(5) To further improve night-time recognition of vehicles, a minimum 8 inch (200 mm) wide horizontal band of high gloss white paint or white reflective tape (Retroreflective, ASTM-D 4956-09, *Standard Specification for Retroreflective Sheeting for Traffic Control*, Type III & above) must be used around the vehicle's surface. Figures 1, 2, and 3 show suggested locations for the horizontal reflective band.

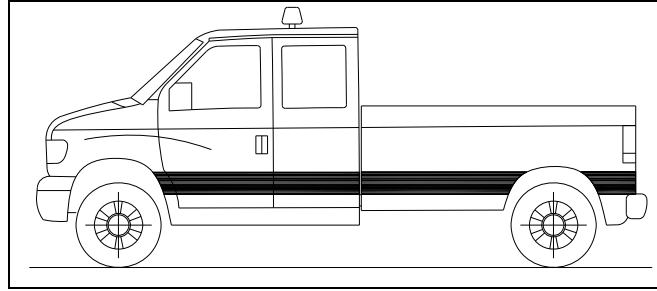


Figure 1: Suggested location for the horizontal reflective band, Option 1

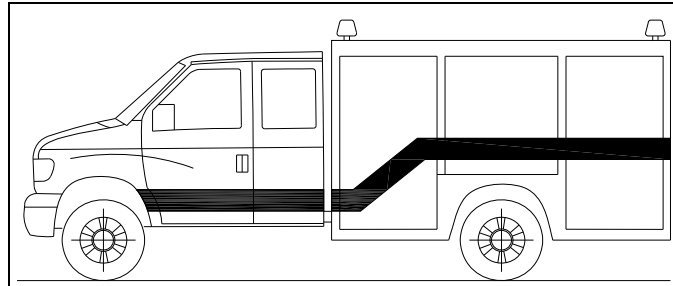


Figure 2: Suggested location for the horizontal reflective band, Option 2

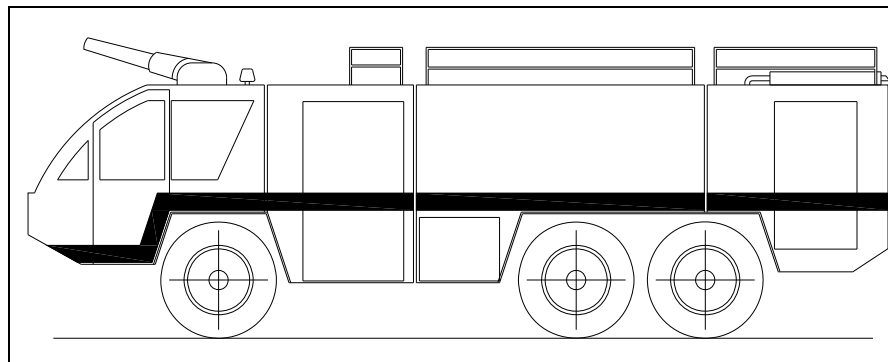


Figure 3: Suggested location for the horizontal reflective band, Option 3

(6) **TLTVs.** Retroreflective tape is used to outline the shape of a TLTV. If the vertical edge of the vehicle is rounded, the tape should be placed on the rounded portion to reflect light in both the horizontal and vertical planes. Where the placement of the tape may interfere with, or may be worn down by, maintenance or operational activities, tape is not required. Suggested locations for the retroreflective bands are shown in Figure 4.

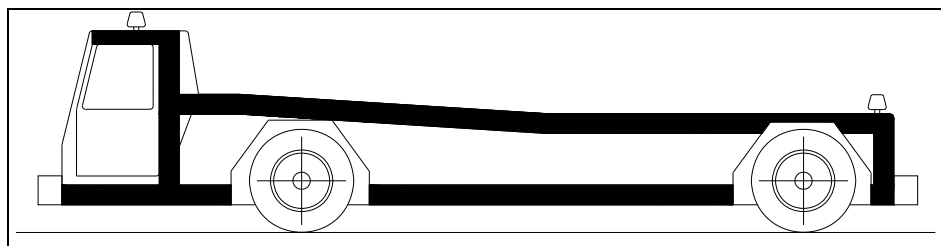


Figure 4: Suggested placement of retroreflective tape on a TLTV

d. Airport Security and Other Vehicles.

- (1) Vehicles other than those that routinely traverse any portion of the AOA under the control of ATC, which are not escorted by a vehicle in constant two-way radio communication with ATC and properly equipped and authorized to operate in the AOA, must be provided with a flag on a staff attached to the vehicle so that the flag will be readily visible.
- (2) At airports without air traffic control facilities, flags must be provided on all vehicles.
- (3) The flag must be at least a 3-foot by 3-foot (0.9 meter by 0.9 meter) square having a checkered pattern of international orange and white squares at least 1 foot (300 mm) on each side (see Appendix A for the fabric color specification).

5. VEHICLE LIGHTING.

a. Airfield Service, Aircraft Support, and Airport Operations Vehicles.

- (1) The standard for identification lighting is a yellow flashing light that is mounted on the uppermost part of the vehicle structure. A steady yellow light designates vehicles limited to non-movement areas.
- (2) The light must be visible from any direction, day and night, including from the air.
- (3) Color specifications for vehicle identification lights are per Appendix B.
- (4) **TLTVs.** An LED light bar placed above the operator's cab may be used in place of the rotating yellow flashing light. In addition, a yellow flashing light (of any type) must be installed on the upper left-rear and right-rear corners of the TLTV, and must be activated when an aircraft is in tow. The size of the rear flashing lights must be large enough to meet the requirements of Section 5.c, but not so large as to interfere with the normal or towing operations of the TLTV.

b. Airport Emergency, Security, and Other Vehicles, which are not escorted by a properly lighted vehicle, must be identified during periods of low visibility by a light.

c. Characteristics of Flashing Lights:

- (1) Ambulance lights must meet the specifications in the most current version of Federal Specification KKK-A-1822, and ARFF vehicles must meet NFPA, state, and local requirements.
- (2) Lights must have peak intensity within the range of 40 to 400 candelas (effective) from 0° (horizontal) up to 10° above the horizontal and for 360° horizontally. The upper limit of 400 candelas (effective) is necessary to avoid damage to night vision.
- (3) From 10° to 15° above the horizontal plane, the light output must be 1/10th of peak intensity or between 4 and 40 candelas (effective).

- (4) Lights must flash at 75 ± 15 flashes per minute.

NOTES:

1. *The effective intensity of a flashing light is equal to the intensity of a steady-burning (fixed) light of the same color that produces the same visual range under identical conditions of observation.*

2. *If xenon flashtubes are used, refer to AC 150/5345-43, Specification for Obstruction Lighting Equipment, for guidance concerning methods of calculating effective intensity.*

d. Light Colors.

(1) Airport Emergency Vehicles.

(a) **Ambulances.** Per the most current version of Federal Specification KKK-A-1822.

(b) **ARFF Vehicles.** Red or a combination of red-and-white flashing lights per the chromaticity requirements in Appendix B.

(2) Airport Security Vehicles. Signal blue or a combination of red and signal blue flashing light per the chromaticity requirements in Appendix B.

(3) Airfield Service, Aircraft Support, Airport Operations, and Other Vehicles. Yellow flashing light per the chromaticity requirements in Appendix B.

APPENDIX A. COLOR SPECIFICATIONS

A-1. SPECIFICATIONS. Colors specified in Table A-1 are per the Commission Internationale de l'Eclairage (CIE) L*a*b* system of color specification. For a description of this system, refer to American Society for Testing & Materials (ASTM) D 2244, *Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates*.

Table A-1. Specification for vehicle and flag colors

Standard Illuminant D65 Usage	Chrome Yellow			Yellowish-Green			International Orange		
	Vehicle Paint			Vehicle Paint			Vehicle Paint / Flag Fabric		
CIELAB DATA	L*	a*	b*	L*	a*	b*	L*	a*	b*
Centroid Color	72.8	24.4	77.6	78.3	-10.2	80.4	45.0	53.5	52.0
Point 1	72.8	31.8	82.9	78.3	-9.0	92.0	45.0	61.4	47.8
Point 2	72.8	25.5	66.7	78.3	-7.6	73.2	45.0	53.9	41.4
Point 3	72.8	18.0	69.3	78.3	-11.0	69.3	45.0	53.5	53.4
Point 4	72.8	22.4	86.0	78.3	-13.4	86.2	45.0	49.7	60.4
Light Limit	77.8			83.3			49.9		
Dark Limit	67.8			73.3			41.6		
Max ΔE	11.1			11.7			10.7		

A-2. COLOR TESTS. Acceptable colors are those that meet the gloss rating test and either a visual or an instrumental color test as follows:

NOTE: *Flag fabric colors must meet either the instrumental tests in Table A-1 or the visual method described in paragraph A-2b(1).*

a. Gloss Rating Test. This test is performed per ASTM D 523, *Standard Test Method for Specular Gloss*, on a paint sample of the color to be applied on the vehicle. An acceptable color sample is high gloss with a minimum gloss rating of 70 units, for 60° geometry.

b. Color Test Methods:

(1) Visual. Prepare a master specimen of the color (per Table A-1) and gloss (per paragraph A-2a). This specimen will be the master color and be used as the basis of comparison per ASTM D 5531-05, *Standard Guide for the Preparation, Maintenance, and Distribution of Physical Product Standards for Color and Geometric Appearance of Coatings*. To verify the paint color of a vehicle visually, vehicle paint samples must be

prepared and viewed per ASTM D 1729-96 (Reapproved 2009), *Standard Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials*.

(2) Instrumental. This test requires a test specimen sample and reference to Table A-1. All test specimen measurements should be conducted per ASTM E 1164-09a *Standard Practice for Obtaining Spectrometric Data for Object-Color Evaluation*. Test specimen tolerances must be per Table A-1 per the following:

(a) Plot the centroid color using the a* and b* CIELAB coordinate data from Table A-1 on graph paper or by entry of the coordinate data into a computer program. Plot and connect points 1 through 4 from the same table to form a quadrilateral; noting that the centroid color is within this figure. See Figure A-1 for plots of all three color specifications in Table A-1.

(b) Perform color sample measurements per ASTM E 1164-09a. If necessary, convert measurements to CIELAB L*, a*, and b* color space. See ASTM E 308-08, *Standard Practice for Computing the Colors of Objects by Using the CIE System*, for color space conversion formulae.

(c) An acceptable color is one that meets:

(i) the chromaticity requirements of the color samples a* and b* CIELAB coordinate data by falling within the quadrilateral;

(ii) the L* data lightness requirement by falling within the range defined by the light and dark data of Table A-1;

(iii) the total color difference (ΔE) by not exceeding the limits in Table A-1 when the CIELAB data are computed in the following formula:

$$\Delta E = (\Delta L^{*2} + \Delta a^{*2} + \Delta b^{*2})^{\frac{1}{2}}$$

where ΔL^* , Δa^* , and Δb^* values are the differences between those values for the centroid color in Table A-1 and those of the color sample measurements.

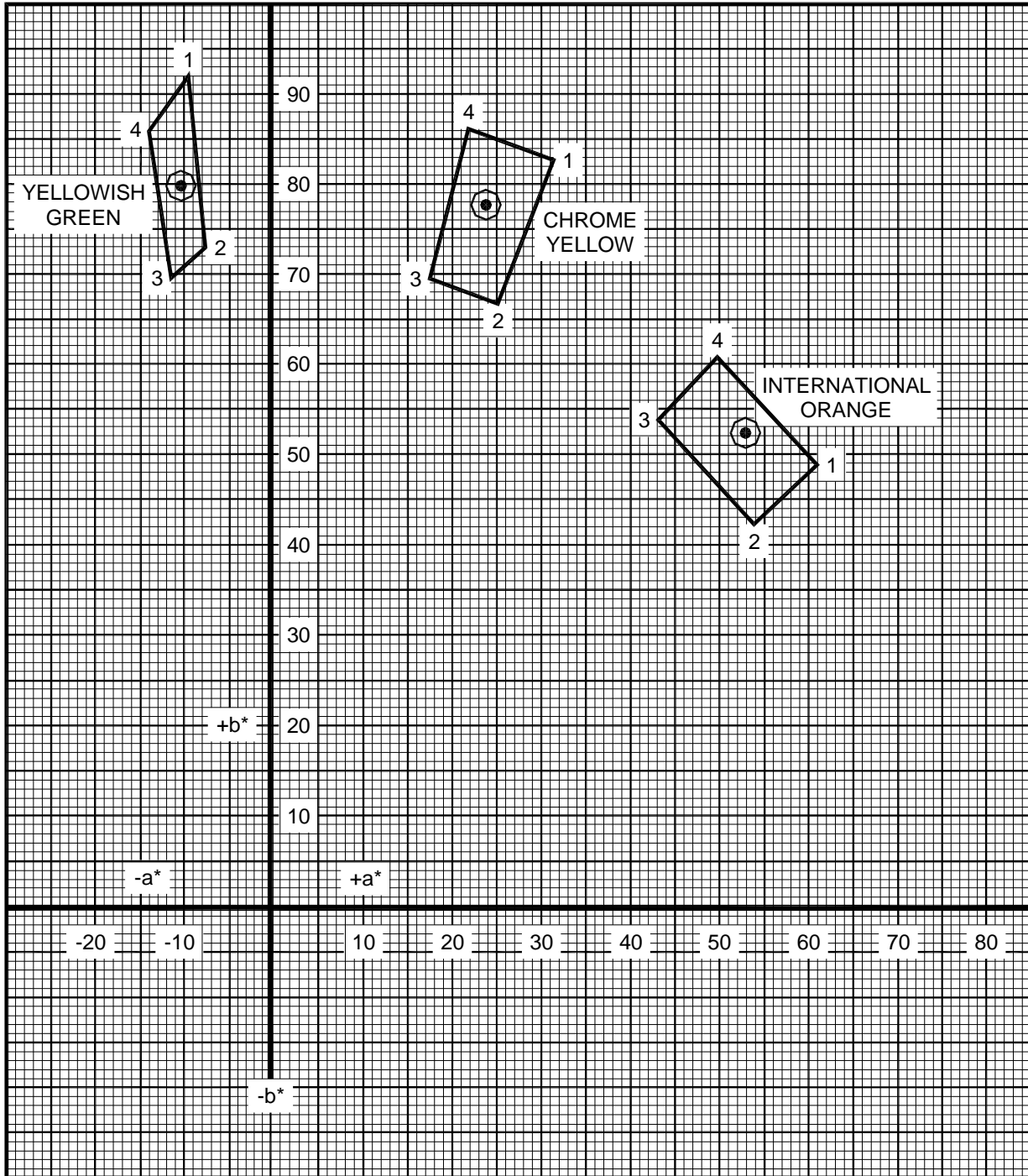


Figure A-1. Plot of selected color paint specifications

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APPENDIX B. COLOR SPECIFICATIONS FOR VEHICLE IDENTIFICATION LIGHTS

B-1. SPECIFICATIONS. The Society of Automotive Engineers (SAE) Standard J578 Revised December 2006, *Color Specification*, defines the acceptable color boundary limits and measurement of emitted red, white, signal blue, and yellow light for vehicle lights. This standard applies to the overall emitted color of light from the device in lieu of emitted light from any small area of the lens. The color of emitted light must fall within the color boundaries per SAE J578 Revised December 2006 (color boundary equations are in the standard) using color measurement methods detailed in the standard. See FAA Engineering Brief #67, *Light Sources Other Than Incandescent and Xenon for Airport and Obstruction Lighting Fixtures*, for additional information and *Alternative Lighting Devices*.

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APPENDIX C

FAA AC 150/5200-18C

AIRPORT SAFETY SELF INSPECTION



U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

**Subject: AIRPORT SAFETY
SELF-INSPECTION**

Date: 04/23/04

AC No: 150/5200-18C

Initiated by: AAS-300 **Change:**

- 1. PURPOSE.** This Advisory Circular (AC) provides information to airport operators on airport self-inspection programs and identifies items that airport operators should include in such a program.
- 2. FOCUS.** Development of a self-inspection program in accordance with this AC represents an acceptable means of compliance with the 14 Code of Federal Regulations (CFR) Part 139 (Part 139) requirements.
- 3. CANCELLATION.** Advisory Circular 150/5200-18B, Airport Safety Self-Inspection, dated 5/2/88, is cancelled.
- 4. RELATED READING MATERIAL.**
 - a. 14 CFR Part 139, Certification of Airports.** While Part 139 requirements are mandatory for a holder of a Part 139 Airport Operating Certificate, the regulation contains many safety practices that the Federal Aviation Administration recommends for use at all airports.
 - b.** 14 CFR Part 77, Objects Affecting Navigable Airspace.
 - c.** Current editions of the following advisory circulars:
 - (1)** AC 150/5200-33, Hazardous Wildlife Attractants on or near Airports
 - (2)** AC 150/5210-21, Airport Certification Manual (ACM). This reference is pertinent for certificated airports only.
 - (3)** AC 150/5210-20, Ground Vehicle Operations on Airports.
 - (4)** AC 150/5200-28, Notices to Airmen (NOTAMs) for Airport Operators.
 - (5)** AC 150/5200-30, Airport Winter Safety and Operations.
 - (6)** AC 150/5210-5, Painting, Marking, and Lighting of Vehicles Used on an Airport.
 - (7)** AC 150/5230-4, Aircraft Fuel Storage, Handling, and Dispensing on Airports.
 - (8)** AC 150/5300-13, Airport Design.
 - (9)** AC 150/5340-1, Standards for Airport Markings.
 - (10)** AC 150/5340-18, Standards for Airport Sign Systems.
 - (11)** AC 150/5340-21, Airport Miscellaneous Lighting Visual Aids.
 - (12)** AC 150/5340-24, Runway and Taxiway Edge Lighting System.

- (13) AC 150/5340-26, Maintenance of Airport Visual Aid Facilities.
- (14) AC 150/5370-2, Operational Safety on Airports During Construction.
- (15) AC 150/5370-10, Standards for Specifying Construction of Airports.

d. Obtain the latest version of the free Advisory Circular publications from the FAA on its Web site at www.faa.gov/arp/. In addition, these ACs are available by contacting the U.S. Department of Transportation, Subsequent Distribution Office, SVC-121.23, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785. All FAA ACs are listed in the Advisory Circular Checklist, AC 00-2.1, which is available on the internet. The Checklist also explains how to obtain the circulars.

5. BACKGROUND.

a. While some hazardous airport conditions develop virtually instantaneously, others are gradual. It is important that the airport operator have an airport safety self-inspection program that monitors specific airport conditions in order to identify unsatisfactory conditions for prompt corrective actions. A number of airport operators have some form of a safety self-inspection program. The programs vary in scope and effectiveness from verbal instructions and unscheduled and unrecorded inspections to very comprehensive inspection programs with multiple daily schedules and widely distributed responsibilities.

b. At airports certificated under 14 CFR Part 139, the self-inspection program is a key component of an airport operator's airport certification program and required under §139.327. An effective self-inspection program enables an airport operator to operate in compliance to Part 139 standards on a day-to-day basis. In accordance with Part 139, all airports must have an Airport Operating Certificate if serving—

(1) Scheduled or unscheduled passenger operations of an air carrier with aircraft having a seating capacity of more than 30 passengers, or

(2) Scheduled passenger operations with aircraft having a seating capacity of more than 9 and less than 31 passengers.¹

One of the requirements of Part 139 is that the operator of each certificated airport regularly conduct a daily safety self-inspection to ensure that prompt corrective action is taken to eliminate unsafe conditions on the airport. The specific requirements of the self-inspection program at each certificated airport are addressed in the airport certification manual.

c. This AC suggests components, responsibilities, and items for regularly scheduled, continuous surveillance, periodic condition and special inspections, and checklists for use during any of these airport safety self-inspections. This guidance can be modified as necessary to meet local situations. The information and guidance in this publication serve as a basis by which airports operators may develop their own safety self-inspection programs.

6. RESPONSIBILITIES.

a. **Safety Self-Inspection.** Self-inspection is a primary responsibility of the airport owner, operator, or a duly authorized representative. It is customary to assign the job of assuring overall airport ground safety to the airport manager or operations supervisor. Primary attention should be given to such operational items as pavement areas, safety areas, markings, signs, lighting, aircraft rescue and fire fighting, fueling operations, navigational aids, ground vehicles, obstructions, public protection, wildlife

¹ Part 139 is only applicable in the State of Alaska to airport operators serving scheduled or unscheduled passenger operations of an air carrier with aircraft having a seating capacity of more than 30 passengers.

hazard management, construction, and snow and ice control. Inspection of areas that have been assigned to individual air carriers, fixed base operators, or other tenants can be made the responsibility of the user. However, at Part 139 airports, the FAA will hold the certificate holder ultimately responsible for operating the airport safely.

b. Recommended Inspection Frequency.

(1) **Regularly scheduled inspection.** The airport should be inspected at least daily during times when aircraft activity is minimal in order to create the least impact on airport operations. Part of this inspection should be done during the hours of darkness at those airports that serve air carriers after dark.

(2) **Continuous surveillance inspection.** Those activities and facilities that have been identified to require continuous surveillance should be inspected any time personnel are in the air operations area. Hazardous conditions can occur at any time and in a short period of time.

(3) **Periodic condition inspection.** Periodic condition inspection of activities and facilities can be conducted on a regularly scheduled basis but less frequently than daily. The time interval could be weekly, monthly, or quarterly, depending on the activity or facility.

(4) **Special inspection.** Special inspections of activities and facilities should be conducted after receipt of a complaint or when an unusual condition or unusual event occurs on the airport, such as a significant meteorological event or an accident or incident. Special inspections should also be conducted at the end of construction activity to ensure that there are no unsafe conditions present related to the construction activity. A special inspection should be conducted prior to construction personnel leaving the airport in the event that corrective actions are necessary. Special inspections should be documented on the appropriate portions of the regularly scheduled inspection checklist.

c. Inspection Records. An effective safety self-inspection program includes procedures for reporting and correcting deficiencies. This means that the airport operator should have a work order system in place so that deficiencies can be corrected in an expeditious manner.

(1) The operator should issue a Notice to Airmen (NOTAM), as appropriate, through the appropriate Flight Service Station (FSS) reporting deficient conditions that could have an immediate and critical impact on the safety of aircraft operations. When corrective actions have been taken, the NOTAM should be cancelled. At Part 139 airports, other similar systems and procedures may be used if approved by the FAA.

(2) For even the smallest airport, it is desirable to use a safety self-inspection checklist that constitutes a written record of conditions noted, and acts as a check on follow-up actions taken. The scheduled use of a dated checklist will assure the regularity and thoroughness of safety inspections and follow-up. The checklist can be an important administrative tool for airport management. It can provide a snapshot of the condition of the airport, indicating trends, defining problem areas, indicating systems that are beginning to deteriorate and helping to define budgetary requirements. It is most desirable to use a format (see examples, Appendices 1–5) in which each inspected area of the airport complex is positively noted. Retain the checklist until indicated actions are completed. Airports certificated under Part 139 must retain the regularly scheduled inspection checklist for 12 months. Airports may use additional, specialized materials and forms, such as maintenance work orders, NOTAMs, fire station and first aid reports, etc. Some airport operators use computerized versions specifically designed to meet their self-inspection requirements. There are several vendors that have developed these computer programs that can use laptops and Personal Data Assistants (PDAs). However, the regularly scheduled inspection checklist should be the basic log documenting that safety inspection responsibilities are being met.

d. Follow-up. The airport operator should follow up on complaints or requests for corrective action and on all deficient items or problem areas noted during the daily inspection. Determine which problems

require immediate attention and treat those with highest priority, including developing appropriate NOTAM notification.

7. INSPECTION TECHNIQUES.

Inspectors should vary the pattern of the inspection. Fixed inspection patterns, while easy to learn, do not provide for an adequate inspection. The use of such fixed inspection patterns can lead to complacency and to the possibility of missing items that are in need of correction. When conducting an inspection on a runway and when there is time to do only one pass on that runway, inspection personnel, whenever practical, should drive towards the direction of landing aircraft with high intensity flashing beacon and headlights on day and night. This practice will enable self-inspection personnel to see approaching aircraft and improve visibility of the vehicle to pilots. However, it is recommended that a runway inspection be done in both directions. Inspection personnel should also drive the stub taxiways between the runway and parallel taxiway as these areas are commonly overlooked.

8. KNOWLEDGE AND EQUIPMENT FOR SELF-INSPECTION.

a. Airport personnel who conduct safety self-inspections (referred to as inspectors in this AC) should receive training in at least the following areas:

b. Inspectors should know the location and types of airport facilities, airport rules and regulations and, at Part 139 airports, be familiar with the FAA-approved Airport Certification Manual.

- (1) Airport familiarization, including airport signs, marking, and lighting;
- (2) Airport Emergency Plan (if the airport has one);
- (3) Notice to Airmen (NOTAM) notification procedures;
- (4) Procedures for pedestrians and ground vehicles in movement areas and safety areas;
- (5) Airport inspection procedures and techniques; and
- (6) Discrepancy reporting procedures.

c. Inspectors should know the FAA Advisory Circular standards applicable to the airport and have access to copies for reference. Some applicable standards can be found in the FAA Advisory Circulars listed in paragraph 3c. (This is not an all-inclusive list.). They can also be found on the Internet at www.faa.gov.

d. Inspectors should have a vehicle equipped with:

- (1) a two-way ground control radio capable of communicating with the Airport Traffic Control Tower on controlled airports and on the Common Traffic Advisory Frequency (CTAF) or UNICOM at uncontrolled airports (or at controlled airports when the tower is closed);
- (2) a beacon for nighttime (or inclement weather conditions) inspections; and
- (3) either a beacon or checkered flag for daytime inspections.

e. Inspectors should know and use correct radio communication phraseology, procedures and techniques, as specified in the Aeronautical Information Manual. If the airport operator uses airport police to do all or part of the self-inspection, the police should use aviation terminology and not 10-4 codes.

f. Inspectors should be supplied with checklists covering the various inspection areas (sample airport safety self-inspection checklists are contained in Appendices 1–5). While format of checklists vary, it is important to develop a checklist that is useful for the airport and its operation. If certain

inspectors will be responsible for only certain items, separate checklists pertinent to those areas may be developed. A sketch of the airport should accompany the checklist so that the location of problems can be marked for easy identification.

g. Inspectors should review the most recently completed checklist from the previous inspection cycle prior to beginning the inspection.

h. If construction is in progress, inspectors should be familiar with the safety plan for the project.

i. If the airport is certificated under Part 139, inspectors should be familiar with the airport certification manual requirements concerning training and self-inspection.

9. COMPONENTS OF A SAFETY SELF-INSPECTION PROGRAM. A successful safety self-inspection program has four components:

a. A regularly scheduled inspection of physical facilities (which must be conducted daily at airports certificated under Part 139 or in accordance with the FAA-approved airport certification manual). If the airport serves air carriers after dark, there should also be a nighttime inspection of lighting;

b. Continuous surveillance inspection of certain airport activities, such as fueling operations, construction, airfield maintenance;

c. A periodic condition inspection program for such things as surveying approach slopes, obstructions, etc.; and

d. Special condition inspections during unusual conditions or situations, such as changing weather or days of unusually high number of aircraft operations.

10. REGULARLY SCHEDULED INSPECTION.

The regularly scheduled inspection consists of specific observations of airport physical facilities on at least a daily basis. This inspection should concentrate on the areas described in this section, which are also included in Appendix 1. If deficiencies exist, the inspector should indicate the deficient item and identify its location on a airport sketch, providing dimensions and depths, as necessary. If appropriate, the inspector should take photographs to document the condition.

a. Pavement Areas. The condition of pavement surfaces is an important part of airport safety. Pavement inspection should be conducted daily before flight operations commence to ensure pavement surfaces are clear. As a minimum, a daily inspection should be performed of all paved areas that are the responsibility of the airport operator or as specified in the FAA-approved Airport Certification Manual. During the pavement inspection, the inspector should:

(1) Check the pavement lips—the area between full-strength pavement and shoulders or paved shoulders and safety areas—to assure that they are no greater than necessary to allow water to drain off the pavement. A lip height no greater than 1 1/2 inches is usually sufficient to allow proper drainage. (At airports certificated under Part 139, pavement lips shall not exceed 3 inches as stated in § 139.305.)

(2) Determine if there are any cracks wide enough to cause directional control problems for an aircraft. Report and monitor these cracks.

(3) Determine if there are any holes that could cause directional control problems for an aircraft. (At airports subject to Part 139, any hole that cannot be covered by a 5-inch circle, and the side slope at any point in the hole that exceeds 3 inches in depth and is 45 degrees or greater, is a discrepancy. If the hole cannot be covered by a 5-inch circle but the side slope at any point in the hole that exceeds 3

inches in depth or is less than 45 degrees, it may be a discrepancy if it is determined to be a surface variation that could impair directional control of an air carrier aircraft.)

(4) Check the condition of pavement areas for cracks, scaling, spalling, bumps, low spots, and for debris that could cause foreign object damage to aircraft.

(5) Check for vegetation growth along runway and taxiway edges that may impede drainage from the pavement surface.

(6) Check for vegetation growth in cracks.

(7) Report and monitor any cracks, holes, variations and vegetation that can cause loss of aircraft directional control or may cause pavement damage, including damaged caused by damming or ponding water.

b. Safety Areas. The inspector should know the dimensions of the runway and taxiway safety areas at the airport. At airports certificated under Part 139, the dimensions of the safety areas should be documented in the airport certification manual. During the safety area inspection, the inspector should:

(1) Determine if there are any hazardous ruts, depressions, humps or variations from the normal smooth surface.

(2) Check to ensure no object is located in a safety area, except objects that must be in the safety areas because of their functions (such as runway lights, signs, or navigational aids). These objects must be constructed on frangibly mounted structures of the lowest practical height. At Part 139 airports, the frangible point must be no higher than 3 inches above grade.

(3) Determine if the base for any equipment in safety areas is at grade level (especially during the winter thaw) and equipment and NAVAIDs mounted on frangible couplings.

(4) Check to ensure that manhole and handhole covers are at grade level and can support vehicles and aircraft. Check to ensure that mounts for light fixtures are at grade level.

(5) Check for surface variation and other damage caused by rodents or other animals.

(6) Report any objects that are not frangible or not at grade level. Also report extraneous equipment and objects, such construction equipment, and surface variations that would cause damage to an aircraft or impede emergency response vehicles. At airports certificated under Part 139, issue a NOTAM regarding objects in the safety area contrary to § 139.309 (see § 139.339)

c. Markings. Airport markings provide important information to pilots during takeoff, landing, and taxiing. To avoid confusion and disorientation, airport markings should be in compliance with FAA marking standards specified in AC 150/5340-1, Standards for Airport Markings. (Compliance with these standards is mandatory for operators of airports certificated under Part 139 and for airport operators that have accepted Federal funds for runway and taxiway construction/rehabilitation.) The inspector should know the appropriate markings required at the airport. During the marking inspection, the inspector should:

(1) Check markings for correct color-coding, peeling, blistering, chipping, fading, and obscurity due to rubber buildup.

(2) Check to see if all runway hold position markings are clearly visible.

(3) During and after construction projects, check new markings for compliance with FAA marking standards.

(4) If the markings have glass beads, check markings during periods of darkness to determine if the reflectivity of glass beads is adequate at night.

(5) Report and monitor any nonstandard marking or markings that are obscured, faded or deteriorating.

d. Signs. Signs provide important information to pilots while taxiing. To avoid pilot confusion and disorientation, airport signs should be in accordance with FAA sign standards specified in AC 150/5340-18, Standards for Airport Sign Systems. (Compliance with these standards is mandatory for operators of airports certificated under Part 139 and for airport operators that have accepted Federal funds for runway and taxiway construction/rehabilitation.) The inspector should know the appropriate sign standards and specifications at the airport and at a Part 139 certificated airport, ensure signs comply with the FAA-approved Sign Plan.

(1) Check signs to ensure they are easy to read, in accordance with color standards, retro-reflective, and that all lighted signs are working and not obscured by vegetation, dirt, snow, etc.

(2) Check signs to ensure they are frangibly mounted and concrete bases are properly maintained at grade level.

(3) Check to see that sign panels are not missing or damaged, that they have the correct legend and arrow orientation, and that they are not cracked or broken.

(4) During and after construction projects, check new signs for compliance to FAA sign standards and, at Part 139 airports, in accordance with the FAA-approved Sign Plan.

(5) During periods of darkness, check signs to ensure they are properly illuminated. Ensure mandatory instruction signs are illuminated with the associated runway lighting system. Check signs for correct operations; that they are on the correct circuits, they do not flicker and that they follow the intensity setting of the runway or taxiway lights.

(6) Report and monitor any nonstandard sign or any sign that is not functioning, is faded or damaged. At airports certificated under Part 139, issue a NOTAM regarding any malfunctioning holding position sign or ILS critical are sign, as specified under § 139.339

e. Lighting. At night and during periods of low visibility, lighting is important for safe airport operations. Lights come in different shapes, sizes, colors, and configurations and can be located either in the pavement or along its edges. Inspection of lighting is best accomplished during periods of darkness in order to evaluate lighting systems when they provide the primary visual aid for pilots. The inspection should concentrate on the lighting owned by the airport operator. However, the inspector should observe any lighting owned or operated by others and report any observed problems immediately to the appropriate responsible owner. During the lighting inspection, the inspector should:

(1) Check to ensure that the following are operable, if installed, and that vegetation or deposits of foreign material do not obscure the light fixture.

(i) Runway and taxiway edge lights;

(ii) Apron edge lights;

(iii) Runway centerline and touchdown zone lights;

(iv) Taxiway centerline lights or centerline reflectors;

(v) Runway threshold/end lights; and

(vi) Runway guard lights (both elevated and in-pavement, if installed).

(2) Check that the following are operable, if installed:

(i) Ramp lights and floodlights used in construction to ensure they are properly shielded);

- (ii) Obstruction lights; and
- (iii) Lighting in fuel storage areas.
- (3) Report all fixtures missing and lights that are not working or appear dim.
- (4) Report any missing or broken light fixture lenses.
- (5) Ensure that runway and taxiway lights and runway threshold lights are the proper color and are oriented correctly.
- (6) Check that lights function properly through the manual or radio control features, and that photocell controls function properly.
- (7) Check the lights for proper alignment, aiming and correct changes in intensity, for correct height, erosion around the bases and the height of frangibility.

f. Navigational Aids (NAVAIDs). The inspection of NAVAIDs should concentrate on the visual navigational aids owned by the airport operator. However, the inspector should observe any navigational aids owned or operated by others, such as the FAA, and report any observed problems immediately to the NAVAID owner. During the inspection of NAVAIDs, the inspector should:

- (1) Determine if the segmented circle is clear of vegetation and that it can be seen easily from the air.
- (2) Determine if the airport rotating beacon is visible and working properly.
- (3) Check the wind cone(s) to ensure that it swings freely, the cone fabric is not faded or frayed, and, if lighted, that all lights are operating.
- (4) Determine if the Runway End Lights (RENs, formerly known as Runway End Identifier Lights) are flashing in proper sequence and mounted on frangible couplings.
- (5) Check Visual Glide Slope Indicators (VASIs, PLASIs, or PAPIs) to ensure that their lights are working and mounted on frangible couplings.
- (6) Determine if the Approach Lighting systems are functioning properly.
- (7) Report and monitor any NAVAID that is malfunctioning, inoperable or misaligned, damaged or missing.

g. Obstructions. The inspection of obstructions should concentrate on a visual check of construction underway on or near the airport that could affect aircraft operations. This also includes checking for any vegetation, especially, trees, that may penetrate the Part 77 surfaces. During the inspection of obstructions, the inspector should:

- (1) Check to ensure that construction equipment, especially tall cranes being used at construction sites, are not an obstruction. If construction is found and thought to create an obstruction, the airport operator should determine if proper notification to FAA, such as is required through Part 77 or Airport Layout Plan review, has been provided.
- (2) Determine if obstructions are properly marked and lighted.
- (3) Direct any person proposing construction near a public-use airport meeting the notice requirements contained in Part 77, Objects Affecting Navigable Airspace, to the Air Traffic Division or Airports District Office immediately if their construction has not been reported to the FAA.
- (4) Report and monitor any obstruction light that is missing, inoperative or damaged, and any object that appears to be an obstruction and is not properly marked or lit.

h. Fueling Operations. The daily inspection on aircraft fueling operations should concentrate on a quick inspection for the most common problems concerning compliance with local fire safety codes at fuel storage areas and with mobile fuelers. The inspection should also include security, fire protection, general housekeeping, and fuel dispensing facilities and procedures. A more detailed fueling operation inspection should be scheduled quarterly (see Quarterly Fueling Operations under Periodic Condition Inspection). During the daily inspection of aircraft fueling operations, the inspector should:

- (1) Determine if the fueling operator is permitting any unsafe fueling practices or is in violation of local fire code, such as failure to bond aircraft with the mobile fuelers during fueling operations or fueling personnel smoking while fueling aircraft.
- (2) Check to ensure that the appropriate signs for the fuel farm are installed and that all gates are locked except when the facility is occupied by an authorized user.
- (3) Report and monitor any unsafe fueling practices and violation of local fire codes. At Part 139 airports, report any noncompliance with fuel fire safety procedures specified in the FAA-approved Airport Certification Manual.

i. Snow and Ice. The inspector should be familiar with the airport's snow and ice removal procedures and guidance provided in AC 150/5200-30, Airport Winter Safety and Operations. At Part 139 certificated airports, the inspector should be familiar with the airport's FAA-approved Snow and Ice Control Plan. During the snow and ice control inspection, the inspector should:

- (1) Determine if any lights and signs are obscured by snow or damaged by snow removal operations.
- (2) Check to ensure that snow banks and drifts next to the runway and taxiways provide clearance for aircraft wing tips, engines, and propellers.
- (3) Check to ensure that snow is not piled across the runway threshold or across runway/runway intersections.
- (4) Check to be sure that no foreign objects are left on the pavement from snow removal operations.
- (5) Check to ensure that snow removal operations have not blocked any taxiways or access routes dedicated for aircraft rescue and fire fighting equipment.
- (6) Check to ensure that snow is not accumulated or piled in the critical areas for electronic NAVAIDs.
- (7) Check for and report slippery pavement conditions in terms of either braking action or MU values. If a friction measurement device is available, issue the appropriate numbers obtained from the equipment. (Do not attempt to correlate friction measurement numbers with braking action reports.)
- (8) Report and monitor any snow and ice accumulation that has been missed by the snow and ice removal operation, and any dangerous condition created by such operations, such as obscured signs or lights. At airports certificated under Part 139, issue a NOTAM regarding snow, ice, slush or water on the movement area or loading ramps, and parking areas, as specified under § 139.339.

j. Construction. The inspector should be familiar with the airport's construction safety procedures and guidance provided in AC 150/5370-2, Operational Safety on Airports During Construction. At Part 139 certificated airports, the inspector should be familiar with the airport's FAA-approved Construction Safety Plan. During the construction inspection, the inspector should:

- (1) Determine if stockpiled material and construction materials are properly stored to keep them from being moved by wind, jet blast, or prop wash, and is not left in safety areas or movement area.

- (2) Check all construction adjacent to movement areas to ensure areas are identified with conspicuous marking and lighting.
- (3) Determine if construction equipment (such as bulldozers, cranes, etc.) are marked and lighted and parked clear of the safety areas.
- (4) Ensure construction barricades are properly positioned to define the limits of construction and hazardous areas and, if barricades are lighted, check to ensure lights are working properly and are positioned correctly.
- (5) Check to ensure that debris and foreign objects are continuously being picked up around construction areas.
- (6) Check for open trenches in the safety areas or adjacent to movement areas.
- (7) Check operation of lighting in areas adjacent to construction daily before the construction crews depart for the day. In particular, ensure that mandatory instruction signs remain lit with the associated runway lights, even on taxiways that have been closed for construction.
- (8) Check NOTAMs daily during construction projects to ensure they accurately reflect the conditions on the airport.
- (9) Verify that closed taxiways or runways are properly marked and lighted.
- (10) Report and monitor any dangerous condition created by construction activity, including damage to signs, lights, markings and NAVAIDS or equipment and supplies left in movement areas and safety areas.

k. Aircraft Rescue and Fire Fighting. During the inspection of aircraft rescue and fire fighting (ARFF) capabilities, the inspector should:

- (1) Check the status of ARFF response, including the availability of equipment, fire fighters and extinguishing agent. At Part 139 airports, ensure that such ARFF capabilities comply with the FAA-approved Airport Certification Manual and that the airport's ARFF Index is still appropriate for air carrier aircraft served.
- (2) Ensure alarm and emergency notification communication systems are operable.
- (3) Determine the adequacy of available fire extinguishing agents.
- (4) Check for construction or maintenance activity on the movement area that could affect ARFF response routes. Ensure that the ARFF Department has been notified if construction or maintenance activity could affect emergency response routes.
- (5) Report and monitor any ARFF vehicle, equipment or extinguishing agent that is not available or inoperative; any ARFF personnel that are not available; and any changes to aircraft that may require a change to ARFF capabilities. At Part 139 airports, notify the FAA if ARFF vehicles is inoperative and cannot be replaced immediately, as specified under § 139.319(g) and issue a NOTAM regarding non-availability of any rescue and firefighting capability, as specified under § 139.339.

l. Public Protection. During the public protection inspection, check gates, fencing, locks, and other safeguards are in place and functioning properly to prevent inadvertent entry to movement areas by unauthorized persons and vehicles and offer protection from jet blast. Report and monitor any safeguards that are damaged or missing. In accordance with the airport's security plan, report unauthorized persons or vehicles in the movement area (airports regulated by the Transportation Security Administration may have additional requirements for reporting and responding to unauthorized persons and vehicles).

m. Wildlife Hazard Management. During the wildlife hazard inspection, the inspector should check for evidence of birds or animals on the runways, taxiways, aprons, and ramps or other signs that

wildlife problems may have developed - such as large flocks of birds on or adjacent to the airport. Wildlife hazards found during the daily self-inspection should be properly documented. All dead wildlife found and all wildlife aircraft strikes should be reported to the FAA on the FAA Form 5200-7, Bird/Other Wildlife Strike Report. This form may be obtained from the FAA Internet site, at www.faa.gov. Additionally, the inspector should check fencing and gates for wildlife accessibility and should ensure that wildlife control equipment is available and operational.

11. CONTINUOUS SURVEILLANCE INSPECTION. Continuous surveillance inspection consists of general observation of activities for compliance with regulations, procedures, etc., as well as abnormalities with physical facilities that are readily apparent. This is performed any time inspection personnel are on the air operations area. Continuous surveillance of airport physical facilities and activities should cover at least the areas described in this section, which are also included in Appendix 2.

a. Ground Vehicles. During the continuous surveillance inspection of ground vehicles, the inspector should:

(1) Determine if vehicle drivers are following the airport's procedures and arrangements for the orderly operations of ground vehicles (including mowing machines or other maintenance vehicles in the safety areas). Extra attention should be paid to ground vehicle activity during construction, winter operations, and other special events.

(2) Report and monitor any vehicle operator that is not complying with the airport's vehicle procedures and arrangements.

(3) Report any ground vehicle accident observed and any ground vehicle signs and markings that are damaged, missing or obscured.

b. Fueling Operations. The inspector should:

(1) Emphasize fire and explosion hazards inherent in aircraft refueling.

(2) Ensure proper bonding is being used, deadman controls are not blocked, and no smoking prohibitions are being observed, and aircraft are not being fueled inside hangars.

(3) Check for proper parking of mobile fuelers to ensure these vehicles are at least 10' apart and 50' from buildings.

(4) Check for fuel leaks or spills in the fuel storage area and around mobile fuelers.

(5) Determine if the fuel farm is free of flammable materials, including litter and vegetation.

(6) Report and monitor any of unsafe fueling conditions discussed above and other obvious violations of local fire code and airport fuel fire safety procedures.

c. Snow and Ice. During the continuous surveillance inspection of snow and ice removal operations, the inspector should check snow or ice covered pavements and report and monitor any surfaces where snow and ice may affect the safety of aircraft operations. In addition, the inspector should monitor snow and ice removal NOTAMS to ensure they remain current and issue timely corrections, as necessary. If the airport uses other means to notify tenants of snow and ice removal operations, e.g., faxed or electronic messages, the inspector should also monitor this information for accuracy. Check to ensure that snow or ice on pavement surfaces does not affect the safety of aircraft operations and that NOTAMS are current.

d. Construction. The Inspector should check construction projects to ensure that the contractor is following the construction safety plan. During the continuous surveillance inspection of construction activity, the inspector should check for, and report, any of the following conditions:

- (1) Unauthorized use of runways, taxiways, and aprons by construction personnel and equipment.
- (2) Conditions that may result in runway incursions and other irregularities. This includes ensuring that construction areas are delineated appropriately with barricades, cones, markings, etc.
- (3) Construction equipment is not operated in ILS/MLS critical areas unless coordination with FAA has been accomplished.
- (4) Perimeter gates are left open and unattended, unlocked or construction vehicles and personnel are not following access and escort procedures.
- (5) Construction vehicles not properly marked or missing appropriate flags and/or beacons.
- (6) Foreign object debris on haul roads adjacent to movement areas that can be tracked onto taxiways, aprons, and ramp areas.
- (7) Confusing or missing signs, markings or lighting that could potentially confuse or mislead pilots.
- (8) Barricades and lighting are in place and operational.

e. Public Protection. Pay special attention to public protection during construction and special events. During the continuous surveillance inspection of safeguards used to protect the public, the inspector should check for, and report, any of the following conditions:

- (1) Unauthorized personnel, vehicles, and animals, particularly in areas aircraft passengers and the general public are present on the air carrier ramp and other portions of the movement area, i.e, remote aircraft parking locations.
- (2) Inoperable or blocked gates, particularly those that would impede access by aircraft rescue and fire fighting equipment.
- (3) Open or unlocked gates and missing or damaged signs posted to prevent unauthorized access to the airfield.
- (4) Damaged or missing jet blast fences.

f. Wildlife Hazard Management. During the continuous surveillance inspection of wildlife hazards, the inspector should check for, and report, any of the following conditions:

- (1) Birds or animals, such as dogs, deer, etc., on or adjacent to the runways, taxiways, aprons, and ramps to determine if there is a potential wildlife hazard problem.
- (2) Potential hazard created by birds on or adjacent to the airport.
- (3) Wildlife strikes and carcasses found on the runways. Report these on FAA Form 5200-7, Bird/Other Wildlife Strike Report. This form may be obtained from the FAA Internet site at www.faa.gov.

g. Foreign Object Debris (FOD). The inspector should continuously check for, and remove any FOD in movement areas, aircraft parking areas and loading ramps.

12. PERIODIC CONDITION INSPECTION. Periodic condition inspections consist of specific checks of physical facilities on a regularly scheduled basis (but less frequently than daily). Checks may require use of equipment (e.g., Walker Bar to measure VASI glide slope angles or transit to survey approach slopes, or continuous friction measurement equipment) or checking specific features of physical facilities. Periodic inspection of airport physical facilities and activities should cover at least the areas described in this section, which are also included in Appendix 3.

a. Pavement Areas. The inspector should check pavement surfaces for rubber buildup, polishing, or other items affecting friction.

b. Markings. The inspector should:

(1) Check pavement markings to ensure they are correct and clearly visible. Markings on concrete and faded asphalt should be outlined with a black border.

(2) Determine if markings are visible at night, especially examine for rubber buildup in the touchdown zone areas.

c. Signs. The inspector should check signs faces for peeling and for fading or faded colors.

d. Quarterly Fueling Inspections. Airports certificated under Part 139 are required to establish fire safety standards for safe fueling operations and conduct quarterly inspections of the fueling facilities. The inspection procedures in this section are based on the NFPA 407 fire code for airport fueling operations, which is one of the more common fire codes in effect at certificated airports. The fire safety standards for fueling operations should be listed in the Airport Certification Manual (ACM) and the quarterly inspections should be conducted for compliance to the fueling fire safety standards listed in the ACM. Sample quarterly inspection checklists for fuel storage areas and mobile fuelers are included in Appendix 5. Typical fire safety standards to inspect quarterly are listed below. Airports certificated under Part 139 are required to maintain a record of this inspection for at least 12 months.

(1) **Fuel storage areas and loading/unloading stations.** The inspector should:

(i) Check fuel storage areas for adequate fencing and security to prevent unauthorized access or tampering.

(ii) Check for “No Smoking” signs that are clearly visible.

(iii) Check fuel storage areas for materials such as trash or vegetation that could contribute to the spread of fire. Also check for equipment, functions or activities that could be ignition sources.

(iv) Note if fueling equipment appears to be in good operating condition and free of fuel leaks.

(v) Check piping for reasonable protection from damage by vehicles if piping is above ground.

(vi) Check fuel storage areas for at least two accessible and serviceable fire extinguishers. Where the open hose discharge capacity of the equipment is more than 200 gallons per minute, at least one wheeled extinguisher with at least 125 lbs of agent is also required.

(vii) Check for explosion proof equipment, switches and wiring that is reasonably protected from heat, abrasion or impact, which could cause an ignition source.

(viii) Check for piping, filters, tanks and pumps being electrically bonded together and interconnected to an adequate grounding rod.

(ix) Check for a serviceable bond/ground wire with clip at each loading/unloading facility for grounding tankers and mobile fuelers.

(x) Check loading stations for deadman control features.

(xi) Look for a boldly marked emergency cutoff capable of stopping all fuel flow with one physical movement. The emergency cutoff should be located outside the probable fuel spill area near the route that normally is used to leave the spill area or to reach the fire extinguishers.

(2) **Mobile fuelers.** At least once every 3 months, inspect all fuel trucks to ensure they meet fire safety standards. The inspector should:

(i) Note if mobile fuelers appear to be in good operating condition and free of fuel leaks.

(ii) Check mobile fuelers for parking at least 50 feet from a building and at least 10 feet from each other. Note: Some airports have a mobile fueller maintenance building that is approved by the local fire marshal.

(iii) Check for flammability decals on all sides. Lettering should be at least 3 inches high. Also check for hazardous materials placards on all sides. The Hazmat number for Jet A trucks should be #1863 and #1203 for 100LL trucks.

(iv) Check the cab for a “No Smoking” sign and the presence of smoking equipment. Ashtrays and cigarette lighters are not to be provided.

(v) Check for two fire extinguishers, accessible from each side of the mobile fueller. Fire extinguishers should be charged, sealed and tagged from the last fire extinguisher inspection. Check dry chemical extinguishers to ensure they are only B-C rated. ABC rated multi-purpose dry chemical extinguishers are not to be used on mobile fuelers as they are highly corrosive to aircraft and can cause significant damage to aircraft engines.

(vi) Check emergency fuel cutoffs to ensure they are boldly marked and operable. There should be an emergency fuel cutoff accessible from each side.

(vii) Check electrical equipment, switches, wiring and tail light lens covers for explosion proof construction and reasonable protection from heat, abrasion or impact which could be an ignition source.

(viii) Check for serviceable bonding wires and clamps.

(ix) Check nozzles for deadman control feature.

(x) Check the vehicle exhaust system for exhaust leaks and for adequate shielding if it extends under the fuel tank portion of the vehicle.

e. Navigational Aids. Periodically check the aiming of REILs and Visual Glide Slope Indicators owned by the airport.

f. Lighting. The inspector should:

(1) Determine that power generator and circuit resistance tests are being conducted.

(2) Ensure lights with adjustable optical systems are checked for proper aiming.

g. Obstructions. The inspector should:

(1) Check to ensure there are no overhead power lines in the aircraft parking areas.

(2) Annually survey trees and other structures near the airport that could affect glide path angles, approach light lanes, or be an obstruction to Part 77 surfaces.

h. Aircraft Rescue and Fire Fighting. The inspector should:

(1) Periodically determine if the aircraft rescue and fire fighting equipment is capable of meeting response times, if it is required under Part 139.

- (2) Ensure that recurrent training and hot-fire drills are being conducted as required by Part 139.
- (3) Check to ensure the availability of adequate entry tools.

13. SPECIAL CONDITION INSPECTIONS. Special condition inspections occur after receipt of a complaint or as triggered by an unusual condition or event. A special inspection should be conducted after an accident or incident. Depending upon circumstances, special condition inspections may include the inspection of any of the specific facilities or activities under the other three components. A special condition inspection of airport physical facilities and activities should cover at least the areas described in this section, which are also included in Appendix 4.

a. Pavement Areas. After a rain or thunderstorm, the inspector should check the pavement areas for ponding and edge damming.

b. Markings and Signs. The inspector should:

(1) Determine if markings are visible at night especially when the pavement is wet following a rain.

(2) After construction or maintenance operations, ensure that pavement markings are correct.

c. Safety Areas. The inspector should:

(1) Ensure that the storm sewer system is checked to verify that inlets are not clogged and drainage channels are free of debris. Note any standing water.

(2) Ensure all inlet covers are in place and sewer covers are at grade level.

(3) Conduct a special inspection before reopening a runway or taxiway following any construction or maintenance that has been performed in or around that safety area.

(4) Any time an aircraft has left the pavement and entered a safety area, check to ensure that no ruts or holes have been made by the aircraft tires or by personnel and equipment during the recovery operation.

(5) Check for construction and maintenance activities to ensure that no hazardous conditions have been created (equipment left in safety areas, unacceptable pavement lips created by ground alteration work, ruts from mowing equipment, etc.).

(6) Inspect engineered materials arresting system (EMAS), if installed, for damage and for deterioration.

(7) Physically drive or walk the safety areas to check for any discrepancies.

d. Snow and Ice. Several special inspections may be needed during a winter storm until the airport is back to a normal operation. The inspector should:

(1) Check to ensure that all foreign objects have been picked up after snow and ice removal operations.

(2) If a friction measurement device is available, issue the appropriate numbers obtained from the equipment. Do not attempt to correlate friction measurement numbers with braking action reports. If a friction measurement device is not available, issue to Air Traffic braking action reports.

(3) Conduct a special sign inspection after snowstorms for signs that may have been damaged by plows or by snow thrown by blowers.

e. Construction. The inspector should:

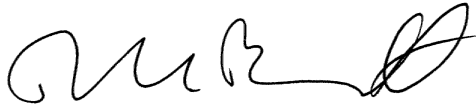
(1) Ensure that construction areas are barricaded and lighted properly.

- (2) Check construction equipment to ensure that they are parked within the pre-arranged areas.
- (3) Conduct night inspections to ensure that barricades, warning lighting, and reflectors are adequate to keep aircraft away from the construction area.
- (4) Check the location of construction material and stockpiles to ensure that they are outside of safety areas and do not block any signs.
- (5) Check any movement areas adjacent to construction areas or movement areas traversed by construction vehicles to ensure there is no FOD present.
- (6) Check movement areas around construction sites for potentially confusing marking, lighting, and signs that could cause pilot confusion or result in a runway incursion.

f. Surface Movement Guidance and Control Systems (SMGCS).

- (1) For operations below 1,200 feet runway visual range, the inspector should conduct an initial inspection of stop bar lights, runway guard lights, clearance bar lights, taxiway centerline lights, and taxiway edge lights installed on the low visibility routes in accordance with the airport's SMGCS plan.
- (2) SMGCS lighting systems that are not electronically monitored should be periodically inspected every 2 to 4 hours for during operations below 1,200 feet to 600 feet. For operations below 600 feet, these inspections should take place every 2 hours. Such inspections should be detailed in the airport's SMGCS plan.

14. CONDITION REPORTING. Alert users of the airport to any unsafe conditions that exists and that could affect their operations. Ensure appropriate NOTAMS are issued for unsafe conditions that are identified during an inspection but cannot be corrected immediately. After reporting NOTAMS to the Flight Service Station, follow-up to ensure that the NOTAMS were processed and transmitted.



David L. Bennett
Director, Office of Airport Safety and Standards

APPENDICES 1–4**SUGGESTED AIRPORT SAFETY SELF-INSPECTION CHECKLISTS**

An airport safety self-inspection checklist should cover the condition of the facilities and equipment on the airport for it to be a part of a good safety inspection program. The checklist should be developed so that it is useful for the airport and its operation. A sketch of the airport is highly recommended to readily identify the location of problems found during the daily inspection.

The suggested checklists consist of a listing of facilities and equipment and a series of conditions that are inspected.

The blank squares indicate the conditions to be evaluated for each facility. A check (✓) in one of these squares would indicate that the condition of the facility and equipment was found to be satisfactory. On the other hand, an “x” in one of these squares would indicate that the condition of the facility and equipment was found to be unsatisfactory.

When an unsatisfactory condition is found:

1. An “x” for each applicable square should be entered;
2. A note provided in the Remark/Action Taken section;
3. The location of the condition should be identified in the airport sketch; and
4. Appropriate follow-up action including NOTAMs should be initiated. Corrective action should be documented on either the self-inspection checklists or on a separate work order system.

These checklists are ideal for electronic conversion to PDAs and laptop computers.

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**APPENDIX 1
AIRPORT SAFETY SELF-INSPECTION CHECKLIST**

DATE: _____ DAY: _____

✓ Satisfactory
X Unsatisfactory

Day Inspector/Time: _____ Night Inspector/Time: _____

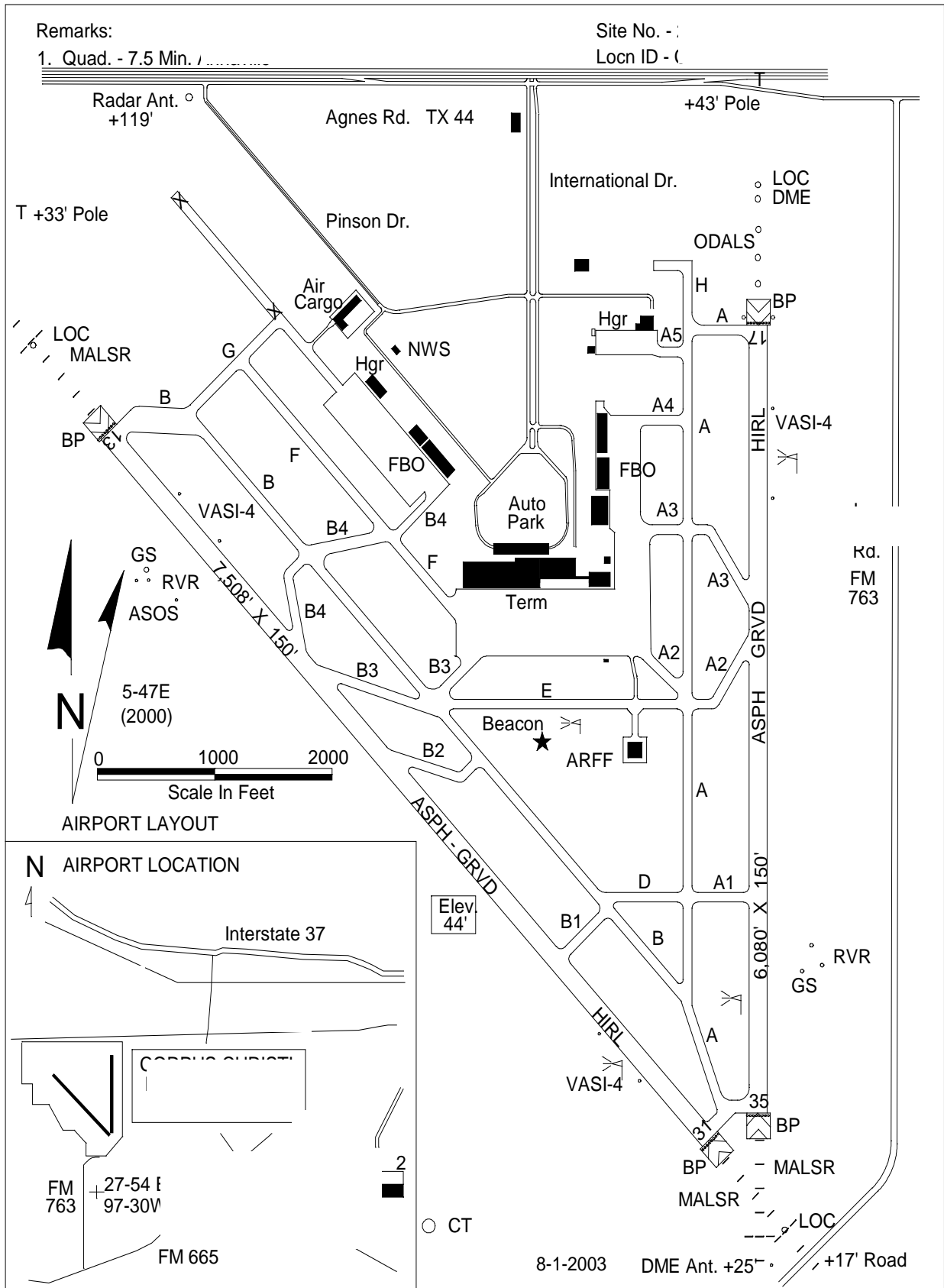
FACILITIES	CONDITIONS	D	N	REMARKS	RESOLVED BY (Date/Initials)
Pavement Areas	Pavement lips over 3"				
	Hole – 5" diam. 3" deep				
	Cracks/spalling/heaves				
	FOD: gravel/debris/sand				
	Rubber deposits				
	Ponding/edge dams				
Safety Areas	Ruts/humps/erosion				
	Drainage/construction				
	Support equipment/aircraft				
	Frangible bases				
	Unauthorized objects				
Markings	Clearly visible/standard				
	Runway markings				
	Taxiway markings				
	Holding position markings				
	Glass beads				
Signs	Standard/meet Sign Plan				
	Obscured/operable				
	Damaged/retroreflective				

FACILITIES	CONDITIONS	D	N	REMARKS	RESOLVED BY (Date/Initials)
Lighting	Obscured/dirty/operable				
	Damaged/missing				
	Faulty aim/adjustment				
	Runway lighting				
	Taxiway lighting				
	Pilot control lighting				
Navigational Aids	Rotating beacon operable				
	Wind indicators				
	RENLS/VGSI systems				
Obstructions	Obstruction lights operable				
	Cranes/trees				
Fueling Operations	Fencing/gates/signs				
	Fuel marking/labeling				
	Fire extinguishers				
	Frayed wires				
	Fuel leaks/vegetation				
Snow & Ice	Surface conditions				
	Snowbank clearances				
	Lights & signs obscured				
	NAVAIDs				
	Fire access				

FACILITIES	CONDITIONS	D	N	REMARKS	RESOLVED BY (Date/Initials)
Construction	Barricades/lights				
	Equipment parking				
	Material stockpiles				
	Confusing signs/markings				
Aircraft Rescue and Fire Fighting	Equipment/crew availability				
	Communications/alarms				
	Response routes affected				
Public Protection	Fencing/gates/signs				
	Jet blast problems				
Wildlife Hazards	Wildlife present/location				
	Complying with WHMP				
	Dead birds				

Comments/Remarks: _____

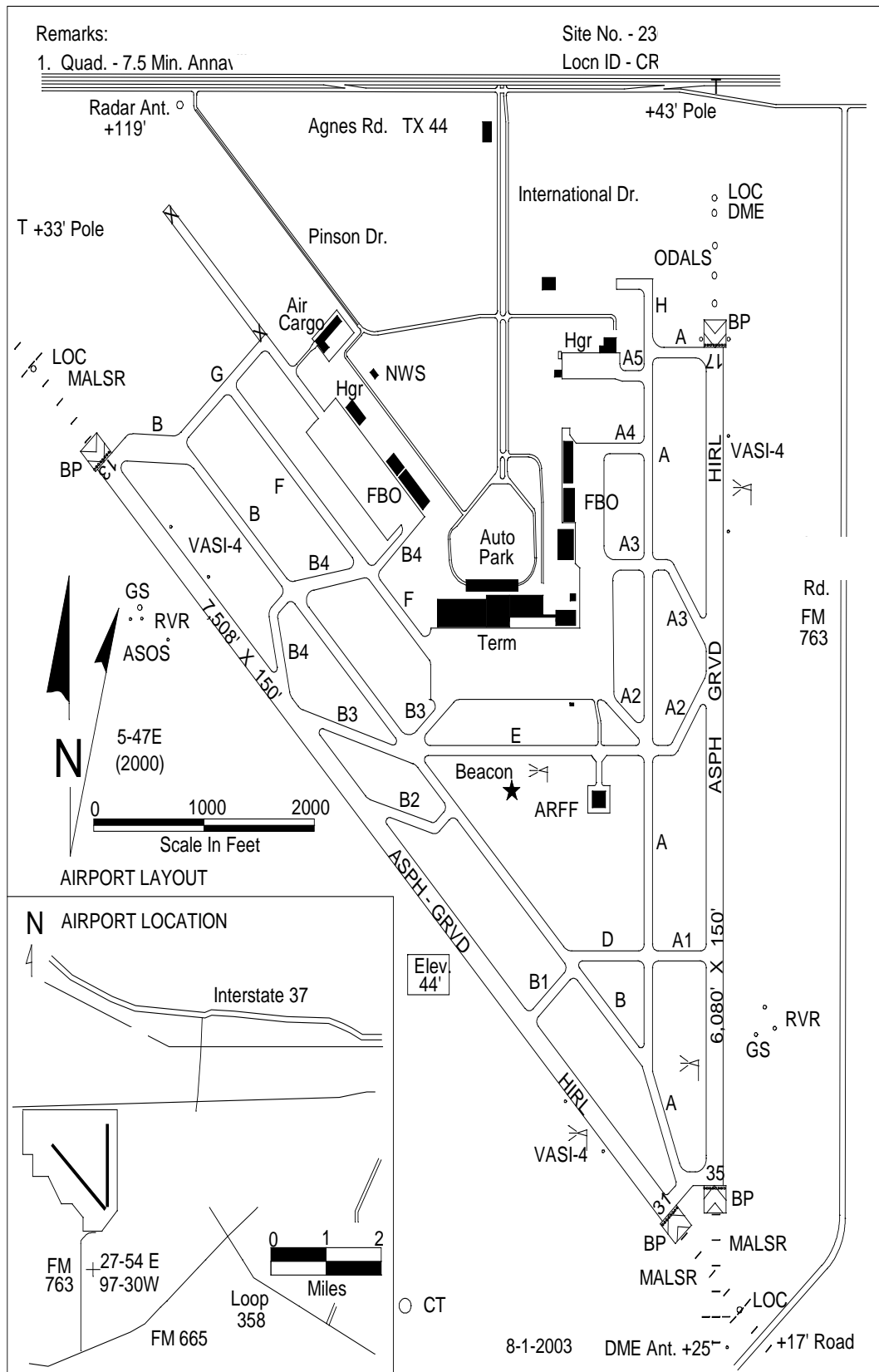
Airfield Map on Reverse Side



**APPENDIX 2
CONTINUOUS SURVEILLANCE CHECKLIST**

<input type="checkbox"/> Satisfactory <input type="checkbox"/> Unsatisfactory			
DATE: _____		DAY: _____	
TIME: _____		INSPECTOR: _____	
FACILITIES	CONDITIONS	√	REMARKS/ACTIONS TAKEN
Ground Vehicles	Rules/Procedures Followed	<input type="checkbox"/>	
		<input type="checkbox"/>	
Fueling Operations	Fire/Explosion Hazards	<input type="checkbox"/>	
	Signing/No smoking	<input type="checkbox"/>	
		<input type="checkbox"/>	
Snow & Ice	Surface Conditions	<input type="checkbox"/>	
		<input type="checkbox"/>	
Construction	Safety Plan	<input type="checkbox"/>	
	Runway Incursions	<input type="checkbox"/>	
	Runway & Taxiway Use	<input type="checkbox"/>	
	FOD	<input type="checkbox"/>	
Public Protection	Unauthorized Persons	<input type="checkbox"/>	
	Unauthorized Vehicles	<input type="checkbox"/>	
	Gates clear	<input type="checkbox"/>	
		<input type="checkbox"/>	
Wildlife Hazards	Birds/Animals	<input type="checkbox"/>	
		<input type="checkbox"/>	
Miscellaneous	Pedestrians in Movement Areas	<input type="checkbox"/>	
	Passenger Load/Unload	<input type="checkbox"/>	
	Debris in Movement Area	<input type="checkbox"/>	
		<input type="checkbox"/>	
Additional Remarks			

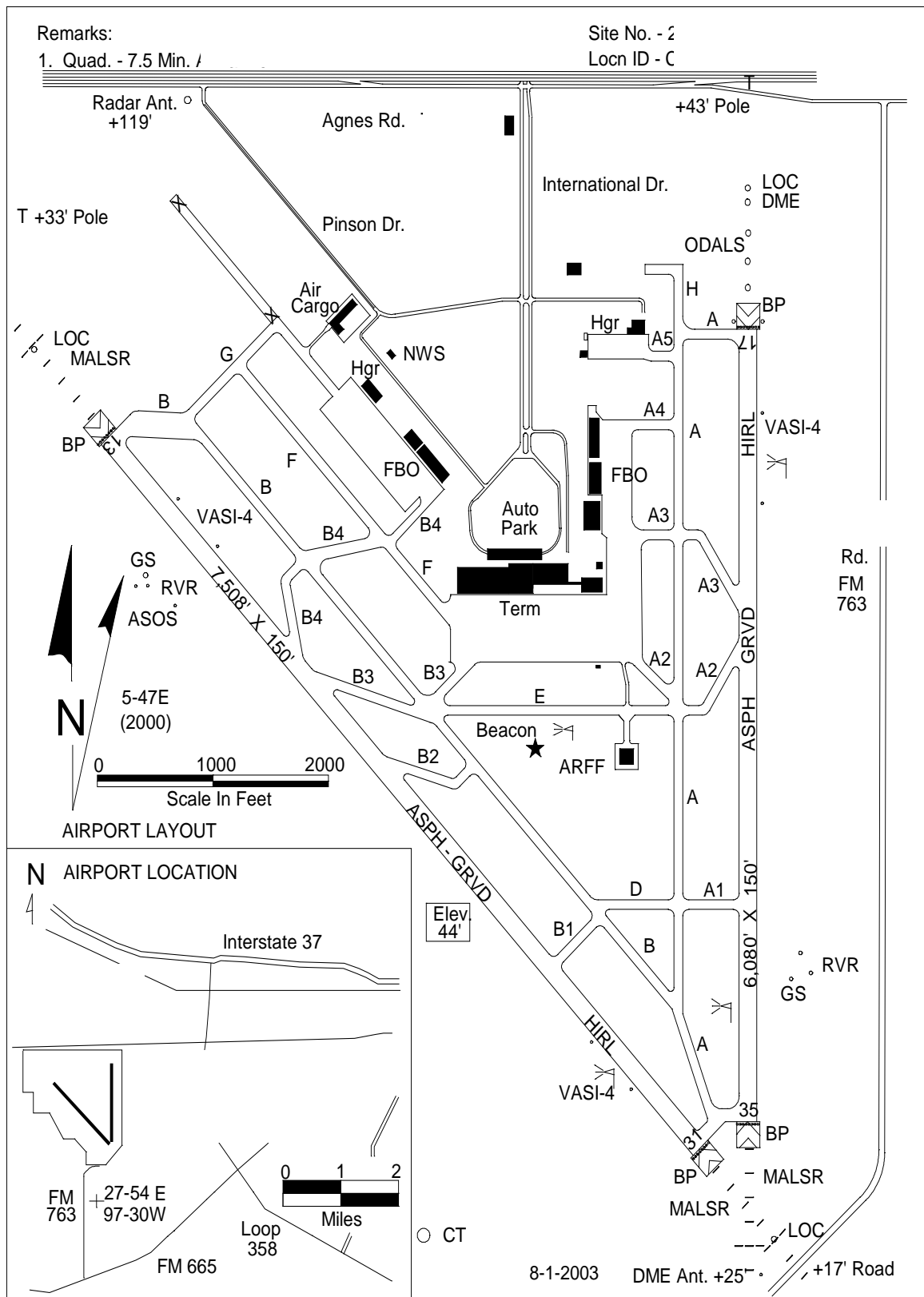
Airfield Map on Reverse Side



**APPENDIX 3
PERIODIC CONDITION INSPECTION CHECKLIST**

DATE: _____ DAY: _____		√ Satisfactory	
TIME: _____ INSPECTOR: _____		X Unsatisfactory	
FACILITIES	CONDITIONS	√	REMARKS/ACTIONS TAKEN
Pavement Areas	Rubber Deposits		
	Polishing		
Markings and Signs	Visible		
	Standards		
Fueling Operations	Physical Facilities		
	Mobile Fuelers		
	Fire Extinguishers		
	Fuel Marking/Labeling		
	Frayed Wiring		
Navigational Aids	RENs/VGSI Aiming		
Lighting	Power Generator Check		
	Circuit Resistance Test		
	Aim/Adjustment		
Obstructions	Surveyed Trees/Structures		
	Overhead Power Lines		
Aircraft Rescue and Fire Fighting	Response Times		
	Live Fire Drills		
	Training		
Additional Remarks			

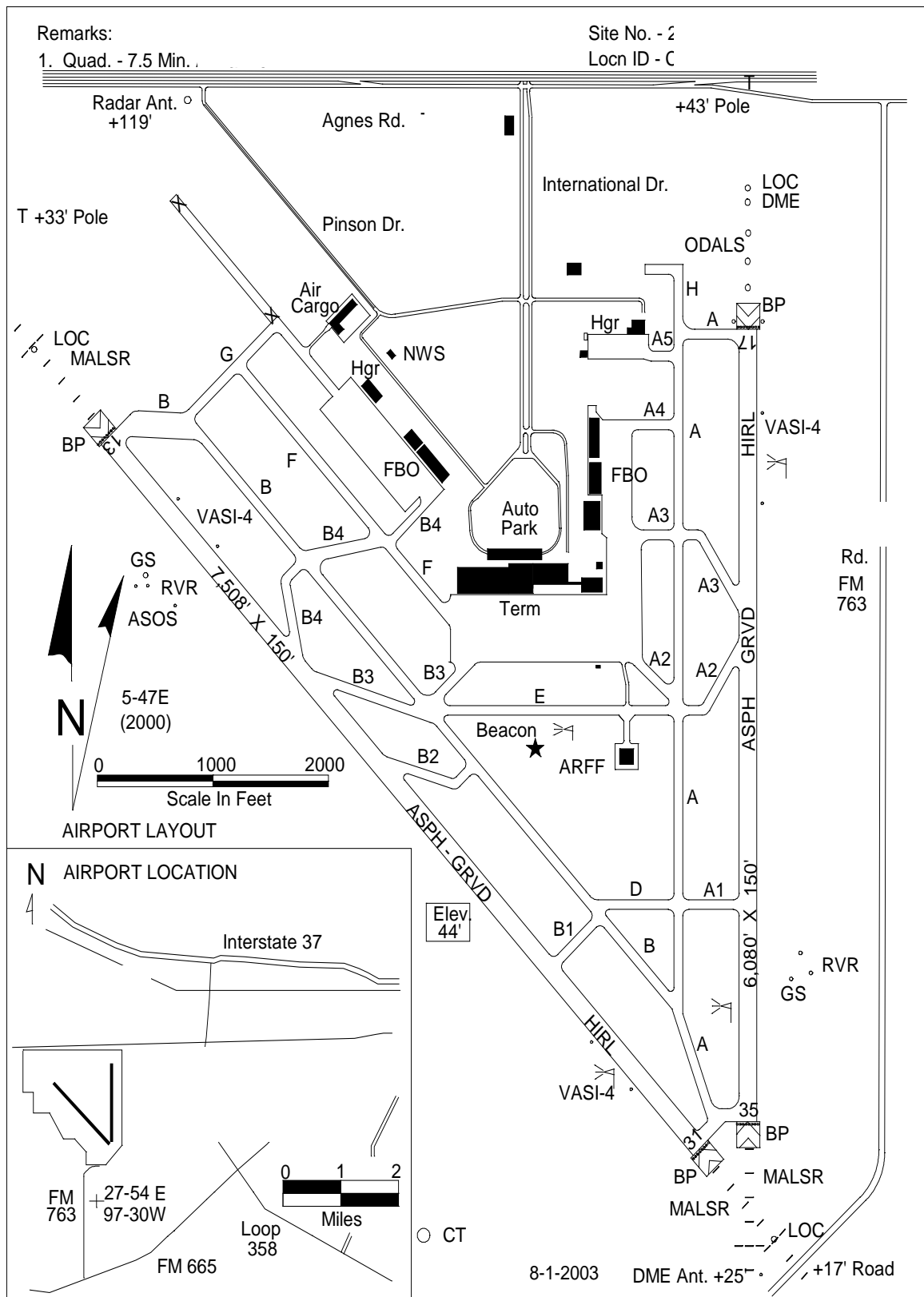
Airfield Map on Reverse Side



**APPENDIX 4
SPECIAL INSPECTION CHECKLIST**

DATE: _____ DAY: _____		√ Satisfactory	
TIME: _____ INSPECTOR: _____		X Unsatisfactory	
FACILITIES	CONDITIONS	√	REMARKS/ACTIONS TAKEN
Pavement Areas	Ponding/Edge Dams		
Markings And Signs	Visible after rain		
	Standards after Construction		
Safety Areas	Drainage		
	Reopening Runways		
	Reopening Taxiways		
Snow and Ice	Surface conditions		
	Snowbank clearance		
	Lights & Signs Obscured		
	FOD		
	Braking Action/MU Reports		
Construction	Barricades		
	Construction Lights		
	Equipment Parking		
SMGCS	SMGCS Lighting		
Additional Remarks			

Airfield Map on Reverse Side



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APPENDIX 5B

QUARTERLY INSPECTION – FUEL STORAGE AREAS

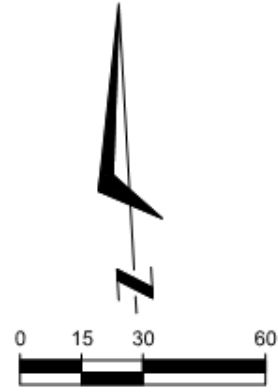
Inspector: _____ Fueling Agent: _____ Date: _____

S – Satisfactory U – Unsatisfactory R – Remark Below	Jet A Section			100LL Section			Other _____		
	S	U	R	S	U	R	S	U	R
Fencing/Locks/Signs									
Piping protected from vehicles									
No Smoking signs posted									
Deadman Controls for loading stations									
2 Fire Extinguishers – Inspected/Accessible									
Boldly Marked Emergency Cutoffs – Location									
No Fuel Leaks									
Bonding wire/clips at loading stations/operable									
Piping/Pumps bonded and grounded									
No vegetation or materials to spread fire									
No evidence of Smoking									
Hoses in good condition									
Explosion Proof Electrical Equipment									
Remarks: _____									

APPENDIX D

PROJECT LAYOUT PLAN EXHIBIT

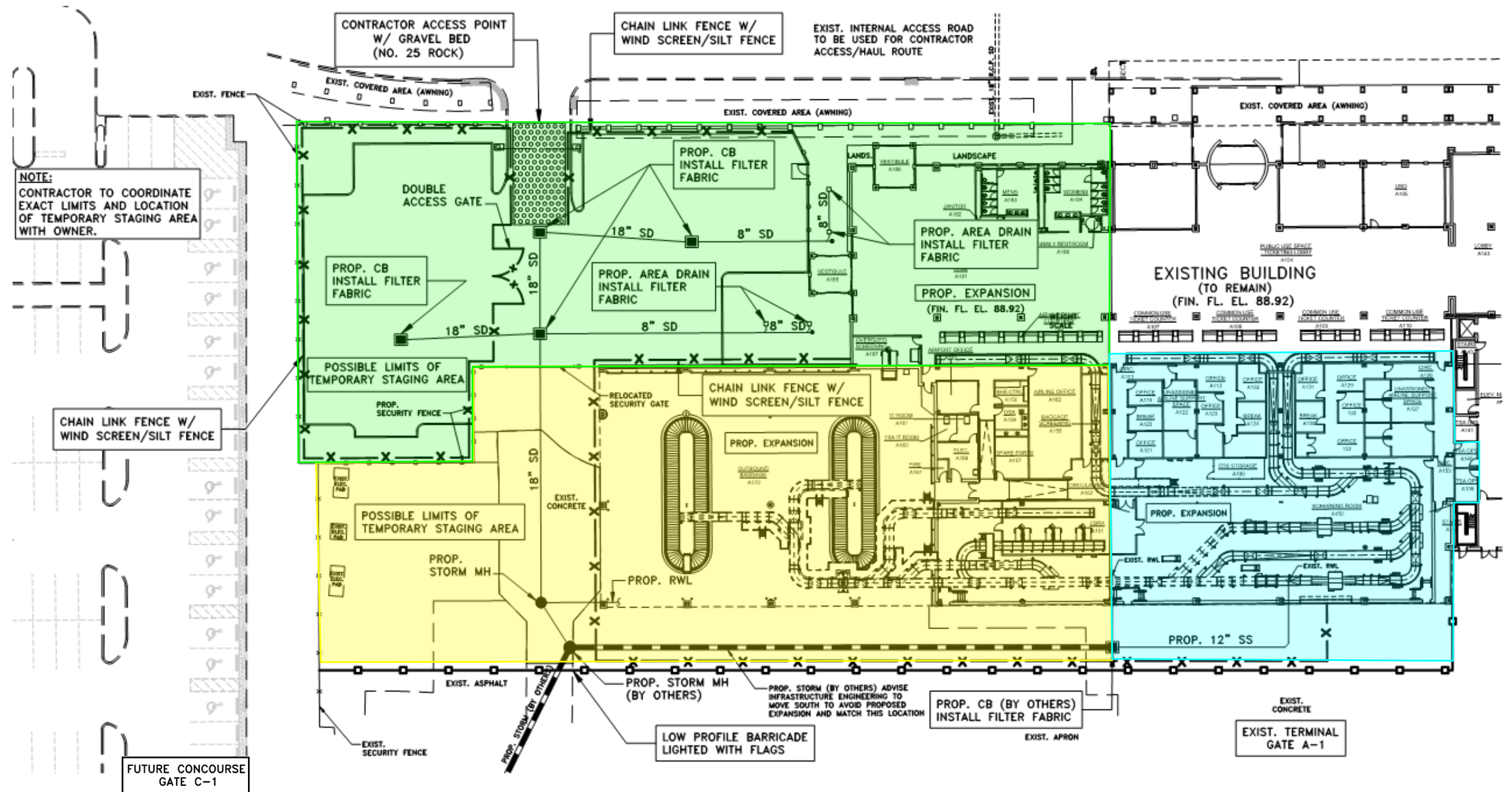
- PHASE 1
- PHASE 2
- PHASE 3



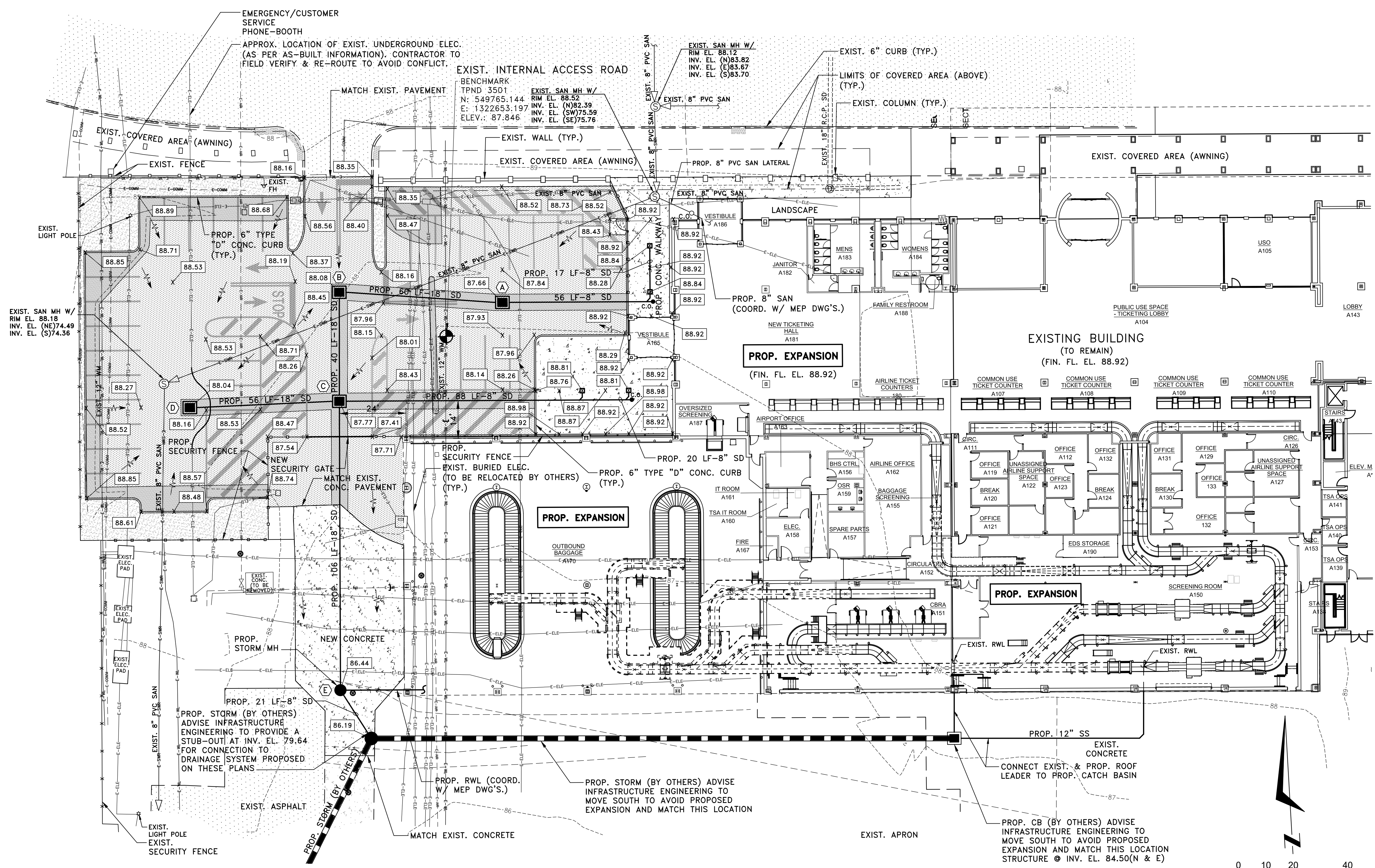
LEGEND

- GRAVEL BED (No. 25 ROCK)
- CHAIN LINK FENCE W/ WIND SCREEN/SILT FENCE
- LOW PROFILE BARRICADE LIGHTED WITH FLAGS

- NOTES:**
1. INSTALLATION OF ANY STAKED SILT FENCE SHALL BE IN ACCORDANCE WITH FDOT INDEX No. 102.
 2. INSTALLATION OF HAY BALES SHALL BE IN ACCORDANCE WITH FDOT INDEX No. 102.
 3. PLACEMENT OF ROCK BAGS (IF USED) SHALL BE IN ACCORDANCE WITH FDOT INDEX No. 102.
 4. LOW PROFILE BARRICADE SHALL MEET REQUIREMENTS OF FAA AC 150/5370-2G. DO NOT LINK BARRICADES AND SPACE ENOUGH TO ALLOW PASSAGE OF EMERGENCY VEHICLES, TUGS, AND GROUND SUPPORT EQUIPMENT BETWEEN BARRICADES.



PROJECT LAYOUT PLAN EXHIBIT



LEGEND

[Pattern]	EXISTING ASPHALTIC PAVEMENT	[Symbol]	NEW AREA DRAIN
[Pattern]	NEW ASPHALTIC PAVEMENT	[Symbol]	NEW STORM DRAINAGE PIPE
[Pattern]	EXISTING ASPHALTIC PAVEMENT TO BE MILLED & RESURFACED (1" MIN.)	[Symbol]	PROP. STORM (BY OTHERS)
[Pattern]	EXISTING CONCRETE PAVEMENT	[Symbol]	EXIST. ELECTRIC
[Pattern]	NEW CONCRETE PAVEMENT/SIDEWALK (COORD. W/ ARCH. DWG'S.)	[Symbol]	EXIST. COMMUNICATIONS
[Pattern]	NEW GRAVEL (MATCH EXIST. GRAVEL)	[Symbol]	EXIST. WATER MAIN
[Pattern]	EXISTING CONTOUR (SEE SURVEY FOR ADDITIONAL INFORMATION)	[Symbol]	EXIST. SANITARY SEWER
[Symbol]	NEW SPOT ELEVATION	[Symbol]	EXIST. SANITARY MANHOLE
[Symbol]	NEW STRUCTURE I.D.	[Symbol]	NEW SANITARY MANHOLE
[Symbol]	NEW CATCH BASIN	[Symbol]	NEW SANITARY SEWER
[Symbol]	NEW STORM MANHOLE	[Symbol]	NEW SANITARY CLEAN-OUT
[Symbol]		[Symbol]	FLOW ARROW

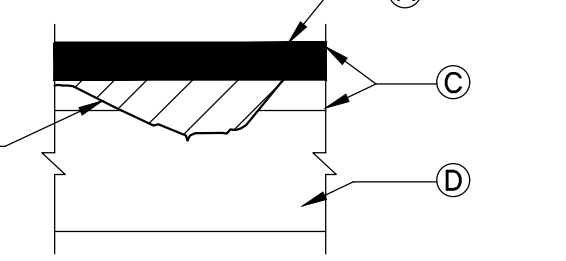
- ### PAVING-GRADING-DRAINAGE NOTES
- HORIZONTAL AND VERTICAL CONTROL POINTS SHALL BE PROVIDED BY THE CONTRACTOR. ALL CONSTRUCTION LAYOUT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. IN THE EVENT THAT CONTROL POINTS ARE DISTURBED BY CONTRACTOR, CONTRACTOR SHALL PAY FOR ALL RESETTING OF CONTROL POINTS.
 - GRADING SHALL CONSIST OF ALL EXCAVATION, FILLING, SHAPING AND SLOPING NECESSARY FOR THE CONSTRUCTION, PREPARATION AND COMPLETION OF ALL SUBGRADES SHOULDERS, SLOPES, INTERSECTIONS, PAVEMENTS AND OTHER AREAS, ALL IN ACCORDANCE WITH THE ALIGNMENTS AND GRADES SHOWN IN THESE DRAWINGS. DRAINAGE STRUCTURES SHALL BE AS DETAILED IN THESE DRAWINGS.
 - DRAINAGE PIPE TO BE HIGH DENSITY POLYETHYLENE, OR APPROVED EQUAL. MUST BE COMPLIANT WITH VPS AIRPORT AND OKALOOSA COUNTY SPECIFICATIONS.
 - ASPHALTIC PAVEMENTS SHALL CONSIST OF COMPACTED SUBGRADE, COMPACTED LIMEROCK SUBBASE AND TYPE S-3 ASPHALTIC CONCRETE, AS SHOWN IN THESE DRAWINGS.
 - WHERE APPLICABLE, SAWCUT ALL PAVEMENT EDGES WHERE EXISTING PAVEMENT IS TO REMAIN.
 - CONCRETE CURB, SIDEWALK AND SLABS SHALL CONSIST OF 3,000 PSI PORTLAND CEMENT CONCRETE, AS SHOWN IN THESE DRAWINGS.
 - ALL REINFORCING, ALL SIZES, SHALL CONFORM TO ASTM A615, GRADE 60.
 - ALL EXPOSED CONCRETE SURFACES SHALL RECEIVE A LIGHT BROOM FINISH, UNLESS OTHERWISE DIRECTED. SEE ARCHITECTURAL DRAWINGS FOR WALKWAY FINISHES.
 - FINAL GRADING OF LANDSCAPING AREAS SHALL BE COORDINATED IN THE FIELD WITH ENGINEER/LANDSCAPE ARCHITECT. COMPACTED FILL IN LANDSCAPED AREAS SHALL BE PLACED SUCH THAT 12 INCHES OF TOP SOIL MAY BE PLACED BETWEEN THE COMPACTED FILL AND FINISHED GRADE.
 - TESTING LABORATORY SHALL BE RETAINED BY THE CONTRACTOR TO VERIFY SPECIFIED COMPACTION DENSITY AND CONCRETE STRENGTH. FAILURE OF ANY TESTING TO MEET SPECIFIED REQUIREMENTS SHALL BE DEEMED NON-COMPLYING.

DRAINAGE STRUCTURE SCHEDULE

ID	TYPE	RIM/GRATE	PIPE INVERT	STRUCTURE INVERT	POLLUTION BAFFLE
A	CATCH BASIN	87.66	80.54	78.54	0
B	CATCH BASIN	88.08	80.30	78.30	0
C	CATCH BASIN	87.77	80.14(N,S) 81.95(E,W)	78.14	0
D	CATCH BASIN	88.04	82.17	82.48	0
E	MANHOLE	86.44	79.72	77.72	0

MILLING & RESURFACING PROCEDURE

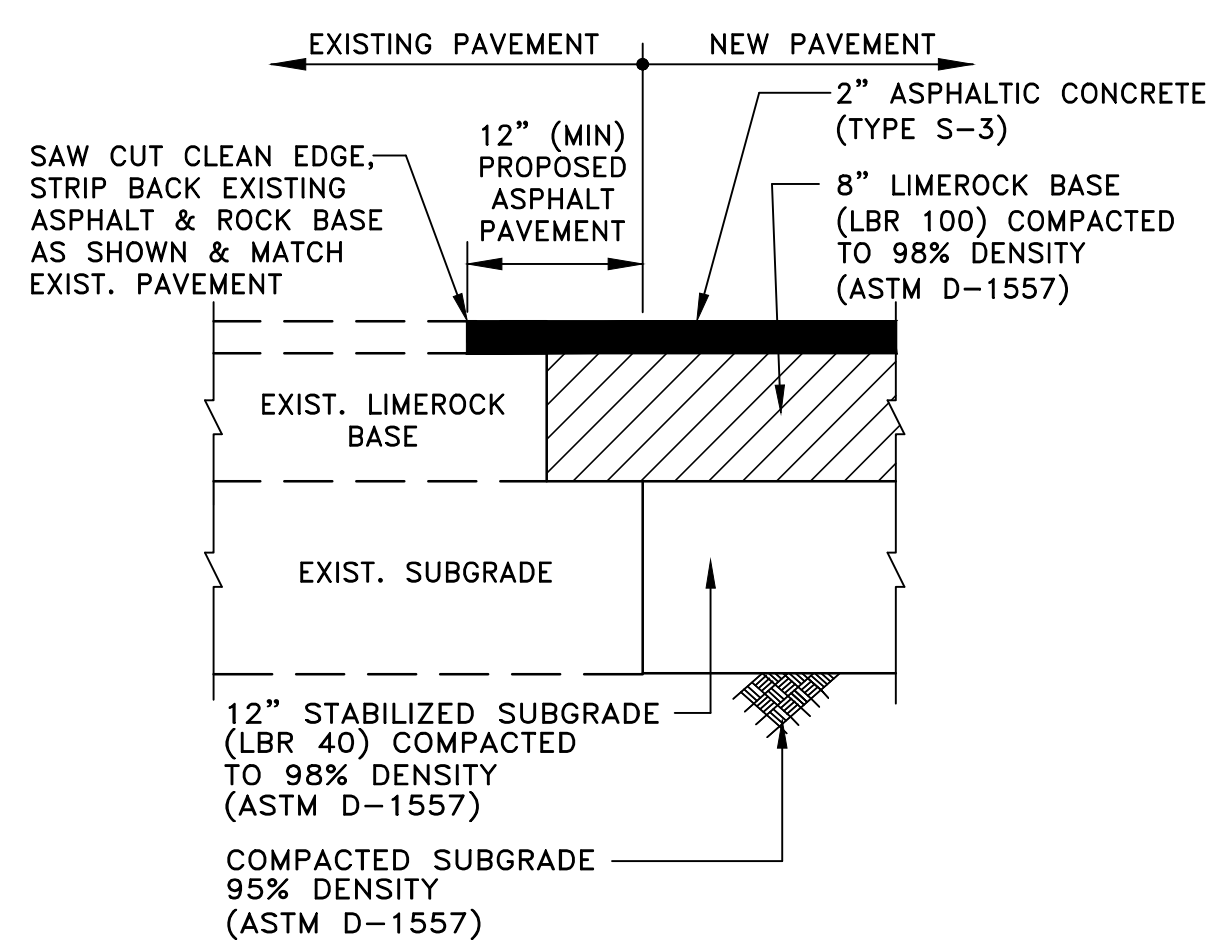
- MILL, 1" THICKNESS
- REPAIR (WHERE REQUIRED, SEE DETAIL)
- RESURFACE, 1" THICKNESS



- A ASPHALTIC CONCRETE RESURFACE COURSE 1" THICK
- B CONTRACTOR SHALL CLEAN ALL DEPRESSIONS, POTHOLES AND OTHER IRREGULARITIES OF ALL LOOSE MATERIALS; TACK COAT THESE AREAS; AND, FILL WITH ASPHALTIC CONCRETE, COMPACTED IN 1" LIFTS TO GENERATE UNIFORM SURFACE
- C EXISTING ASPHALTIC CONCRETE
- D EXISTING BASE COURSE

POTHOLE REPAIR DETAIL

N.T.S.

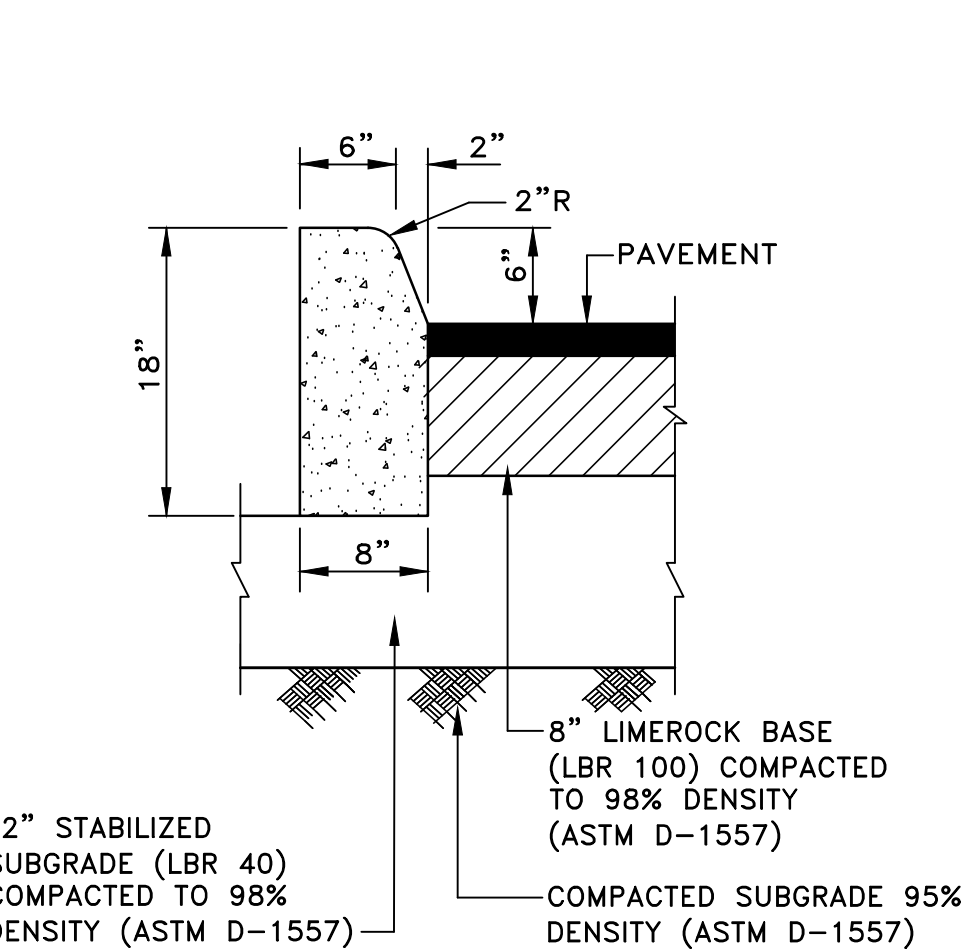


CONNECTION DETAIL AT EXISTING ASPHALT PAVEMENT

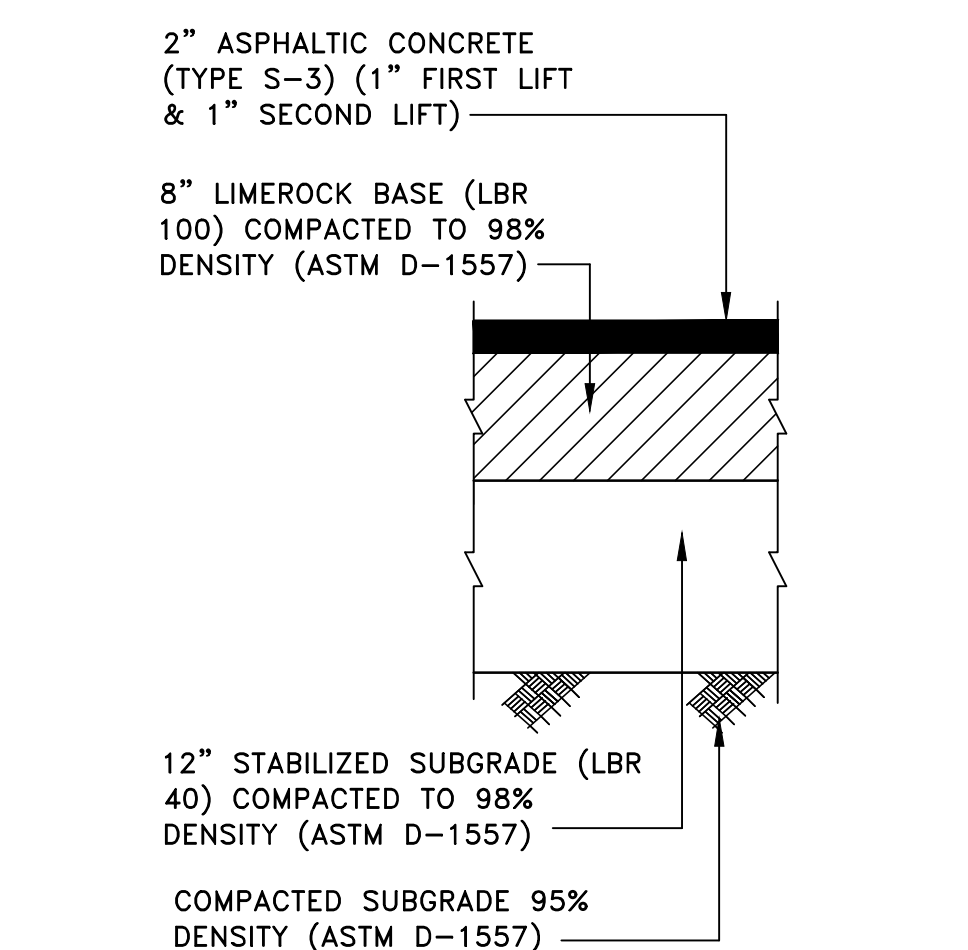
SCALE: 1" = 1'-0"



NOTE:
PAVEMENT RESTORATION/MILLING/RESURFACING SHALL BE IN STRICT CONFORMANCE WITH OKALOOSA PUBLIC WORKS STANDARDS, AS APPLICABLE; AND, ALL GENERAL AND SPECIAL CONDITIONS OF PERMITS ISSUED BY OKALOOSA COUNTY. CONTRACTOR SHALL REPLACE ALL STRIPING, PAVEMENT MARKINGS, SIGNAGE AND ROADWAY PAVEMENT MARKERS (RPM'S) TO MATCH THE CONDITIONS PRIOR TO CONSTRUCTION, TO COMPLY WITH THESE CONSTRUCTION DRAWINGS AND/OR AS DIRECTED BY OKALOOSA COUNTY PWD INSPECTOR AND/OR VPS AIRPORT INSPECTOR.

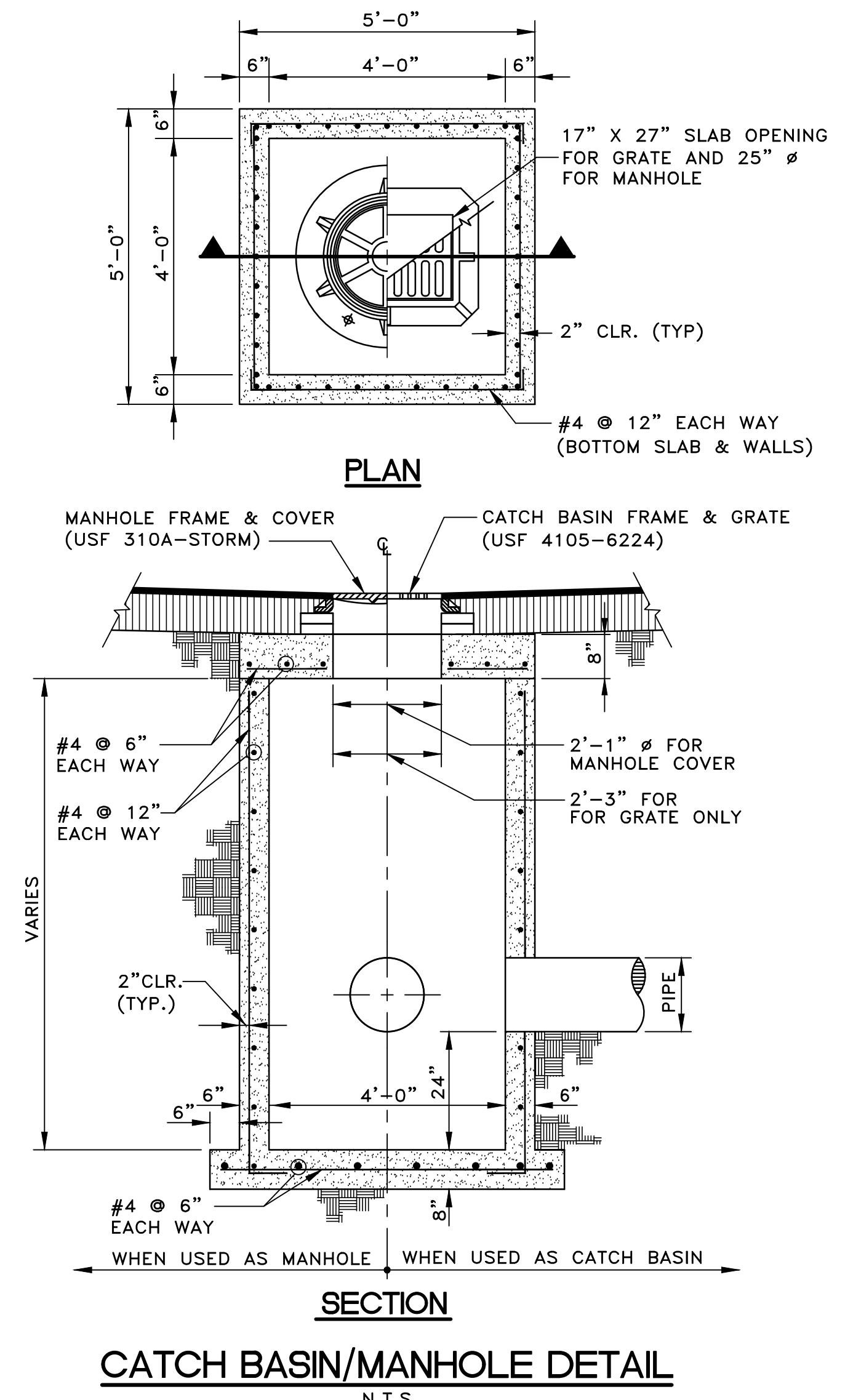
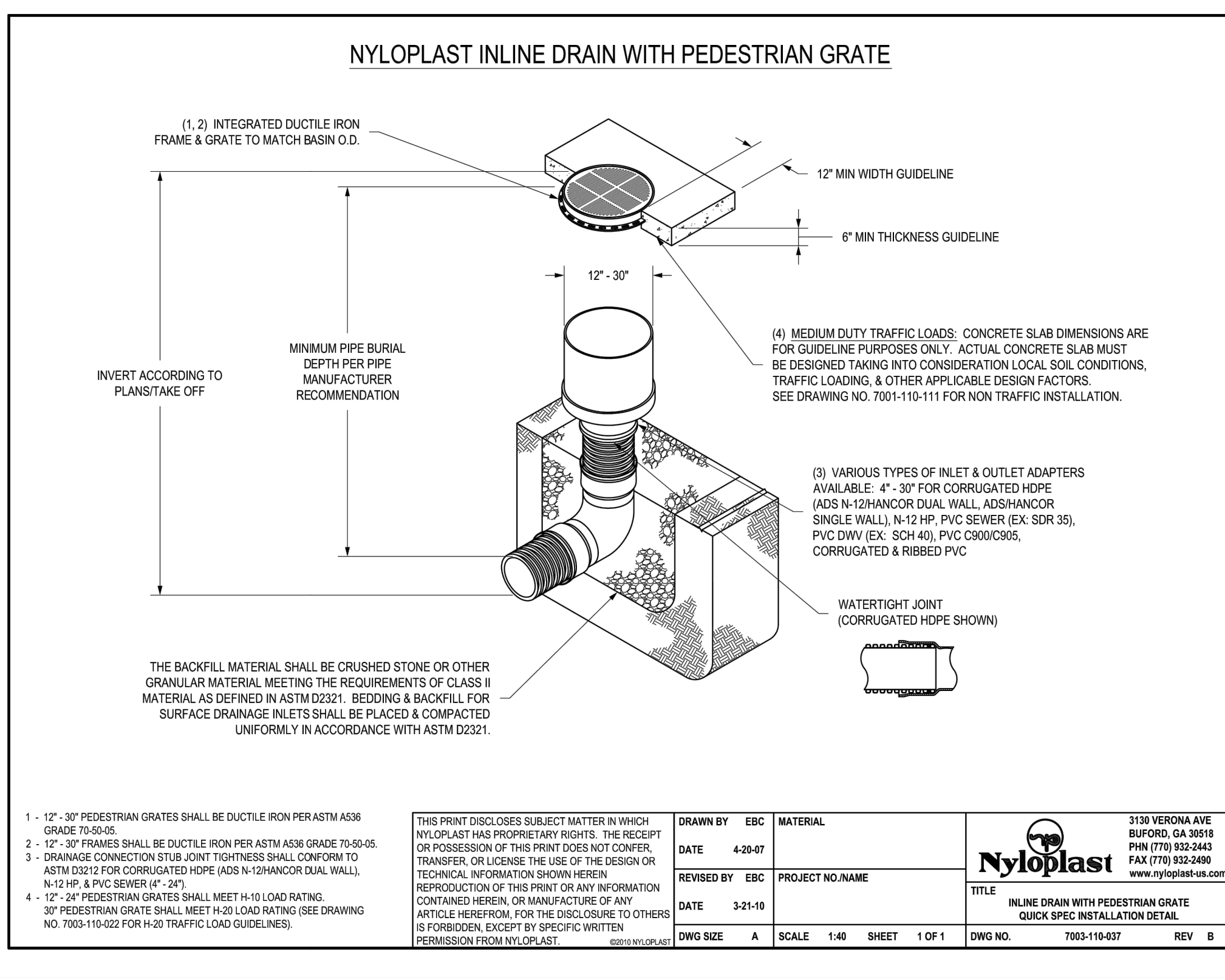


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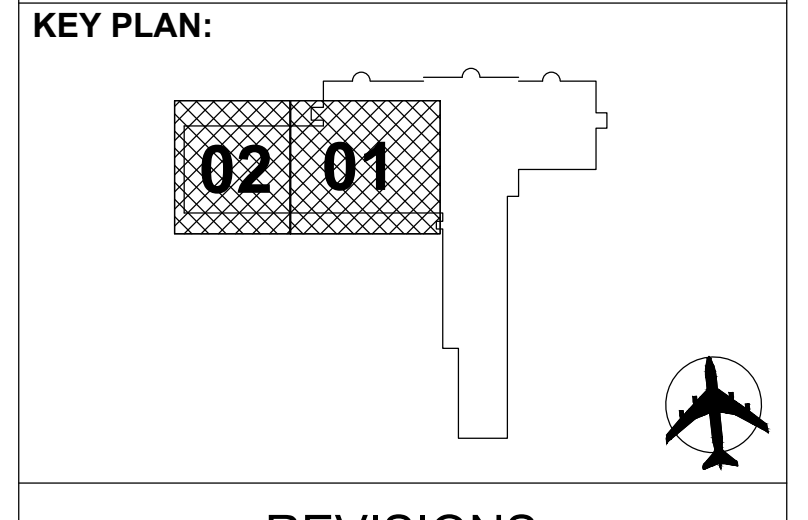
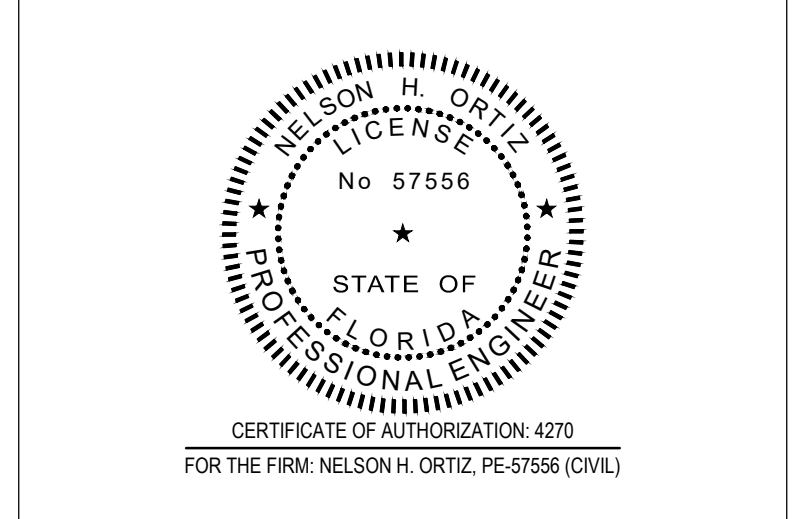
ASPHALTIC PAVEMENT DETAIL

SCALE: 1" = 1'-0"



CATCH BASIN/MANHOLE DETAIL

N.T.S.



REVISIONS

REV	DESCRIPTION	DATE
A	RELEASE FOR BID SET	05/15/2020

BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION

PROJECT NO: C18-2709-AP
DRAWN: G.G.G.
CHECKED: N.H.O.
SCALE: 1" = 20'

RELEASE FOR BID SET

05/15/2020

PAVING-GRADING-DRAINAGE PLAN, DETAILS AND NOTES

SHEET NUMBER: CP1-100

THRESHOLD INSPECTION PLAN

PART 1 ADMINISTRATION

1.1 GENERAL INFORMATION

- A. SPECIAL INSPECTIONS NOT BY GRAEF.
B. THIS IS A THRESHOLD BUILDING AS DEFINED BY CHAPTER 553 OF THE FLORIDA STATUTES AND THEREFORE REQUIRES THE OWNER TO RETAIN A SPECIAL INSPECTOR.
C. THE SPECIAL INSPECTOR SHALL ENSURE THAT THE STRUCTURAL PORTIONS OF THE BUILDING CONSTRUCTION ARE EXECUTED IN SUBSTANTIAL CONFORMANCE WITH THE OFFICIAL CONTRACT DOCUMENTS.
D. THE SPECIAL INSPECTOR SHALL NOT MAKE DESIGN DECISIONS, DIRECT THE CONTRACTOR'S WORK, NOR BE RESPONSIBLE FOR THE CONSTRUCTION MEANS AND METHODS.
E. PROPOSALS FOR SPECIAL INSPECTION SERVICES ARE TO BE SEPARATE AND INDEPENDENT FROM OTHER MATERIAL TESTING AND QUALITY ASSURANCE SERVICES.

1.2 QUALIFICATIONS OF THE SPECIAL INSPECTOR

- A. THE SPECIAL INSPECTOR SHALL BE A REGISTERED ENGINEER WITH SPECIAL INSPECTOR CERTIFICATION BY THE FLORIDA BOARD OF PROFESSIONAL ENGINEERS. ANY FUTURE REQUIREMENTS, IF ENACTED BY LAW, WILL ALSO BE APPLICABLE.
B. THE SPECIAL INSPECTOR SHALL ENSURE THAT HIS AUTHORIZED REPRESENTATIVE IS EXPERIENCED IN THE STRUCTURAL SYSTEM BEING INSPECTED.
C. AS USED IN THIS PLAN, THE TERM SPECIAL INSPECTOR SHALL INCLUDE HIS REPRESENTATIVE UNLESS OTHERWISE STATED.

1.3 RESPONSIBILITIES AND LIMITATIONS

- A. THE SPECIAL INSPECTOR DOES NOT SURROGATE THE OWNER'S REPRESENTATIVE OR THE ARCHITECT/ENGINEER-OF-RECORD'S RESPONSIBILITIES.
B. IT IS NOT INTENDED THAT THE CONTRACTOR'S CONTRACTUAL OR STATUTORY OBLIGATIONS ARE IN ANY WAY RELIEVED OR FOREGONE BY THE PRESENCE OF THE SPECIAL INSPECTOR.
C. THE SPECIAL INSPECTOR IS TO PROVIDE SERVICES ONLY WITH REGARD TO THE STRUCTURAL FRAME OF THE BUILDING INCLUDING FOUNDATION, PRIMARY AND SECONDARY FRAMING SYSTEMS, EXTERIOR WALL GLASS AND STOREFRONT SYSTEMS, PRECAST CONCRETE PANELS AND ANY OTHER ITEMS SPECIFICALLY INCLUDED IN THE SPECIAL INSPECTION GUIDELINES.
D. THE SPECIAL INSPECTOR IS NOT RESPONSIBLE FOR THE INSPECTION OF ANY SAFETY PROVISIONS TO COMPLY WITH OSHA REQUIREMENTS OR OTHER SAFETY STANDARDS WHICH APPLY DURING THE CONSTRUCTION PERIOD.
E. ALL SPECIAL INSPECTIONS SHALL BE IN ACCORDANCE WITH THE PROVISIONS OF THE THRESHOLD INSPECTOR LAW, CHAPTER 553.79 OF THE FLORIDA STATUTES.
F. IT SHALL BE THE RESPONSIBILITY OF THE SPECIAL INSPECTOR TO OBSERVE THE CONSTRUCTION OF STRUCTURAL COMPONENTS ONLY, AND TO REPORT TO THE CONCERNED PARTIES THAT THE STRUCTURE IS BUILT IN GENERAL CONFORMANCE WITH THE OFFICIAL CONTRACT DOCUMENTS.
G. SINCE THE SPECIAL INSPECTOR DOES NOT CERTIFY THAT THE OFFICIAL CONTRACT DOCUMENTS ARE, IN THEMSELVES, IN COMPLIANCE WITH THE GOVERNING BUILDING CODE, ALL CERTIFICATIONS ISSUED WILL REFER TO COMPLETED WORK BEING IN SUBSTANTIAL CONFORMANCE WITH THE OFFICIAL CONTRACT DOCUMENTS, RATHER THAN THE APPLICABLE BUILDING CODES.
H. AT THE COMPLETION OF STRUCTURAL WORK, THE SPECIAL INSPECTOR SHALL CERTIFY THAT "TO THE BEST OF MY KNOWLEDGE AND BELIEF, THE STRUCTURE (ADD PROJECT DESCRIPTION HERE) AND THE CONSTRUCTION OF ALL LOAD BEARING COMPONENTS COMPLIES WITH THE OFFICIAL CONTRACT DOCUMENTS".

1.4 DUTIES OF THE SPECIAL INSPECTOR

- A. THE SPECIAL INSPECTOR IS RESPONSIBLE TO THE OWNER AND THE ENFORCING AGENCY HAVING JURISDICTION FOR THIS PROJECT.
B. THE SPECIAL INSPECTOR IS RESPONSIBLE FOR THOROUGH KNOWLEDGE OF THE CONTRACT DOCUMENTS INCLUDING THE SPECIFICATIONS AND APPROPRIATE PORTIONS OF THE GOVERNING CODES.
C. PRIOR TO PERFORMING INSPECTIONS, HE SHALL ALSO OBTAIN COPIES OF PROPERLY RECORDED RFIS RELATED TO THE WORK FROM THE CONTRACTOR.
D. THE SPECIAL INSPECTOR SHALL OBSERVE AND RECORD THE CONDITIONS OF THE WORK BEING INSPECTED, THE PROGRESS OF WORK, ANY DEVIATIONS OF THE STRUCTURAL COMPONENTS FROM THE OFFICIAL CONTRACT DOCUMENTS AND ANY VERBAL INSTRUCTIONS GIVEN TO THE CONTRACTOR SHALL BE NOTED AND REPORTED.
E. THE SPECIAL INSPECTOR IS RESPONSIBLE FOR VERIFYING THAT THE TESTING AGENCY COMPLIES WITH THE CONTRACT DOCUMENTS.
F. THE SPECIAL INSPECTOR SHALL VISIT THE SITE WITH ENOUGH FREQUENCY TO ENSURE THAT HIS AUTHORIZED REPRESENTATIVE IS COMPLYING WITH THIS PLAN.

1.5 REPORTING

- A. THE SPECIAL INSPECTOR SHALL RECORD PROGRESS, CONDITIONS, OBSERVATIONS, TESTING AND ANY DEVIATION FROM THE CONTRACT DOCUMENTS.
B. IT IS THE RESPONSIBILITY OF THE SPECIAL INSPECTOR OR HIS AUTHORIZED REPRESENTATIVE TO IMMEDIATELY NOTIFY THE CONTRACTOR, ARCHITECT/ENGINEER OF RECORD OF THE FOLLOWING:
1. THE USE OF MATERIALS, EQUIPMENT OR WORKMANSHIP THAT DOES NOT CONFORM TO THE OFFICIAL CONTRACT DOCUMENTS, GOVERNING BUILDING CODES OR GENERALLY ACCEPTED INDUSTRY STANDARDS THAT MAY CAUSE IMPROPER CONSTRUCTION.
2. ANY STRUCTURAL COMPONENTS THAT HAVE BEEN CONSTRUCTED WITHOUT TESTING OR INSPECTIONS PRIOR TO OR DURING THE CONSTRUCTION AND THAT CANNOT BE INSPECTED OR TESTED IN PLACE USING NON-DESTRUCTIVE METHODS.
C. THE SPECIAL INSPECTOR SHALL MAINTAIN A LOG OF SUCH NON-CONFORMING ITEMS WITH THE DESCRIPTION OF THE ITEM, DATE FIRST OBSERVED, AND DATE THE DEFICIENCY WAS CORRECTED. THE LOG SHALL BE DISTRIBUTED TO THE CONTRACTOR, THE OWNER'S REPRESENTATIVE, THE ARCHITECT AND THE STRUCTURAL ENGINEER OF RECORD ON A WEEKLY BASIS.
D. INSPECTION REPORTS SHALL BE WRITTEN AFTER EACH INSPECTION. THE SPECIAL INSPECTOR IS RESPONSIBLE FOR MAINTAINING A LOG OF INSPECTIONS AND COPIES OF INSPECTION REPORTS AVAILABLE AT THE JOBSITE. THE REPORTS SHALL CONSIST OF SOME OR ALL OF THE FOLLOWING:
1. NAME AND LOCATION OF THE PROJECT.
2. NAME OF THE INSPECTOR.
3. DATE AND TIME OF INSPECTIONS.
4. WEATHER CONDITIONS DURING INSPECTION.
5. NAME OF THE CONTRACTOR'S REPRESENTATIVE OR OWNER'S REPRESENTATIVE PRESENT DURING INSPECTIONS.
6. DESCRIPTIONS OF THE PORTIONS OF STRUCTURE BEING INSPECTED.
7. CHANGES MADE DURING OBSERVATIONS.
8. ANY PART OF THE STRUCTURAL COMPONENT THAT IS NOT IN COMPLIANCE WITH THE OFFICIAL CONTRACT DOCUMENTS.
9. COMMENTS ON OTHER REPORTS SUCH AS TESTING REPORTS, GEOTECHNICAL ENGINEERS' INSPECTION REPORTS, SHORING AND RE-SHORING ENGINEERS' INSPECTION REPORTS WHEN APPLICABLE.
10. PHOTOGRAPHS.
E. FIELD REPORTS SHALL BE SIGNED BY THE PERSON PERFORMING THE INSPECTION. WEEKLY SUMMARY OF INSPECTIONS AND REPORTS SHALL BE SUBMITTED TO THE OWNER, ENFORCING AGENCY, ARCHITECT AND STRUCTURAL ENGINEER UNDER A COVER LETTER SIGNED AND SEALED BY THE SPECIAL INSPECTOR.
F. PRIOR TO THE ISSUANCE OF A CERTIFICATE OF OCCUPANCY, THE SPECIAL INSPECTOR SHALL ISSUE TO THE OWNER, ENFORCING AGENCY, ARCHITECT AND STRUCTURAL ENGINEER A SIGNED AND SEALED LETTER STATING THAT THE STRUCTURE HAS BEEN CONSTRUCTED IN SUBSTANTIAL CONFORMANCE WITH THE OFFICIAL CONTRACT DOCUMENTS. THIS STATEMENT SHALL BE IN CONFORMANCE WITH SECTION 553.79(7)(A) OF THE FLORIDA STATUTES.

1.6 OWNER REQUIREMENTS

- A. THE OWNER SHALL PROVIDE THE SPECIAL INSPECTOR A COMPLETE SET OF THE OFFICIAL CONTRACT DOCUMENTS INCLUDING DRAWINGS, SPECIFICATIONS AND THE GEOTECHNICAL REPORT WHEN CONSTRUCTION BEGINS. THE OWNER SHALL ALSO ARRANGE THROUGH HIS AUTHORIZED REPRESENTATIVE, TO PROVIDE ANY REVISIONS TO THE CONTRACT DOCUMENTS, INCLUDING RFIS, ADDENDUMS, ETC. AND COPIES OF THE APPROVED SHOP DRAWINGS.
B. THE OWNER SHALL ALSO ARRANGE FOR ALL NECESSARY CONSTRUCTION RECORDS TO BE FURNISHED TO THE SPECIAL INSPECTOR IN A TIMELY MANNER. SUCH RECORDS INCLUDE CONCRETE CYLINDER TEST REPORTS, SOIL DENSITY TEST REPORTS, MILL RECORDS, SHOP DRAWINGS, PILE INSTALLATION RECORDS, ETC.
C. THE OWNER SHALL REQUIRE IN THE CONTRACT WITH THE CONTRACTOR TO PROVIDE THE SPECIAL INSPECTOR TO HAVE ADEQUATE ACCESS TO PERFORM THE INSPECTIONS AND REQUEST THE INSPECTIONS IN A TIMELY MANNER.

1.7 CONTRACTOR REQUIREMENTS

- A. THE CONTRACTOR SHALL PROVIDE THE SPECIAL INSPECTOR A WORK SPACE AT THE PROJECT SITE FOR KEEPING INSPECTION RECORDS, CONTRACT DOCUMENTS AND TELEPHONE/FAX/INTERNET CONNECTIONS.
B. THE CONTRACTOR SHALL COOPERATE AND ASSIST THE SPECIAL INSPECTOR WITH PERFORMING INSPECTION DUTIES AND WILL PROVIDE ACCESS TO THE WORK DURING ALL WORKING HOURS.
C. THE INSPECTOR MAY MAKE SPOT INSPECTIONS OF THE WORK IN PROGRESS IN ORDER FOR EARLY DETECTION OF ANY DEVIATIONS FROM THE CONTRACT DOCUMENTS. HOWEVER, THIS DOES NOT RELIEVE THE CONTRACTOR OF THE RESPONSIBILITY OF CORRECTING DEVIATIONS FROM THE CONTRACT DOCUMENTS DISCOVERED AT ANY TIME.
D. THE CONTRACTOR SHALL PROVIDE A MINIMUM OF 24 HOUR NOTICE FOR ALL INSPECTIONS.
E. IF ANY OF THE CONTRACTOR'S WORK IS NOT IN COMPLIANCE WITH THE CONTRACT DOCUMENTS, THE WORK MAY EITHER BE CORRECTED OR THE CONTRACTOR MAY SUBMIT TO THE ARCHITECT/ENGINEER A REQUEST TO ACCEPT THE DEVIATION.
F. CONSTRUCTION THAT HAS NOT BEEN INSPECTED MAY REQUIRE TESTING OR REMOVAL AS DECIDED BY THE STRUCTURAL ENGINEER.

PART 2 INSPECTIONS

2.1 GENERAL

- A. SPECIAL INSPECTIONS REQUIRED FOR THE FOLLOWING MATERIALS, SYSTEMS, COMPONENTS AND WORK IN ACCORDANCE WITH THE THRESHOLD INSPECTION PLAN.
1. CAST-IN-PLACE CONCRETE
2. STEEL FRAMING
3. WELDING/BOLTING
4. REINFORCED CONCRETE MASONRY
5. REINFORCING STEEL
6. FOUNDATIONS - SOIL
B. THE STRUCTURE IS DEPICTED ON STRUCTURAL PLANS THAT ARE PART OF THE OFFICIAL CONTRACT DOCUMENTS. ALL SPECIFICATION SECTIONS RELATED TO THE STRUCTURE, ALL APPLICABLE ADDENDA, APPROVED SHOP DRAWINGS AND PROPERLY RECORDED RESPONSES TO THE RFIS (REQUESTS FOR INFORMATION) SHALL GOVERN THE REQUIREMENTS OF THE WORK.
C. FOR REQUIRED FREQUENCY OF INSPECTIONS, REFER TO CHAPTER 17 OF THE 2009 INTERNATIONAL BUILDING CODE.

2.2 SUBSURFACE PREPARATIONS

- A. THE GEOTECHNICAL TESTING AGENCY RETAINED BY THE OWNER SHALL MONITOR AND TEST BACKFILL AND COMPACTIONS OPERATIONS AS DESCRIBED IN THE GEOTECHNICAL ENGINEERING REPORT. THE SPECIAL INSPECTOR SHALL ENSURE THAT THE TESTING AGENCY IS ONSITE MONITORING THE SUBSURFACE PREPARATION.
B. THE SPECIAL INSPECTOR SHALL BE FURNISHED WITH THE TESTING AGENCY'S DAILY REPORTS AS WELL AS THE COMPLETION REPORT TO BE REVIEWED AND MAINTAINED IN HIS FILE.
C. VERIFY THAT ANY SUB-GRADE DISTURBED BY OTHER TRADES HAS BEEN PROPERLY RE-COMPACTED.

2.3 CAST-IN-PLACE REINFORCED CONCRETE

- A. THE CONTRACTOR SHALL NOTIFY THE SPECIAL INSPECTOR A MINIMUM OF 24 HOURS PRIOR TO THE PLACEMENT OF ANY STRUCTURAL CONCRETE.
B. SHORING
1. VERIFY THAT THE SHORING AND RE-SHORING ENGINEER HAS CONFIRMED THAT THE SHORING AND RE-SHORING ARE IN COMPLIANCE WITH HIS DRAWINGS.
2. CHECK LOCATION, SPACING, SUITABILITY, GENERAL SIZE AND QUALITY OF SHORING FOR CONFORMANCE WITH THE SHORING AND RE-SHORING PLANS SUBMITTED.
3. CONFIRM THE TIMING OF SHORING, RE-SHORING AND FORMWORK REMOVAL COMPLY WITH THE CONTRACT DOCUMENTS AND THE SHORING AND RE-SHORING DRAWINGS.
C. FORMWORK
1. INSPECT FORMS FOR THEIR CORRECT LOCATIONS, REQUIRED DIMENSIONS, ALIGNMENT, BRACING, FORM TIES AND SPACERS.
2. VERIFY THAT THE FORM IS CLEAN AND ALL FOREIGN MATERIALS HAVE BEEN REMOVED.
3. VERIFY THAT THE FORMS HAVE BEEN PROPERLY COATED.
4. AFTER FORMWORK REMOVAL, SPOT CHECK CONCRETE SURFACES FOR HONEYCOMBING OR VOIDS.

D. JOINTS

- 1. REVIEW LOCATIONS OF ALL JOINTS SUCH AS EXPANSION, CONTRACTION AND CONSTRUCTION JOINTS AS SHOWN ON THE CONSTRUCTION DOCUMENTS OR OTHERWISE APPROVED DOCUMENT SUCH AS THE CONTRACTOR'S CONSTRUCTION JOINT PLAN.
2. VERIFY THAT THE PREPARATION OF JOINTS AS REQUIRED BY THE DRAWINGS AND/OR SPECIFICATIONS, SUCH AS WET SAND BLASTING, ROUGHENING, WETTING, ETC. CONFORMS TO CONTRACT DOCUMENTS OR MANUFACTURER RECOMMENDATIONS.
3. VERIFY THAT SAW CUT JOINTS ARE TO THE PROPER DEPTH AND HAVE BEEN PROVIDED IN THE TIME FRAME INDICATED ON THE CONTRACT DOCUMENTS.
4. VERIFY THAT DOWELS, KEYS, AND BULKHEADS IN STRUCTURAL MEMBERS COMPLY WITH CONTRACT DOCUMENTS.
5. EXPANSION JOINTS SHOULD BE FREE FROM DEBRIS OR IRREGULARITIES THAT WOULD INTERFERE WITH FREE MOVEMENT.
6. CHECK IF FILLER HAS BEEN INSTALLED AND SECURELY FASTENED IN EXPANSION JOINTS IN ACCORDANCE WITH THE SPECIFICATIONS AND/OR MANUFACTURER'S RECOMMENDATIONS.

E. REINFORCING

- 1. CHECK IF ALL REINFORCEMENT IS IN PLACE IN ACCORDANCE WITH THE STRUCTURAL DRAWINGS. IN THE EVENT OF ANY CONFLICT BETWEEN THE CONTRACT DOCUMENTS AND SUPPLIER'S SHOP DRAWINGS, NOTIFY THE ENGINEER OF RECORD IMMEDIATELY. THE FOLLOWING ITEMS MUST BE CHECKED BY THE SPECIAL INSPECTOR PRIOR TO THE PLACEMENT OF CONCRETE:
a. CHECK REINFORCEMENT FOR SIZE, QUANTITY, BENDING, GRADE AND BAR-TO-BAR SPACING.
b. CHECK IF REINFORCEMENT HAS BEEN CLEANED OF ALL LOOSE, FLAKY RUST AND SCALE, GREASE OR OTHER FOREIGN MATERIALS WHICH WOULD REDUCE OR PREVENT BOND.
c. CHECK TO ENSURE THAT THE REINFORCEMENT IS TIED AND SUPPORTED SECURELY SO THAT IT WILL NOT BE DISPLACED DURING CONCRETE PLACEMENT.
d. CHECK CONCRETE COVER OF ALL REINFORCEMENT FOR COMPLIANCE WITH SPECIFICATIONS AND CONTRACT DOCUMENTS.
e. CHECK EMBEDMENT LENGTH, SPICE LOCATIONS AND LENGTHS, AND LAP LENGTHS FOR COMPLIANCE. NO SPLICES SHOULD BE MADE WITHOUT THE APPROVAL OF THE ENGINEER.
f. VERIFY APPROVAL OF MECHANICAL COUPLERS AND PROPER INSTALLATION PER MANUFACTURER'S SPECIFICATIONS.
g. CHECK ADDITIONAL REINFORCING REQUIRED AT OPENINGS.
h. CHECK FOR PROPER LAYERING OF MAIN REINFORCING VERSUS TEMPERATURE REINFORCING STEEL IN ONE-WAY SLABS.
i. VERIFY SIZE AND SPACING OF WELDED WIRE FABRIC, THAT IT IS ADEQUATELY SUPPORTED AND TIED TO RESIST DISPLACEMENT DURING CONCRETE PLACEMENT, AND THAT ITS SPLICES ARE OF ADEQUATE LENGTH AND PROPERLY TIED.

F. EMBEDDED FIXTURES

- 1. UNLESS OTHERWISE PROVIDED OR APPROVED, ANCHOR BOLTS, INSERTS, PIPE SLEEVES, PIPES, CONDUIT, WIRING, FLASHING, INSTRUMENTS, AND OTHER EMBEDDED FIXTURES SHOULD BE FIXED FIRMLY IN CORRECT POSITION BEFORE CONCRETE IS PLACED.
2. IF EMBEDDED ITEMS ARE IN CONFLICT WITH EACH OTHER OR WITH REINFORCING STEEL, THE RELOCATION OF THESE ITEMS AND/OR CUTTING, BENDING, DISPLACEMENT OR OMISSION OF STEEL REINFORCING BARS SHALL NOT BE ALLOWED EXCEPT AS APPROVED BY THE ENGINEER.
3. CHECK IF ALL EMBEDDED ITEMS ARE IN PLACE AS SHOWN ON THE APPROVED CONTRACT DOCUMENTS.

G. OPENINGS

- 1. LOCATIONS OF ALL OPENINGS SHALL BE CHECKED.
2. ADDITIONAL OPENINGS THAT ARE NOT SHOWN IN THE CONTRACT DOCUMENTS THAT ARE GREATER IN SIZE THAN 12" X 12" SHALL BE APPROVED BY THE ENGINEER.

H. CONCRETE PLACEMENT

- 1. THE SPECIAL INSPECTOR SHALL BE PRESENT ON THE SITE FOR ALL CONCRETE POURS.
2. VERIFY THAT ALL REINFORCING CORRECTIONS HAVE BEEN COMPLETED PRIOR TO CONCRETE PLACEMENT.
3. VERIFY THAT THE NECESSARY CONSOLIDATION AND PLACING TECHNIQUES ARE BEING USED.
4. VERIFY THAT THE PROPER MIXES ARE BEING DELIVERED TO EACH AREA AND THAT THE BATCH TIME LEAVES SUFFICIENT TIME TO POUR ALL CONCRETE FROM THE TRUCK.
5. VERIFY THAT ANY CONCRETE MIX WHICH HAS ADDED WATER AT THE SITE HAS BEEN BROUGHT TO THE CONTRACTOR'S ATTENTION AND THAT A SET OF CONCRETE CYLINDERS IS TAKEN FROM THE MIX AFTER THE WATER IS ADDED. ADDING WATER TO A MIX WHICH HAS A SPECIFIC WATER/CEMENT RATIO REQUIREMENT IS NOT ALLOWED.
6. VERIFY THAT THE CONCRETE TESTING LAB TECHNICIAN IS PRESENT AT THE SITE.
7. VERIFY THAT THE SLUMP, AIR CONTENT, AND TEMPERATURE ARE WITHIN THE SPECIFIED RANGES.
8. VERIFY THAT CONCRETE IS PLACED IN A CONTINUOUS FASHION AND THAT NO CONCRETE HAS AGED PAST THE LIMITATIONS OF THE CONTRACT DOCUMENTS, DOCUMENT SPECIFICALLY WHERE ANY CONCRETE IS PLACED WHICH DOES NOT MEET THESE REQUIREMENTS.
9. THE UNIFORMITY OF FRESHLY MIXED CONCRETE SHALL BE VISUALLY CHECKED.
10. RECORD REJECTED BATCHES CAREFULLY, WITH REASONS FOR REJECTION AND REPORT PROMPTLY TO THE CONTRACTOR AND THE ARCHITECT/ENGINEER.
11. CHECK FOR HONEYCOMBING AND ROCK POCKETS OF CAST CONCRETE AFTER THE REMOVAL OF FORMS. DURING REPAIRS, CHECK IF THEY HAVE BEEN CUT BACK TO SOLID MATERIAL AND ALSO IF ALL LOOSE MATERIALS HAVE BEEN REMOVED. ANY LARGE AREAS SHOULD BE REPORTED TO THE ENGINEER OF RECORD.
12. CHECK THE CONTRACT DOCUMENTS FOR THE REQUIREMENTS OF TREATING DEFECTIVE AREAS OF CONCRETE.
13. CHECK FOR COMPLETE CURING OF AREAS OF CONCRETE THAT HAVE BEEN PATCHED.
14. VERIFY THAT THE VARIOUS CURING COMPOUNDS AND TOPPING HAVE BEEN PLACED AS REQUIRED BY THE CONTRACT DOCUMENTS.
15. VERIFY MAINTENANCE OF SPECIFIED CURING TEMPERATURE AND TECHNIQUES.

I. INSPECT EXPANSION ANCHORS AND CHEMICAL ADHESIVE ANCHORING USED TO SUPPORT WORK AS FOLLOWS:

- 1. VERIFY HOLE DIAMETER, DEPTH, LOCATION, SPACING AND EDGE DISTANCE. CONFIRM THAT THE HOLE HAS BEEN CLEANED AS REQUIRED BY THE MANUFACTURER.
2. VERIFY THAT EXPANSION ANCHORS ARE PROPERLY TIGHTENED.
3. VERIFY THAT THE EPOXY TYPE IS PROPER FOR THE APPLICATION. VERIFY EPOXY MIXING AND INSTALLATION COMPLIES WITH MANUFACTURER'S REQUIREMENTS.

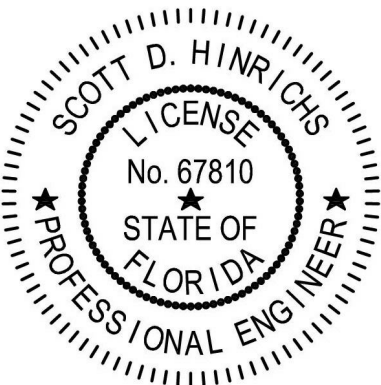
PART 3 TESTING AND SUBMITTALS

3.1 MATERIAL TESTING

- A. TESTING AGENCY SHALL BE RETAINED BY THE OWNER TO PERFORM ALL TESTS DESCRIBED IN THE CONTRACT DOCUMENTS. THE TESTING AGENCY SHALL PROVIDE REPORTS FOR EACH TEST TO THE OWNER, CONTRACTOR, ARCHITECT/ENGINEER AND SPECIAL INSPECTOR.
B. THE SPECIAL INSPECTOR SHALL REVIEW ALL MATERIAL TEST REPORTS AND COMMENT ON ANY RESULTS THAT DO NOT COMPLY WITH THE CONTRACT DOCUMENTS.

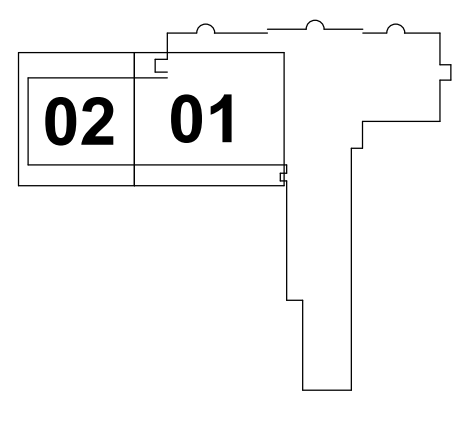
3.2 STRUCTURAL SUBMITTALS

- A. THE SPECIAL INSPECTOR SHALL REVIEW AND BECOME FAMILIAR WITH ALL STRUCTURAL SUBMITTALS.
B. THE SPECIAL INSPECTOR SHALL BE GIVEN ONE COPY OF ALL STRUCTURAL SUBMITTALS, WITH EVIDENCE OF REVIEW BY THE CONTRACTOR AND ARCHITECT/ENGINEER, FOR HIS RECORD AND USE.
C. SUBMITTALS SHALL INCLUDE BUT ARE NOT LIMITED TO:
1. THE DELEGATED SHORING AND RE-SHORING ENGINEER'S SIGNED AND SEALED INSPECTION REPORTS SHALL BE RECEIVED PRIOR TO THE PLACEMENT OF CONCRETE.
2. REINFORCING STEEL FABRICATION AND PLACEMENT SHOP DRAWINGS AND BAR LISTS. MILL REPORTS FOR ALL REINFORCING STEEL TO BE INCORPORATED INTO THE WORK SHALL BE PROVIDED TO THE SPECIAL INSPECTOR.
3. CONCRETE MIX DESIGNS FOR ALL PROPOSED STRENGTHS AND GRADES OF CONCRETE.
4. FABRICATION AND ERECTION DRAWINGS FOR EMBEDDED PLATES, HANGERS AND ALL OTHER STRUCTURAL METALS.



GRAEF CERT # 4270 05/15/2020

KEY PLAN:



REVISIONS

Table with columns: REV, DESCRIPTION, DATE. Row 1: A, RELEASE FOR BID SET, 05/15/2020.

BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION

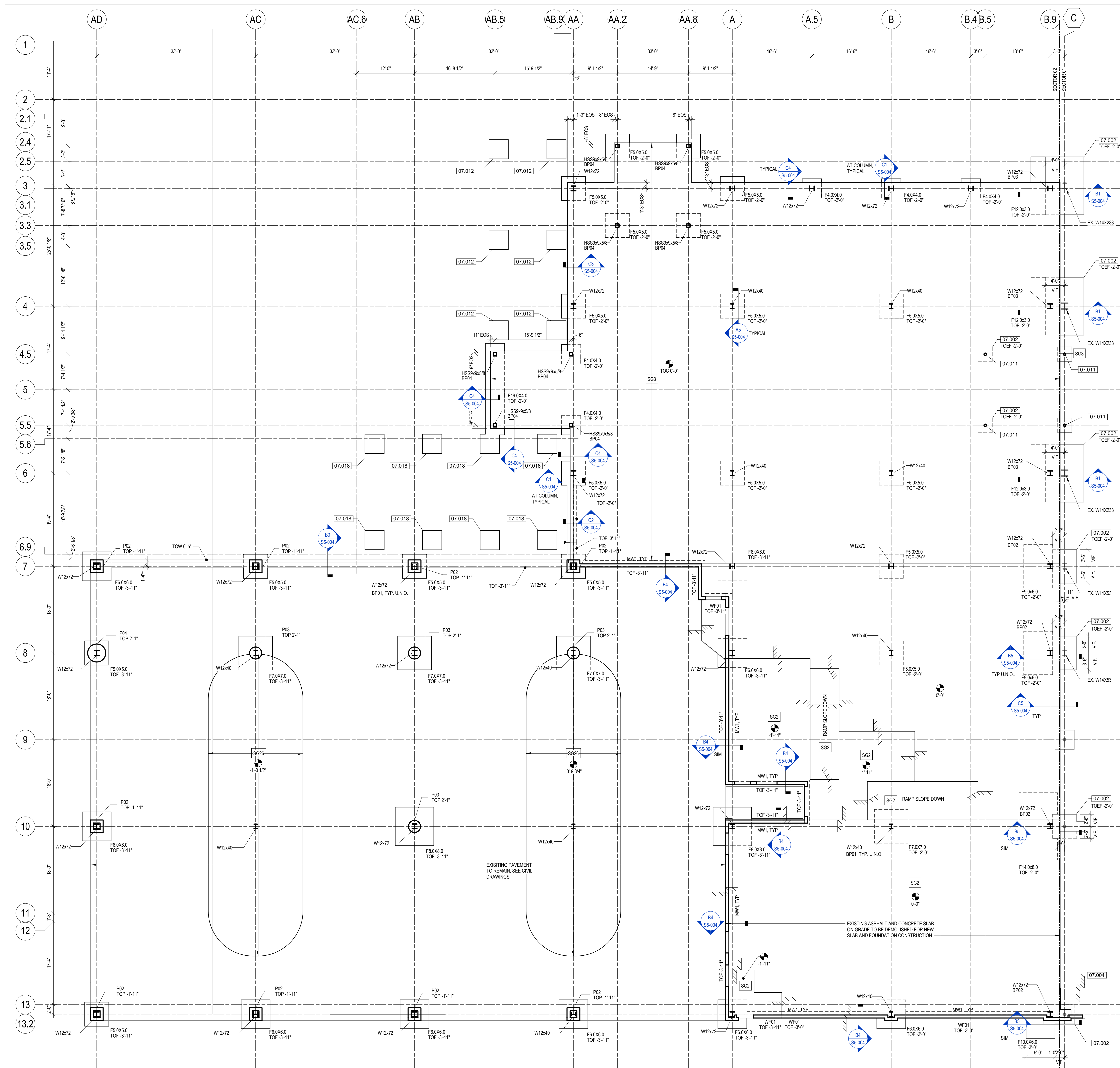
PROJECT NO: C18-2709-AP
DRAWN: HQ
CHECKED: SDH
SCALE: 1/2" = 1'-0"

RELEASE FOR BID SET

05/15/2020

SHEET TITLE: SPECIAL INSPECTION NOTES

SHEET NUMBER: S0-003

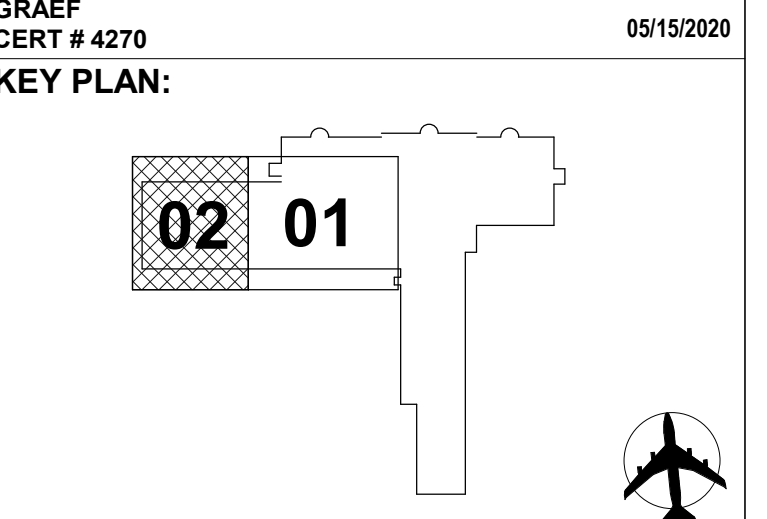
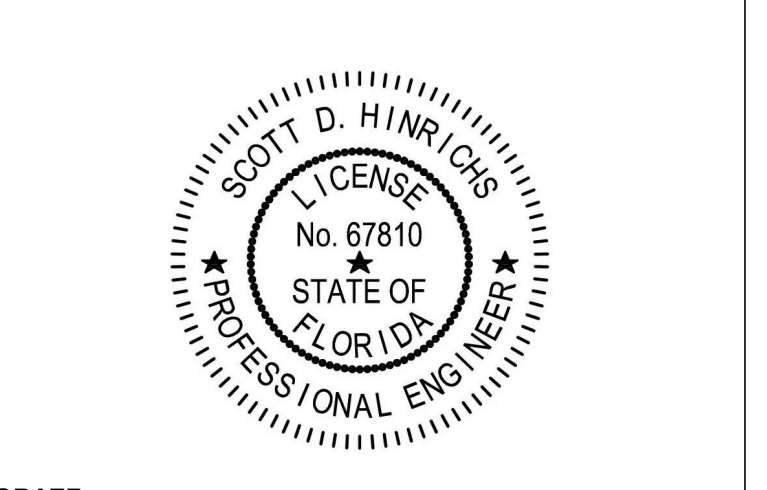
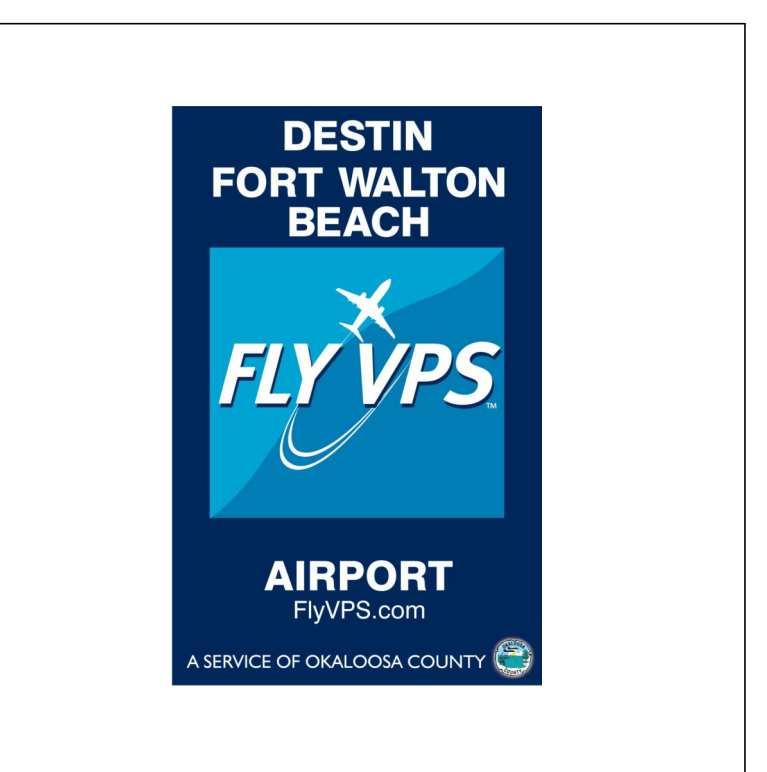


GENERAL SHEET NOTES

- REFERENCE ELEVATION AT THE TOP OF THE SLAB-ON-GRADE IS EL. 0'-0". ACTUAL ELEVATION IS 88.92'. ELEVATION ABOVE OR BELOW THE REFERENCE ELEVATION ARE NOTED AS PLUS (+) OR MINUS (-).
- SEE "SCHEDULES" SHEET(S) FOR FOOTING, PIER, BASE PLATE, AND MASONRY WALL SCHEDULES.
- SEE "GENERAL DETAILS" SHEET(S) FOR THE FOLLOWING DETAILS:
 - OPENING REINFORCEMENT
 - SLAB ON GRADE CONTROL AND CONSTRUCTION JOINT
 - WALL CONTROL AND CONSTRUCTION JOINT
 - WALL CORNER
 - WALL INTERSECTION
 - FOOTING STEP
 - SLAB ON GRADE DEPRESSION
 - CMU WALL ON SLAB ON GRADE
 - INTERIOR COLUMN ISOLATION JOINT
 - EXTERIOR COLUMN ISOLATION JOINT

SHEET KEYNOTES

- 07.002 EXISTING FOOTING.
- 07.004 EXISTING SLAB-ON-GRADE TO REMAIN.
- 07.012 DEMO EXISTING VESTIBULE COLUMNS AND ROOF STRUCTURE. FOUNDATION TO BE DESIGNED BY SUPPLIER. NOTIFY AND COORDINATE WITH EOR WHERE CANOPY AND BUILDING FOUNDATIONS NEED TO BE COMBINED DUE TO THEIR CLOSE PROXIMITY.
- 07.018 FOUNDATION FOR SOLAR SHADE TO BE DESIGNED BY SUPPLIER. NOTIFY AND COORDINATE WITH EOR WHERE SOLAR SHADE AND BUILDING FOUNDATIONS NEED TO BE COMBINED DUE TO THEIR CLOSE PROXIMITY.



REVISIONS

REV	DESCRIPTION	DATE
A	RELEASE FOR BID SET	05/15/2020

BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION

PROJECT NO: C18-2709-AP
DRAWN: KRN
CHECKED: SDH
SCALE: 1/8" = 1'-0"

RELEASE FOR BID SET
05/15/2020

SHEET TITLE:
FLOOR PLAN - LEVEL 01 - SECTOR 02

SHEET NUMBER:
S1-102

PROJECT LOCATION



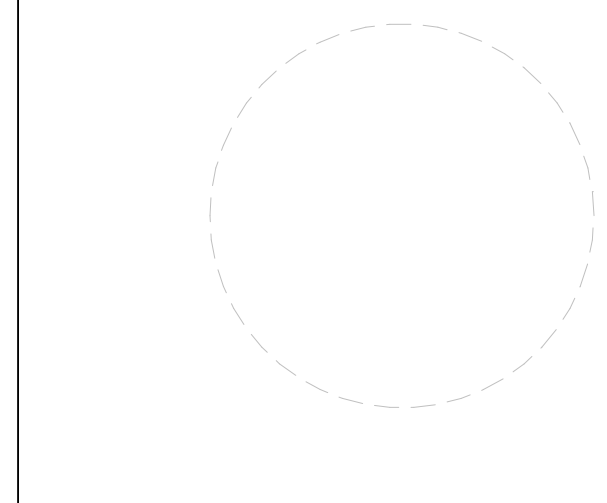
Destin-Fort Walton Beach Airport (VPS)

ACCESSIBILITY NOTES

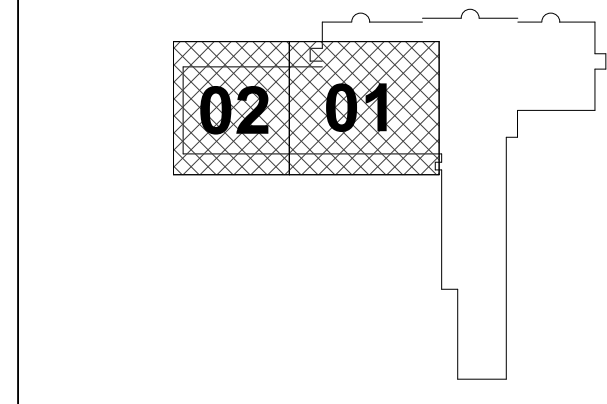
- 01 EXTERIOR ROUTE CONSTRUCTION**
1. AN ACCESSIBLE ROUTE, IN THE DIRECTION OF TRAVEL, SHALL NOT HAVE A SLOPE EXCEEDING 1:20 (5/8" PER FOOT) EXCEPT AT A RAMP.
 2. AN ACCESSIBLE ROUTE CROSS SLOPE SHALL NOT EXCEED 1:48 (1/4" PER FOOT).
 3. ALL NEW PAVING AND WALKS FOR AN ACCESSIBLE ROUTE, SHALL NOT HAVE AN ABRUPT CHANGE IN SURFACE LEVEL (VERTICALLY) GREATER THAN 1/4" WHEN ABUTTING EITHER EXISTING OR OTHER NEW SURFACES DESIGNATED FOR AN ACCESSIBLE ROUTE.
 4. AN ACCESSIBLE ROUTE CROSSING OR PARALLELING A HAZARDOUS AREA, SHALL BE CLEARLY MARKED IN A CONTRASTING COLOR, WITH THE ROUTE LOCATION, MARKING MATERIALS AND COLOR SHOWN ON THE DRAWING.
 5. ANY OPENINGS THAT ARE CONSTRUCTED IN THE SURFACE OF AN ACCESSIBLE ROUTE SHALL HAVE THE OPENINGS DIRECTION PERPENDICULAR TO THE DIRECTION OF TRAVEL WITH THE OPENINGS DIMENSION NOT TO EXCEED 1/2" IN THE DIRECTION OF TRAVEL.
- 02 CURB RAMPS**
1. THE TOP AND BOTTOM OF THE RAMP, AT THE TRANSITION TO EITHER EXISTING OR NEW SURFACES, SHALL BE FLUSH AND FREE OF ANY ABRUPT VERTICAL CHANGES.
 2. THE SURFACE FINISH OF THE RAMP, EITHER RAISED OR RECESSED AS PERMITTED BY ACCESSIBILITY CODES AND GUIDELINES, SHALL BE INSTALLED TO PERMIT WATER DRAINAGE.
 3. THE RAMP CROSS SLOPE SHALL NOT EXCEED 1:48 (1/4" PER FOOT).
- 03 INTERIOR ROUTE CONSTRUCTION**
1. AN ACCESSIBLE ROUTE, IN THE DIRECTION OF TRAVEL, SHALL NOT HAVE A SLOPE EXCEEDING 1:20 (5/8" PER FOOT), EXCEPT AT A RAMP.
 2. AN ACCESSIBLE ROUTE CROSS SLOPE SHALL NOT EXCEED 1:48 (1/4" PER FOOT).
 3. ALL NEW FLOOR CONSTRUCTION AND FLOORING MATERIALS SHALL NOT HAVE AN ABRUPT VERTICAL CHANGE IN FINISH SURFACE LEVEL GREATER THAN 1/4" WHEN ABUTTING EITHER EXISTING OR NEW SURFACES DESIGNATED FOR AN ACCESSIBLE ROUTE.
- 04 DOORS**
1. ANY THRESHOLD SHALL NOT EXCEED 1/2" IN HEIGHT, NOR 1:2 SLOPE.
 2. ALL ACCESSIBLE HARDWARE OPERABLE BY THE DISABLED, SHALL NOT EXCEED A HEIGHT OF 4'-0" AFF AND SHALL BE EASILY OPERATED WITH ONE HAND WITHOUT GRASPING, PINCHING OR TWISTING OF THE WRIST.
 3. ALL ACCESSIBLE DOORS WITH CLOSERS SHALL HAVE THE CLOSER ADJUSTED SO THAT THE CLOSING TIME, FROM A 70 DEGREE OPEN ANGLE TO WITHIN 3" OF THE JAMB, IS NOT LESS THAN 3 SECONDS.
 4. THE OPENING FORCE OF ALL ACCESSIBLE DOORS, EXCEPT FIRE EXIT DOORS, SHALL NOT EXCEED 5 POUNDS IN THE DIRECTION OF TRAVEL FOR EXITING.
 5. THE OPERABLE HARDWARE ON A DOOR LEADING TO HAZARDOUS AREAS (E.G. BOILER ROOMS, MECHANICAL AND ELECTRICAL ROOMS, OTHER EQUIPMENT ROOMS, AND LOADING DOCK), SHALL HAVE A TEXTURED SURFACE ON THE TOUCHABLE AREA.
- 05 SIGNAGE**
1. ALL ACCESSIBLE PERMANENT ROOMS AND SPACES, EXIT WAYS AND EXIT STAIRWAYS, SHALL HAVE SIGNAGE THAT MEETS ACCESSIBLE SIGNAGE REQUIREMENTS FOR LETTER SIZE, LETTER AND NUMBER TYPESTYLE, RAISED LETTERS, GRADE 2 BRAILLE, COLOR/CONTRAST, AND LOCATION.

SHEET SYMBOLS

	NEW PARTITION		ELEVATION IDENTIFICATION TAG
	EXISTING PARTITION		CEILING TAG
	DEMOLISHED PARTITION		BREAK LINE
	PARTIAL HEIGHT PARTITION		CENTER LINE
	TEMPORARY PARTITION		PROPERTY LINE
	NO SCOPE		MATCHLINE
	KEYNOTE		EXTERIOR ELEVATION IDENTIFICATION TAG
	WINDOW TYPE IDENTIFICATION TAG		INTERIOR ELEVATION IDENTIFICATION TAG
	DOOR IDENTIFICATION TAG		BUILDING SECTION IDENTIFICATION TAG
	ROOM NAME IDENTIFICATION TAG		WALL SECTION IDENTIFICATION TAG
	BATHROOM ACCESSORIES TAG		DETAIL REFERENCE TAG
	ROOM LIFE SAFETY EXITING CODE TAG		FIRE EXTINGUISHER CABINET
	FINISH TYPE IDENTIFICATION TAG		FIRE EXTINGUISHER
	PARTITION TYPE IDENTIFICATION TAG		REVISION CLOUD AND IDENTIFICATION TAG
	LOUVER TAG		
	GRID LINE IDENTIFICATION TAG		
	EXISTING GRID LINE IDENTIFICATION TAG		



KEY PLAN:



REVISIONS

REV	DESCRIPTION	DATE
A	RELEASE FOR BID SET	05/15/2020

PROJECT DATA AND CODE INFORMATION

PROJECT DATA				
PROJECT NAME:	BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION			
PROJECT ADDRESS:	1701 STATE ROAD 85 NORTH EGLIN AIR FORCE BASE, FL 32542			
OWNER:	Destin-Fort Walton Beach Airport			
LIFE SAFETY INFORMATION				
REFERENCE:	-			
USE OR OCCUPANCY CLASSIFICATION				
OCCUPANCY:	BUSINESS GROUP - B STORAGE GROUP - S			
REFERENCE:	FBC 2014 - 304 FBC 2014 - 311			
TYPE OF CONSTRUCTION				
CONSTRUCTION TYPE:	TYPE IB			
FIRE PROTECTION REQUIREMENTS				
BEARING WALLS: INT./EXT.	CMU			
NONBEARING WALLS: INT./EXT.	METAL STUD			
ROOF / CEILING:	SINGLE-PLY/ACT			
FLOOR/CEILING:	CONCRETE			
STRUCTURAL FRAME / COLUMNS:	STEEL			
RATED SEPARATIONS:	2 HR			
DESIGN LIMITATIONS				
HEIGHT:	160' - 0"			
AREA:	48000 SF			
MAX. ALLOWED:	16' - 0"			
MAX. PROVIDED:	27930 SF			
MEANS OF EGRESS				
TRAVEL DISTANCE TO EXIT:	250' - 0"			
TOTAL OCCUPANT LOAD:	300			
MAX. ALLOWED:	249' - 0"			
MAX. PROVIDED:	97			
EGRESS WIDTH PER OCCUPANT				
0.2' STAIRS:	0' - 8"			
0.15' DOORS:	3' - 9"			
MIN. ALLOWED:	16" - 10"			
PROVIDED:	19" - 2"			
PLUMBING FIXTURE REQUIREMENTS				
FIXTURE	# REQUIRED	# PROVIDED	# REQUIRED	# PROVIDED
WATER CLOSETS	4	8	4	5
URINALS			0	3
LAVATORIES	3	3	3	3
SHOWERS	0	0	0	0
SERVICE		# REQUIRED	# PROVIDED	
DRINKING FOUNTAINS	0	2		
SERVICE SINKS	1	1		

STANDARD ABBREVIATIONS

A.D.	AREA DRAIN	DWR.	DRAWER	INFO.	INFORMATION	REF.	REFERENCE
A.F.F. OR AFF	ABOVE FINISH FLOOR	E.	EAST	INSUL.	INSULATION	REFG.	REFRIGERATOR
A.P.	ACCESS PANEL	E.J.	EXPANSION JOINT	INT.	INTERIOR	REINFG.	REINFORCED
A/C.	AIR CONDITIONING	E.S.	EXPOSED STRUCTURE	INV.	INVERT	REQU.	REQUIRED
ABV.	ABOVE	E.W.C.	ELECTRIC WATER COOLER	JAN CLO.	JANITOR CLOSET	RESIL.	RESILIENT
ACOUS.	ACOUSTICAL	E.A.	EACH	JAN.	JANITOR	REV.	REVISION
ACP.	ACOUSTICAL CEILING PANEL	E.A.	EACH	JST.	JOIST	REFL.	REFLECTED
ADD'L.	ADDITIONAL	E.A.	EACH	JT.	JOINT	RM.	ROOM
ADJ.	ADJUSTABLE OR ADJACENT	ELEC. OR ELEV.	ELEVATION	L.	LEG	S.	SOUTH
AL.	ALUMINUM	EMERG. OR EMER.	EMERGENCY	L.AB.	LABORATORY	S.C.	SOLID CORE
ANCH.	ANCHOR	ENCL.	ENCLOSURE	L.AM.	LAMINATE	S.H.	SPRINKLER HEAD
APPROX.	APPROXIMATE	EQ	EQUAL	L.AV.	LAVATORY	S.S.	STAINLESS STEEL
ARCH.	ARCHITECTURAL	EQUIP.	EQUIPMENT	L.LK.	LOCKER	SAN.	SANITARY
ASPH.	ASPHALT	EXIST.	EXISTING	L.LT.	LIGHT	SCHED. OR SCHED.	SCHEDULE
ASS'Y.	ASSEMBLY	EXP. OR EXPAN.	EXPANSION	M.	METER	SECT.	SECTION
ATC.	ACOUSTICAL CEILING TILE	EXT.	EXTERIOR	M.H.	MANHOLE	SEW.	SEWER
AUTO.	AUTOMATIC	F.A.	FIRE ALARM	M.O.	MASONRY OPENING	SGL.	SINGLE
AWC.	ACOUSTICAL WALL PANELS	F.D.	FLOOR DRAIN	M.O.	MASONRY	SH.	SHOWER
B.L.	BUILDING LINE	F.E.C.	FIRE EXTINGUISHER	M.AS.	MATERIAL	SHWR.	SHOWER
B.O.	BOTTOM OF	F.H.C.	FIRE HOSE CABINET	MATL.	MATERIAL	SIM.	SIMILAR
BD.	BOARD	F.H.R.	FIRE HOSE REEL	MAX	MAXIMUM	SPEC. OR SPECS.	SPECIFICATION(S)
BLDG.	BUILDING	F.H.T.	FULL HEIGHT	MBL.	MARBLE	SPKR.	SPEAKER
BLK.	BLOCK	F.F.T.	FACE OF CONCRETE	MECH.	MECHANICAL	SQ.	SQUARE
BLM.	BEAM	F.O.C.	FACE OF CONCRETE	MEMB.	MEMBRANE	SQ. FT. OR S.F.	SQUARE FOOT (FEET)
BOT.	BOTTOM	F.O.F.	FACE OF FINISH	MEP.	MECHANICAL, ELECTRICAL, PLUMBING	SQ. YD. OR S.Y.	SQUARE YARD(S)
BRK.	BREAK	F.O.S.	FACE OF STUD	MFG.	MANUFACTURER	STA.	STATION
BRKT.	BRACKET	F.S.	FULL SIZE	MIN.	MINIMUM	STD.	STANDARD
BSMT.	BASEMENT	F.V.C.	FIRE VALVE CABINET	MIR.	MIRROR	STL.	STEEL
BTWN.	BETWEEN	FDN.	FOUNDATION	MISC.	MISCELLANEOUS	STOR.	STORAGE
C.B.	CATCH BASIN	FIN.	FINISH	MTD.	MOUNTED	STRUCT.	STRUCTURE OR STRUCTURAL
C.G.	CORNER GUARD	FL. OR FLR.	FLOOR	MTL.	METAL	SUSP.	SUSPENDED
C.I.	CAST IRON	FLASH.	FLASHING	MUL.	MULLION	SYM.	SYMMETRICAL
C.I.P.	CAST IN PLACE	FLUOR.	FLUORESCENT	N.	NORTH	T&G.	TONGUE & GROOVE
C.J.	CONTROL JOINT	FRF.	FIREPROOF(ING)	N.I.C.	NOT IN CONTRACT	T.	TREAD
C.O.	CLEAR OPENING	FRP.	FIBERGLASS REINFORCED PLASTIC	N.T.S.	NOT TO SCALE	T. OR TEMP.	TEMPERED
C.T.	CERAMIC TILE	FT.	FASTENER	NO.	NUMBER	T.O.C.	TOP OF CONCRETE
CAB.	CABINET	FT.	FASTENER	NOM.	NOMINAL	T.O. CMU	TOP OF CMU
CAT.	CATEGORY	FTG.	FOOTING	O.C.	ON CENTER	T.O.D.	TOP OF DECK
CER.	CERAMIC	FURR.	FURRING	O.D.	OUTSIDE DIAMETER/DIMENSION	T.O.P.	TOP OF PARAPET
CFMF.	COLD FORMED METAL FRAMING	FUT.	FUTURE	OFF.	OFFICE	T.O.S.	TOP OF STEEL
CLG.	CEILING	G.B.	GRAB BAR	OPNG.	OPENING	T.O. S.S.	TOP OF STRUCTURAL SLAB
CLO.	CLOSET	G.C.	GENERAL CONTRACTOR	OPP.	OPPOSITE	T.V.	TELEVISION
CLR.	CLEAR	GA.	GAUGE	OPP HD.	OPPOSITE HAND	TEL.	TELEPHONE
CMU.	CONCRETE MASONRY UNIT	GALV.	GALVANIZED	OVHD.	OVERHEAD	THK.	THICK
COL.	COLUMN	GFRG.	GLASS FIBER REINFORCED GYPSUM	OZ.	OUNCE	TLT.	TOILET
CONC.	CONCRETE	GL.	GLASS	P.C.	PRECAST CONCRETE	TYP.	TYPICAL
CONN.	CONNECTION	GND.	GROUND	P.LAM.	PLASTIC LAMINATE	U.N.O.	UNLESS NOTED OTHERWISE
CONST.	CONSTRUCTION	GR.	GRADE	PAV.	PAVING	UNF.	UNFINISHED
CONT.	CONTINUOUS	GRN.	GRANITE	P.M.P.	PREMANUFACTURED METAL PANEL	UR.	URINAL
CONTR.	CONTRACTOR	GRS.	GRASS	PC.	PLATE	V.I.F.	VERIFY IN FIELD
CORR.	CORROSION	GRY. BD.	GYPSUM BOARD	PL.	PLATE	VB.	VAPOR BARRIER
CPT.	CARPET	H.B.	HOSE BIB	PLAS.	PLASTIC	VERT.	VERTICAL
CPTT.	CARPET TILE	H.C.	HOLLOW CORE	PLBG.	PLUMBING	VEST.	VESTIBULE
CTR.	CENTER	H.K.	HOUSEKEEPING	PLYWD.	PLYWOOD	W.	WEST OR WIDTH
CTRL.	CONTROL	H.M.	HOLLOW METAL	P.M.P.M.	PREMANUFACTURED METAL PANEL	W.B.	WEATHER BARRIER
D.F.	DRINKING FOUNTAIN	HCP.	HANDICAPPED	PR.	PAINT	W.P.	WATERPROOF
D.O.	DOOR OPENING	HD.	HAND	PNT.	POLISHED	W/	WITH
D.P.	DAMP PROOFING	HDW. OR HDWR.	HARDWARE	POL.	POLISHED	W/O	WITHOUT
D.S.	DOWNSPOUT	HW.	HARDWOOD	PR.	PAIR	WD.	WOOD
DBL.	DOUBLE	HWID.	HORIZONTAL	PRCST.	PRECAST	WDW.	WINDOW
DEMO.	DEMOLITION	HNDRL.	HANDRAIL	PRMNUF.	PREMANUFACTURED	WRGB.	WATER RESISTANT GYP. BOARD
DEPT.	DEPARTMENT	HORZ.	HORIZONTAL	PT.	POINT	W.SCT.	WAINSCOT
DET. OR DTL.	DETAIL	HR.	HOUR	PTD.	PAINTED PARTITION	WT.	WEIGHT
DIA. OR DIAM.	DIAMETER	HT.	HEIGHT	PTN.	PARTITION		
DN.	DOWN	HVAC.	HEATING, VENTILATION, AIR CONDITIONING	R.	RADIUS		
DR.	DOOR	I.D.	INSIDE DIAMETER/DIMENSION	R.D.	ROOF DRAIN		
DRN.	DRAIN	IN.	INCH	R.O.	ROUGH OPENING		
DWG.	DRAWING	INCL.	INCLUDE(DY)ING	RCP.	REFLECTED CEILING PLAN		
DWGS.	DRAWINGS			REBAR.	REINFORCING BAR		

ACCESSIBLE MOUNTING HEIGHTS

	ADULT	SECTION
WATER CLOSET		
TOP OF SEAT	17"-19"	604.4
FLUSH CONTROLS	15" MIN-48" MAX	604.6/309.3/308
URINAL		
RIM OF BASIN	17" MAX	605.2
FLUSH CONTROLS	15" MIN-48" MAX	604.6/309.3/308
LAVATORY/SINKS		
RIM OR COUNTER SURFACE	34" MAX	606.3
APRON CLEARANCE	27" MIN	306
KNEE CLEARANCE	27" MIN	306.3
TOE CLEARANCE	9" MIN	306.2
DRINKING FOUNTAIN		
SPOUT HEIGHT	36" MAX	602.4
KNEE CLEARANCE	27" MIN	306.3
TOE CLEARANCE	9" MIN	306.2
DRINKING FOUNTAIN (BENDING DISABLED)		
SPOUT HEIGHT	38"-43"	602.7
GRAB BARS		
TOP OF BAR	33" MIN-36" MAX	609.4
MIRROR		
BOTTOM OF REFLECTIVE SURFACE (above counters & lavs.)	40" MAX	603.3
TOP OF REFLECTIVE SURFACE	74" MIN	603.3
CONTROLS AND OPERATING MECHANISMS		
TOWEL DISPENSER	48" MAX	308
SOAP DISPENSER	48" MAX	308
HAND DRYER	48" MAX	308
TOILET TISSUE DISPENSER	15"-48" MAX	604.7
SANITARY NAPKIN DISPENSER/RECEPTACLE	48" MAX	308
TOILET SEAT COVER DISPENSER	48" MAX	308
ELECTRICAL DEVICES		
ELECTRICAL, PHONE AND DATA OUTLETS (TO CENTER)	17" MIN-48" MAX	308.2.1
ABOVE COUNTER OUTLETS (TO CENTER)	44" MAX	308.2.2
LIGHT SWITCHES (HIGHEST OPERABLE PART)	48" MAX	308
FIRE ALARM PULL (HIGHEST OPERABLE PART)	48" MAX	308
THERMOSTATS (HIGHEST OPERABLE PART)	48" MAX	308
FIRE EXTINGUISHER CAB. (T.O. HANDLE/OPER. DEVICE)	48" MAX	308.3.1
PUBLIC TELEPHONE (TO HIGHEST OPERABLE PART)	48" MAX	308
RAMP AND STAIRS		
TOP OF HANDRAILS	34"-38"	505.4
ELEVATORS		
HALL CALL BUTTON	48" MAX	407.2.1.1/308
HALL LANTERNS	72" MIN	407.2.2.2

BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION

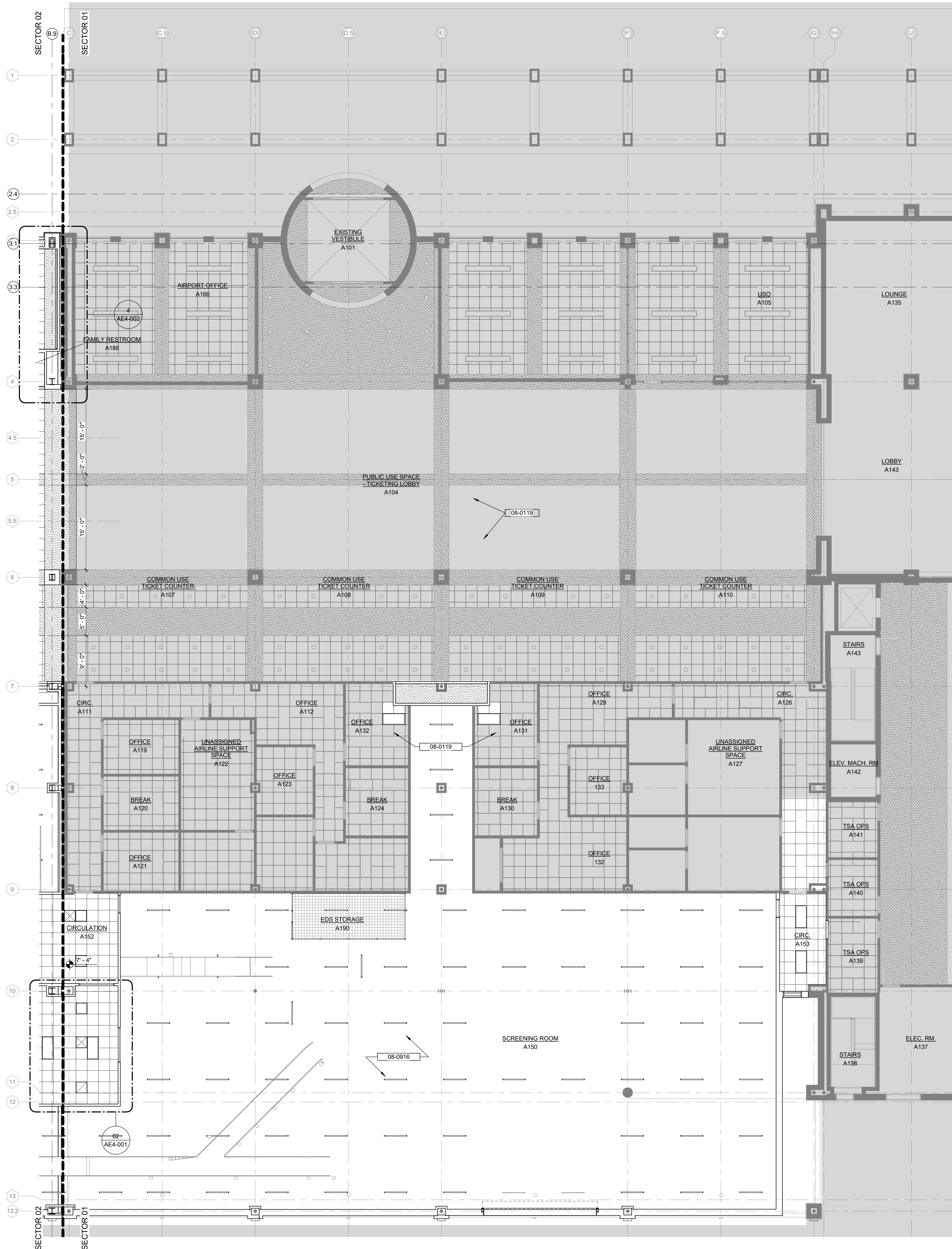
PROJECT NO: C18-2709-AP
DRAWN: R. SMOTHERS
CHECKED: K. MCGILBERRY
SCALE: 1/2" = 1'-0"

RELEASE FOR BID SET

05/15/20

SHEET TITLE:
STANDARDS AND SYMBOLS

SHEET NUMBER:
AG0-001

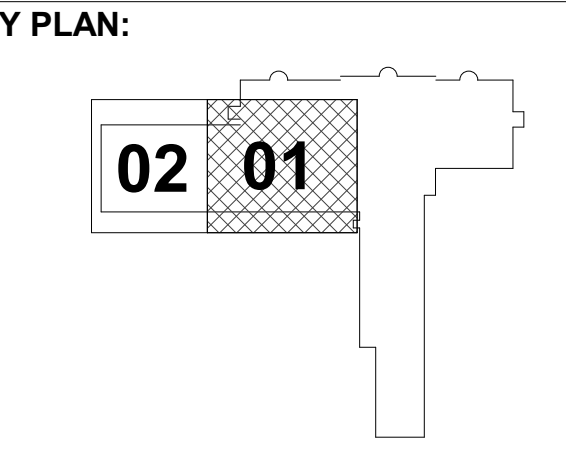
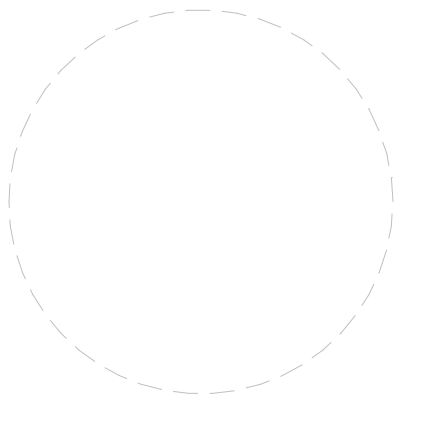
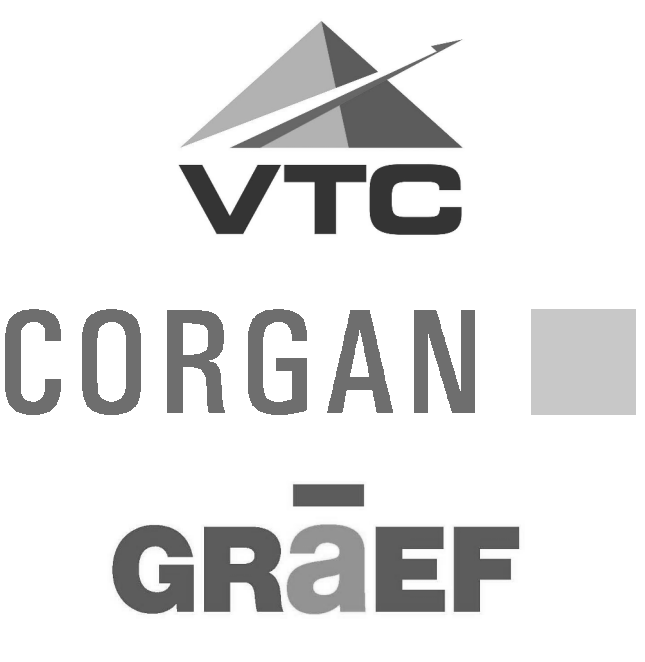


GENERAL RCP NOTES

- CEILING HEIGHTS ARE 9'-0" A.F.F. UNLESS NOTED OTHERWISE.
- THE ROOM FINISH SCHEDULE TYPICALLY INDICATES CEILING MATERIALS AND FINISHES. MATERIALS OR FINISHES THAT VARY WITHIN A ROOM WILL BE INDICATED ON THE R.C.P. R.C.P.'S WILL TYPICALLY INDICATE:
 - LOCATIONS, DIMENSIONS AND HEIGHTS A.F.F. OR FURRED/DOWNS.
 - VARYING CEILING MATERIALS AND THEIR LOCATIONS.
 - HEIGHTS OF WALLS A.F.F. (FULL HEIGHT AND PARTIAL HEIGHT).
 - REQUIRED FIRE-RATINGS OF WALLS.
 - FINAL LOCATIONS OF CEILING MOUNTED FIXTURES/DEVICES.
- WHERE WALL TYPE FIRE-RATING DESIGNATIONS FROM THE FLOOR PLANS CONFLICT WITH THE FIRE-RATING DESIGNATIONS INDICATED ON THE R.C.P., THE MORE STRINGENT DESIGNATIONS SHALL APPLY.
- COORDINATE MEP/ETC. DRAWINGS FOR ALL FIXTURES/DEVICES MOUNTED IN, ABOVE, OR HUNG FROM THE CEILING. FINAL FIXTURE/DEVICE LOCATIONS ARE DETERMINED BY THE ARCHITECTURAL R.C.P. WHERE CONDITIONS DIFFER SIGNIFICANTLY BETWEEN THE PLANS, REQUEST CLARIFICATION FROM THE ARCHITECT BEFORE PROCEEDING. WHERE FIXTURES/DEVICES SHOWN OR SPECIFIED ON DRAWINGS OTHER THAN THE ARCHITECTURAL R.C.P.'S ARE VISIBLE AT THE CEILING PLANE, COORDINATE LOCATIONS WITH THE ARCHITECT.
- DO NOT INSTALL CEILING GRID UNTIL WORK ABOVE CEILING IS COORDINATED AND INSTALLED WITHIN AVAILABLE PLENUM SPACE.
- LOCATE CEILING MOUNTED FIXTURES/DEVICES IN THE CENTERS OF FULL CEILING PANELS U.N.O.
- LIGHT FIXTURES IN MECHANICAL AND EQUIPMENT ROOMS ARE SHOWN FOR QUANTITY ONLY. CONTRACTOR IS TO COORDINATE FIXTURE PLACEMENT WITH ALL MEP ITEMS AND SET FINAL FIXTURE LOCATIONS AS REQUIRED TO EVENLY AND FULLY LIGHT ACCESSIBLE AREAS OF THE ROOM WITH THE QUANTITY OF FIXTURES SHOWN.
- GYP. CEILINGS AND BULKHEADS TO BE PAINTED PER FINISH PLANS, U.N.O.
- ACCENT PAINT ON GYP. BOARD BULKHEADS TO BE ON BOTTOM AND SIDES OF BULKHEAD.
- ALL INTERIOR PARTITIONS ARE TO BE TO DECK, U.N.O.

KEYNOTE LEGEND

- 08-0119 AREA INDICATED BY HATCH IS OUT OF SCOPE. ELEMENTS SHOWN FOR REFERENCE ONLY. REFER TO X SERIES DRAWINGS FOR MORE INFORMATION.
- 08-0916 OPEN TO STRUCTURE ABOVE. INSTALL BIRD NETTING. COORDINATE HEIGHT/LOCATION TO MAXIMIZE PROTECTION FROM BIRDS WHILE NOT IMPACTING REQUIRED CLEARANCES ABOVE BAGGAGE SYSTEM CONVEYORS/EQUIPMENT.



REVISIONS

REV	DESCRIPTION	DATE
A	RELEASE FOR BID SET	05/15/2020

BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION

PROJECT NO: C18-2709-AP
 DRAWN: R. SMOTHERS
 CHECKED: K. MCGILBERRY
 SCALE: 1/8" = 1'-0"

RCP LEGEND

- 2X2 LAY-IN CEILING
- EXPOSED STRUCTURE
- 1'-0" FINISHED CEILING HEIGHT A.F.F.
- RETURN AIR DIFFUSER
- CEILING SPEAKER
- FENCE TOP ENCLOSURE
- GYP. BD. CEILING
- 2X4 LAY-IN LENS FIXTURE
- 1'X2' HUNG LIGHT STRIP
- SUPPLY AIR DIFFUSER
- EMERGENCY EXIT FIXTURE

PARTITION RATING LEGEND

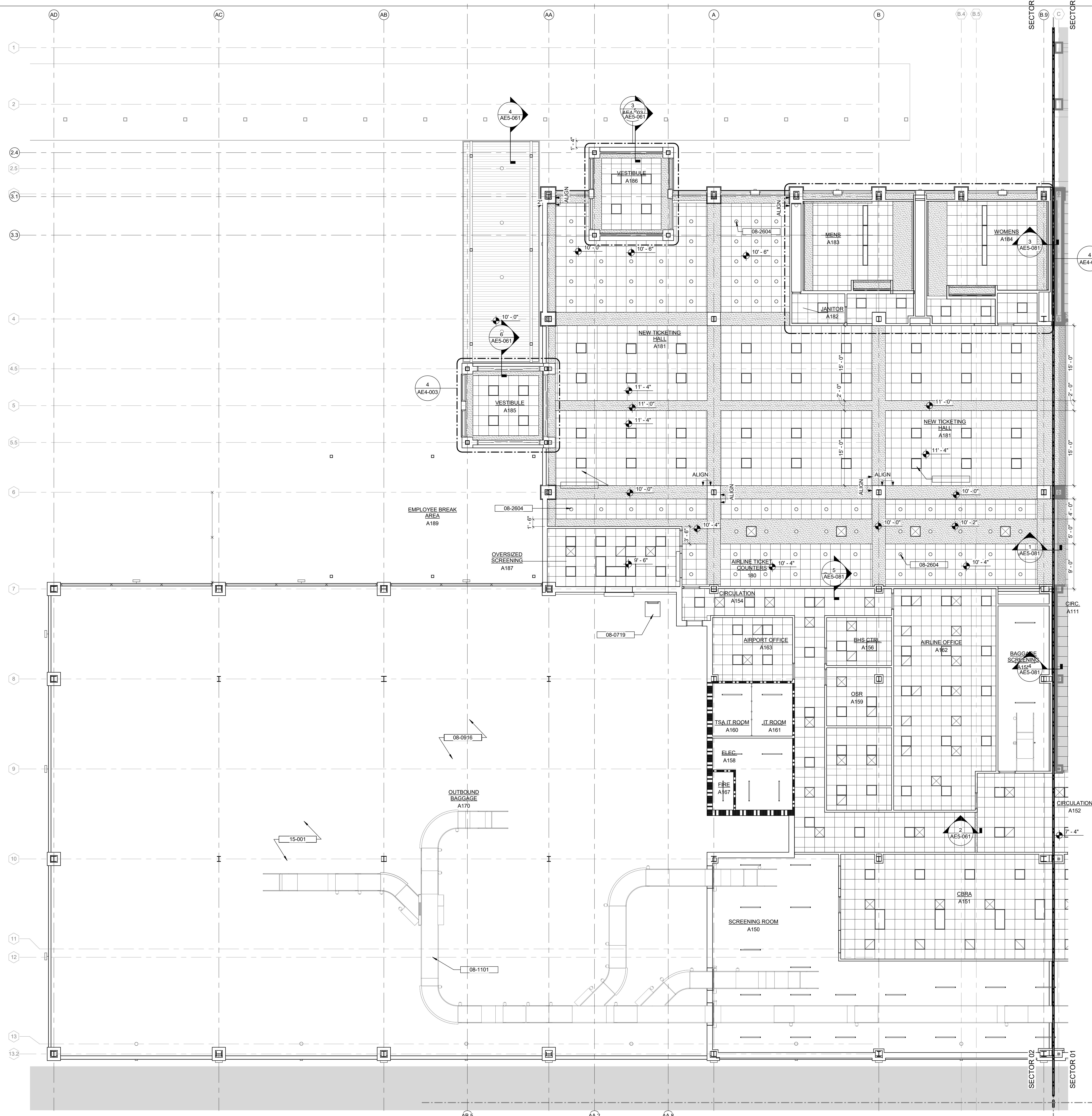
- UNRATED PARTITION ASSEMBLY
- 1 HOUR RATED PARTITION ASSEMBLY
- 2 HOUR RATED PARTITION ASSEMBLY
- 3 HOUR RATED PARTITION ASSEMBLY
- 1 HOUR SMOKE RATED PARTITION ASSEMBLY

RELEASE FOR BID SET

05/15/20

SHEET TITLE:
REFLECTED CEILING PLAN - LEVEL 01 - SECTOR 01

SHEET NUMBER:
AR1-101



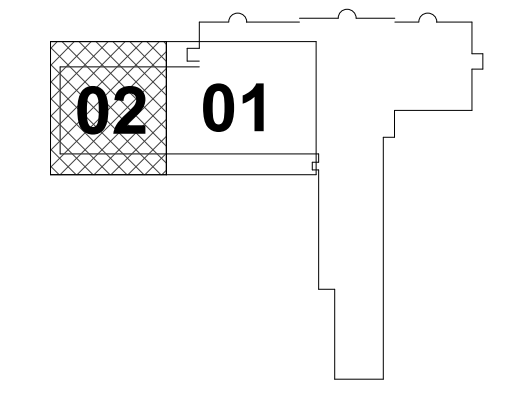
GENERAL RCP NOTES

- CEILING HEIGHTS ARE 9'-0" A.F.F. UNLESS NOTED OTHERWISE.
- THE ROOM FINISH SCHEDULE TYPICALLY INDICATES CEILING MATERIALS AND FINISHES. MATERIALS OR FINISHES THAT VARY WITHIN A ROOM WILL BE INDICATED ON THE R.C.P. R.C.P.'S WILL TYPICALLY INDICATE:
 - LOCATIONS, DIMENSIONS AND HEIGHTS A.F.F. OR FURRED/DOWNS.
 - VARYING CEILING MATERIALS AND THEIR LOCATIONS.
 - HEIGHTS OF WALLS A.F.F. (FULL HEIGHT AND PARTIAL HEIGHT).
 - REQUIRED FIRE-RATINGS OF WALLS.
 - FINAL LOCATIONS OF CEILING MOUNTED FIXTURES/DEVICES.
- WHERE WALL TYPE FIRE-RATING DESIGNATIONS FROM THE FLOOR PLANS CONFLICT WITH THE FIRE-RATING DESIGNATIONS INDICATED ON THE R.C.P., THE MORE STRINGENT DESIGNATIONS SHALL APPLY.
- COORDINATE MEP/ETC. DRAWINGS FOR ALL FIXTURES/DEVICES MOUNTED IN, ABOVE, OR HUNG FROM THE CEILING. FINAL FIXTURE/DEVICE LOCATIONS ARE DETERMINED BY THE ARCHITECTURAL R.C.P. WHERE CONDITIONS DIFFER SIGNIFICANTLY BETWEEN THE PLANS, REQUEST CLARIFICATION FROM THE ARCHITECT BEFORE PROCEEDING. WHERE FIXTURES/DEVICES SHOWN OR SPECIFIED ON DRAWINGS OTHER THAN THE ARCHITECTURAL R.C.P.'S ARE VISIBLE AT THE CEILING PLANE, COORDINATE LOCATIONS WITH THE ARCHITECT.
- DO NOT INSTALL CEILING GRID UNTIL WORK ABOVE CEILING IS COORDINATED AND INSTALLED WITHIN AVAILABLE PLENUM SPACE.
- LOCATE CEILING MOUNTED FIXTURES/DEVICES IN THE CENTERS OF FULL CEILING PANELS U.N.O.
- LIGHT FIXTURES IN MECHANICAL AND EQUIPMENT ROOMS ARE SHOWN FOR QUANTITY ONLY. CONTRACTOR IS TO COORDINATE FIXTURE PLACEMENT WITH ALL MEP ITEMS AND SET FINAL FIXTURE LOCATIONS AS REQUIRED TO EVENLY AND FULLY LIGHT ACCESSIBLE AREAS OF THE ROOM WITH THE QUANTITY OF FIXTURES SHOWN.
- GYP. CEILINGS AND BULKHEADS TO BE PAINTED PER FINISH PLANS, U.N.O.
- ACCENT PAINT ON GYP. BOARD BULKHEADS TO BE ON BOTTOM AND SIDES OF BULKHEAD.
- ALL INTERIOR PARTITIONS ARE TO BE DECK, U.N.O.

KEYNOTE LEGEND

- 08-0719 NEW ROOF HATCH WITH LADDER OVERHEAD
- 08-0916 OPEN TO STRUCTURE ABOVE, INSTALL BIRD NETTING. COORDINATE HEIGHT/LOCATION TO MAXIMIZE PROTECTION FROM BIRDS WHILE NOT IMPACTING REQUIRED CLEARANCES ABOVE BAGGAGE SYSTEM CONVEYORS/EQUIPMENT
- 08-1101 BAGGAGE CONVEYORS SHOWN FOR REFERENCE. REFER TO BAGGAGE
- 08-2604 NEW LIGHT FIXTURE TO BE PLACED AT CENTER OF 2'X2' ACT TILE, TYP.
- 15-001 REFER TO ELECTRICAL DRAWINGS FOR MORE INFORMATION

KEY PLAN:



REVISIONS

REV	DESCRIPTION	DATE
A	RELEASE FOR BID SET	05/15/2020

BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION

PROJECT NO: C18-2709-AP
 DRAWN: R. SMOTHERS
 CHECKED: K. MCGILBERRY
 SCALE: 1/8" = 1'-0"

RELEASE FOR BID SET

05/15/20

SHEET TITLE:
REFLECTED CEILING PLAN - LEVEL 01 - SECTOR 02

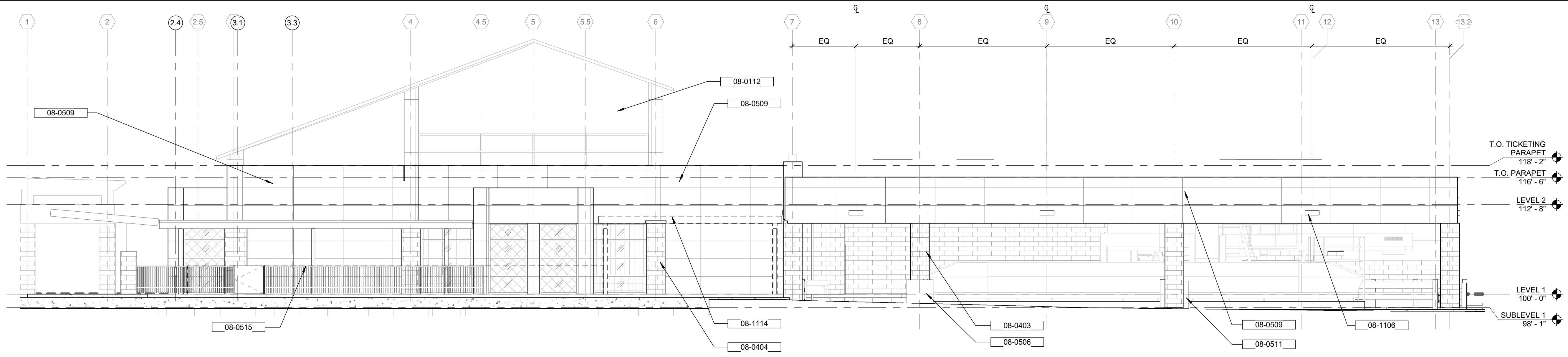
SHEET NUMBER:
AR1-102

RCP LEGEND

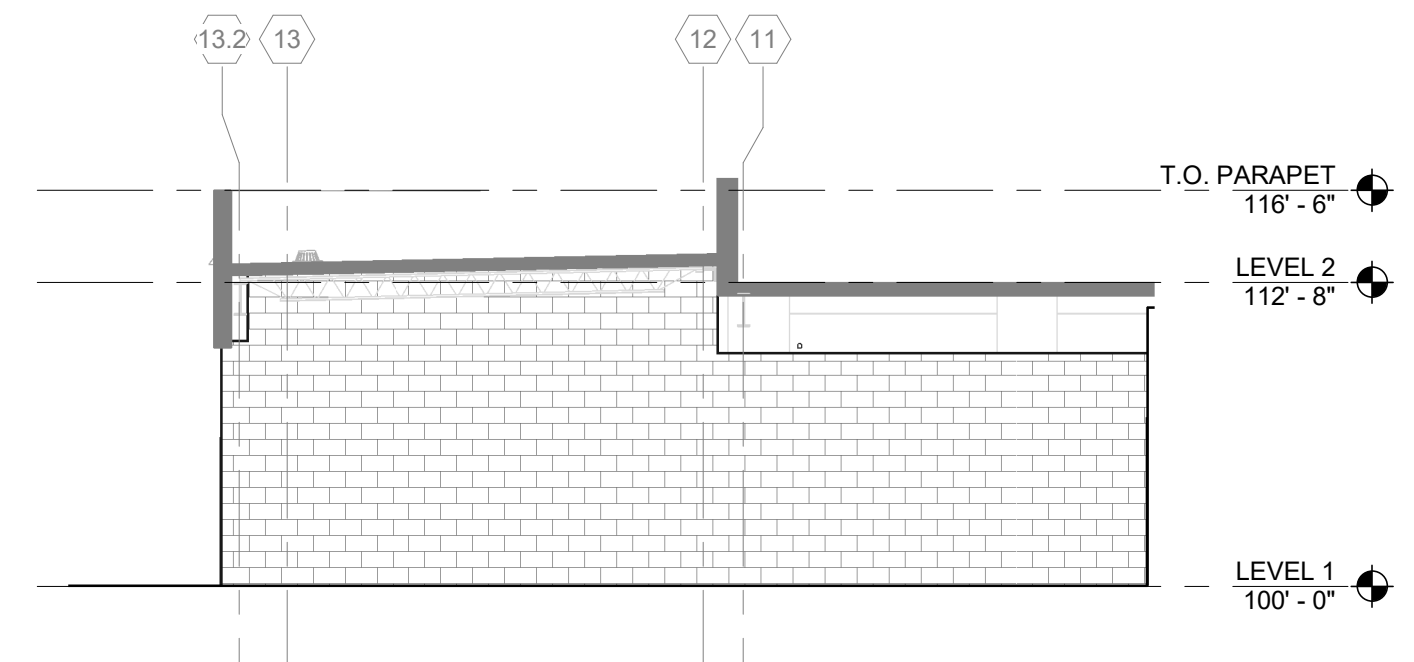
	2X2 LAY-IN CEILING		GYP. BD. CEILING
	EXPOSED STRUCTURE		2X4 LAY-IN LENS FIXTURE
	1'-0" FINISHED CEILING HEIGHT A.F.F.		1'X2' HUNG LIGHT STRIP
	RETURN AIR DIFFUSER		SUPPLY AIR DIFFUSER
	CEILING SPEAKER		EMERGENCY EXIT FIXTURE
	FENCE TOP ENCLOSURE		

PARTITION RATING LEGEND

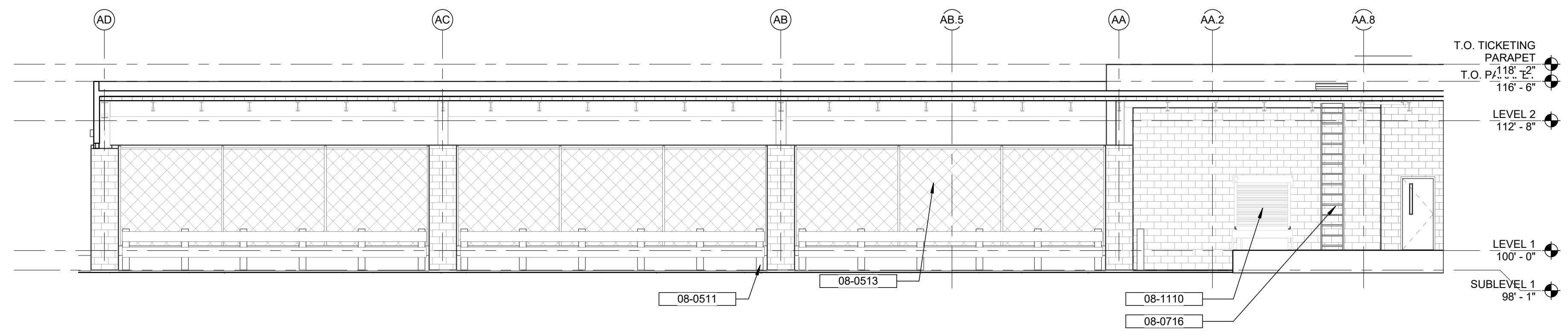
	UNRATED PARTITION ASSEMBLY
	1 HOUR RATED PARTITION ASSEMBLY
	2 HOUR RATED PARTITION ASSEMBLY
	3 HOUR RATED PARTITION ASSEMBLY
	1 HOUR SMOKE RATED PARTITION ASSEMBLY



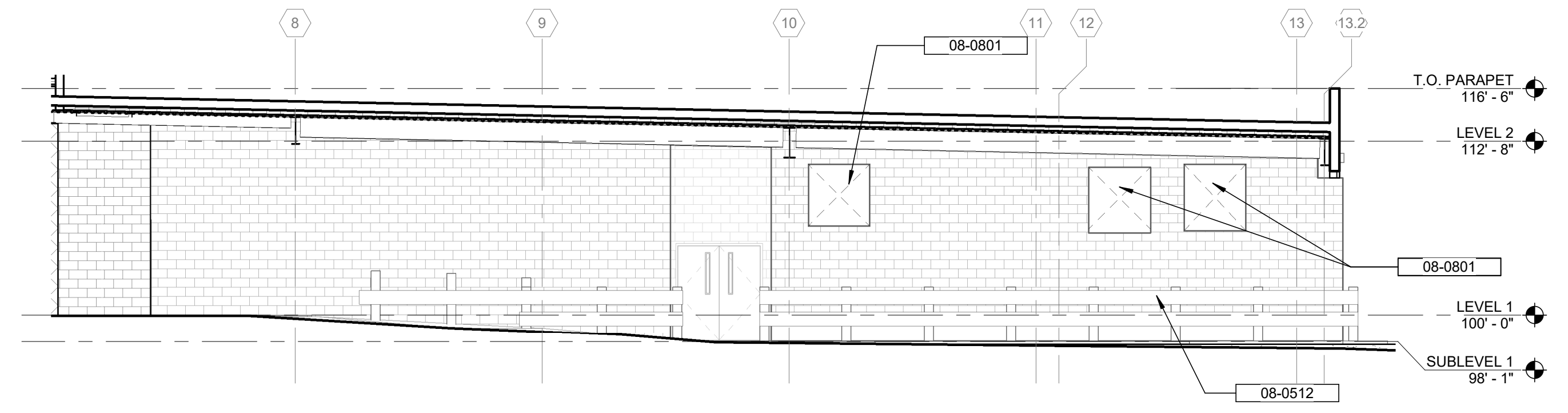
4 EAST OVERALL EXTERIOR ELEVATION
1/8" = 1'-0"



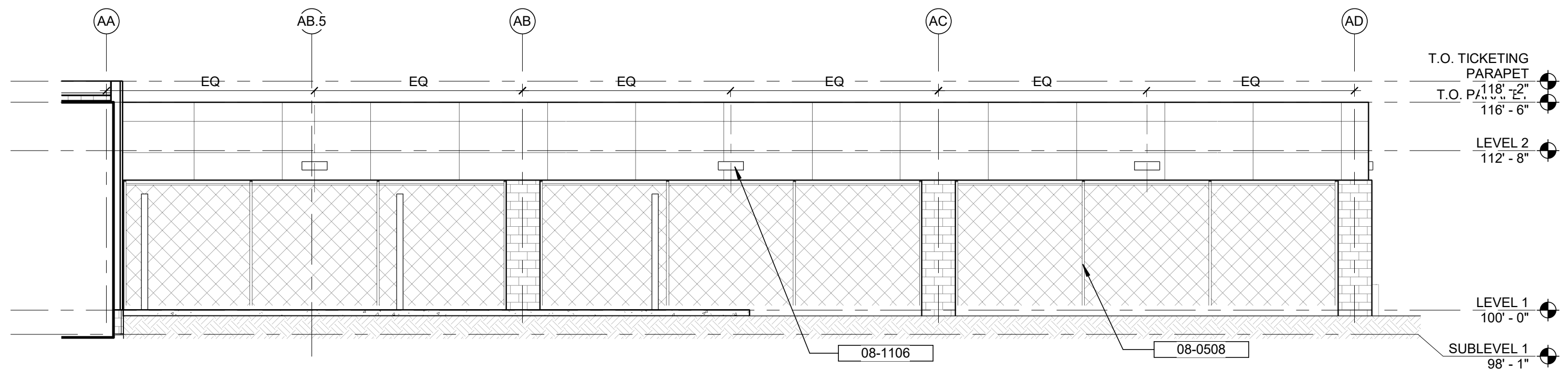
5 EXTERIOR ELEVATION - SCREENING ROOM EAST WALL
1/8" = 1'-0"



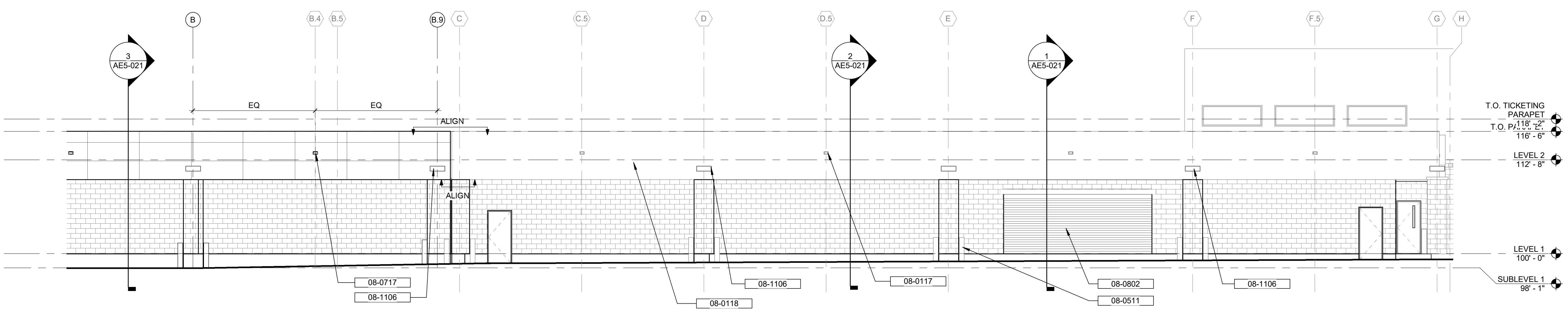
7 BUILDING ELEVATION IN OUTBOUND BAGGAGE
1/8" = 1'-0"



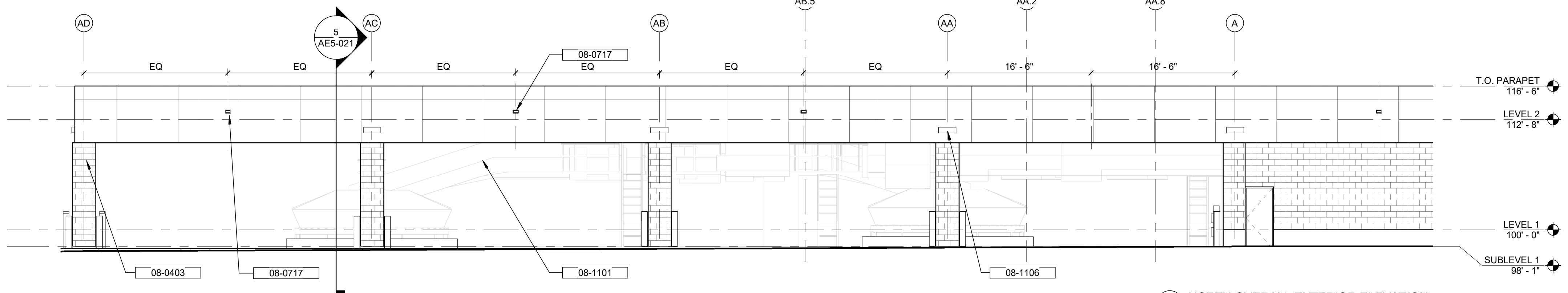
6 INTERIOR ELEVATION - OUTBOUND BAGGAGE
1/8" = 1'-0"



3 SOUTH OVERALL EXTERIOR ELEVATION
1/8" = 1'-0"



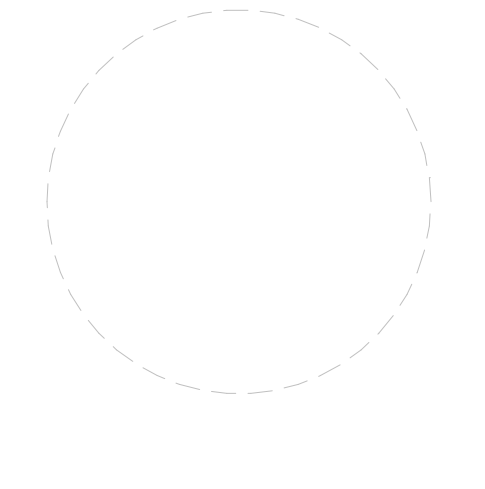
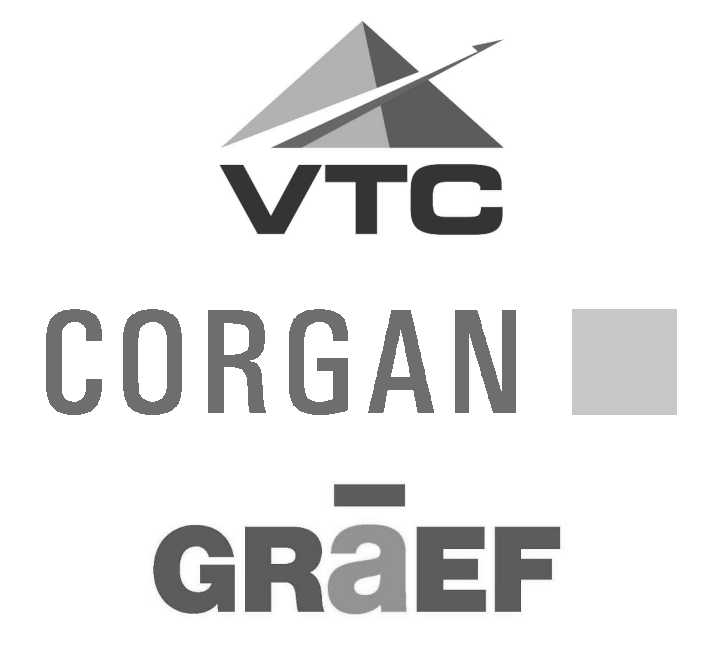
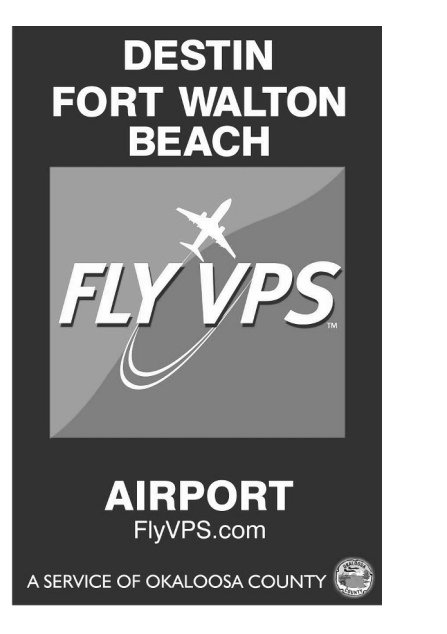
2 NORTH OVERALL EXTERIOR ELEVATION
1/8" = 1'-0"



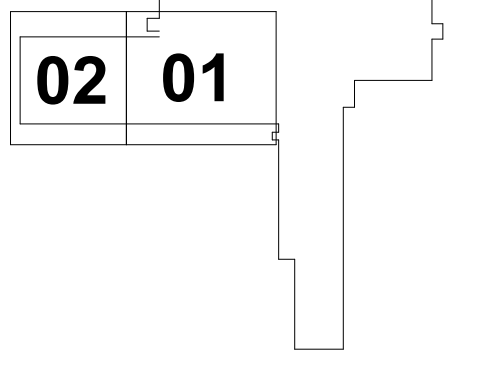
1 NORTH OVERALL EXTERIOR ELEVATION
1/8" = 1'-0"

KEYNOTE LEGEND

08-0112	EXISTING FAÇADE TO REMAIN.
08-0117	EXISTING SCUPPER TO REMAIN
08-0118	EXISTING METAL PANEL FAÇADE TO REMAIN
08-0403	8" CMU, BURNISHED BLOCK FINISH
08-0404	4" CMU, BURNISHED BLOCK FINISH. MATCH EXISTING COLOR.
08-0506	STEEL COLUMN PROTECTION PAINTED SAFETY YELLOW, TYP. REFER TO STRUCTURAL.
08-0508	CHAINLINK FENCE WITH SLATS.
08-0509	METAL PANEL SYSTEM, SPACING TO MATCH EXISTING.
08-0511	BOLLARD PAINTED SAFETY YELLOW, TYP.
08-0512	GUARDRAILS AND BOLLARDS PAINTED SAFETY YELLOW, TYP.
08-0513	METAL FENCE
08-0515	4'-0" HIGH DECORATIVE METAL FENCE TO MATCH EXISTING. PAINT WHITE FROM MANUFACTURER'S STANDARD COLORS
08-0716	NEW ROOF HATCH WITH LADDER
08-0717	OVERFLOW SCUPPER
08-0801	WALL PENETRATION FOR BHS. CONTRACTOR TO COORDINATE EXACT LOCATION OF WALL PENETRATION WITH BHS CONTRACTOR.
08-0802	OVERHEAD DOOR REFER TO DOOR SCHEDULE FOR MORE INFORMATION.
08-1101	BAGGAGE CONVEYORS SHOWN FOR REFERENCE. REFER TO BAGGAGE.
08-1106	EXTERIOR LIGHT FIXTURE. CONTRACTOR TO MATCH EXISTING.
08-1110	BAGGAGE EQUIPMENT SHOWN FOR REFERENCE. REFER TO BAGGAGE.
08-1114	PRE-FABRICATED CANOPY. REF. SPECIFICATIONS.



KEY PLAN:



REVISIONS

REV	DESCRIPTION	DATE
A	RELEASE FOR BID SET	05/15/2020

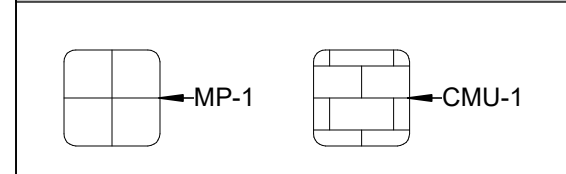
BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION

PROJECT NO: C18-2709-AP
DRAWN: R. SMOTHERS
CHECKED: K. MCGILBERRY
SCALE: As indicated

RELEASE FOR BID SET

05/15/20

EXT. MATERIALS LEGEND



SHEET TITLE:

EXTERIOR ELEVATIONS

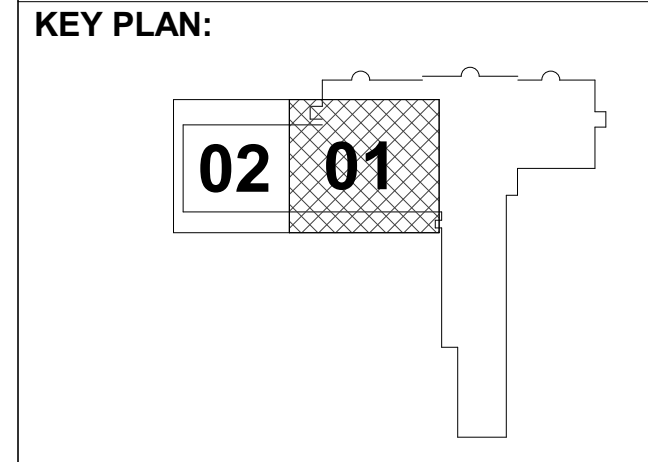
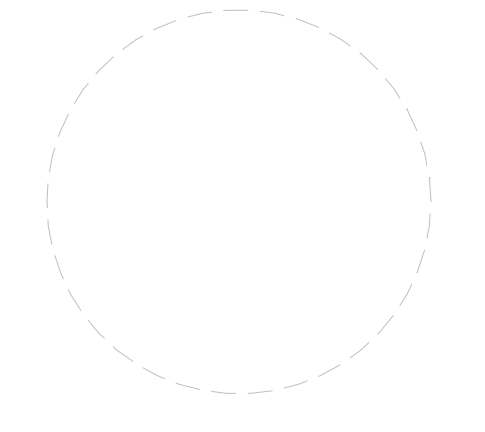
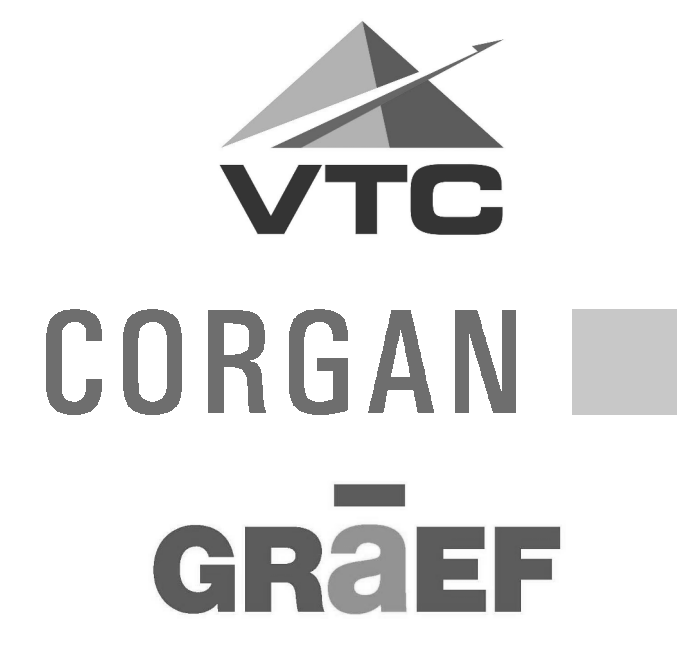
SHEET NUMBER:

AE3-001

ROOM FINISH SCHEDULE							
Room Number	Room Name	Floor Finish	Base Finish	Millwork Finish	Wall Finish	Ceiling Finish	Comments
A180	AIRLINE TICKET COUNTERS	LVT-1	RB-1	(none)	PT-1	ACT-1	
A133	SCREENING ROOM	SC-1	RB-1	(none)	PT-1	(none)	
A139	TSA OPS	EXISTING TO REMAIN	RB-1	(none)	PT-1	ACT-1	
A140	TSA OPS	EXISTING TO REMAIN	RB-1	(none)	PT-1	ACT-1	
A141	TSA OPS	EXISTING TO REMAIN	RB-1	(none)	PT-1	ACT-1	
A150	SCREENING ROOM	SC-1	RB-1	(none)	PT-1	(none)	
A151	CBRA	VCT-1, AFM-1, SC-1	RB-1	(none)	PT-1	ACT-1	Anti-fatigue matt flooring at inspection table area.
A152	CIRCULATION	VCT-1	RB-1	(none)	PT-1	ACT-1	
A154	CIRCULATION	VCT-1	RB-1	(none)	PT-1	ACT-1	
A155	BAGGAGE SCREENING	SC-1	(none)	(none)	(none)	(none)	
A159	BHS CTRL.	VCT-1	RB-1	PL-1	PT-1	ACT-1	
A157	SPARE PARTS	SC-1	RB-1	(none)	PT-1	ACT-1	
A158	ELEC.	SC-1	RB-1	(none)	PT-1	(none)	
A159	OSR	VCT-1	RB-1	PL-1	PT-1	ACT-1	
A160	TSA IT ROOM	SC-1	RB-1	(none)	PT-1	(none)	
A161	IT ROOM	SC-1	RB-1	(none)	PT-1	(none)	
A162	AIRLINE OFFICE	VCT-1	RB-1	(none)	PT-1	(none)	
A163	AIRPORT OFFICE	VCT-1	RB-1	(none)	PT-1	ACT-1	
A167	FIRE	SC-1	RB-1	(none)	PT-1	(none)	
A181	NEW TICKETING HALL	CPT-1	RB-1	(none)	PT-1	ACT-1	
A182	JANITOR	SC-1	CB-1	(none)	PT-1	(none)	
A183	MENS	T-1	CB-1	(none)	(none)	(none)	
A184	WOMENS	T-1	CB-1	(none)	(none)	ACT-1	
A185	VESTIBULE	CPT-1	RB-1	(none)	PT-1	ACT-1	
A186	VESTIBULE	CPT-1	RB-1	(none)	PT-1	ACT-1	
A187	OVERSIZED SCREENING	VCT-1	RB-1	(none)	PT-1	ACT-1	
A188	FAMILY RESTROOM	T-1	RB-1	(none)	(none)	ACT-1	

FINISH SCHEDULE								
CODE	DESCRIPTION	MANUFACTURER	STYLE	COLOR / FINISH	SIZE	COMMENTS	CONTACT	
BASE								
CB-1	COVE BASE	AMERICAN OLEAN	JA-2001 COVE BASE, STRAIGHT TOP	1007 ALMOND	1/2" HIGH			
RB-1	RUBBER BASE	JOHNSONITE		03 BURNT LAMBER	1/2"			
CEILING								
ACT-1	ACOUSTIC CEILING TILE	JARMSTRONG	ULTIMA-1912 BEVELED	WHITE	24" X 24" X 3/4"			
FLOORS								
AFM-1	ANTI-FATIGUE MATT	REF. SPECIFICATIONS						
CPT-1	CARPET TILE	INTERFACE	8602	10298 ATLANTIC	11" X 11" X 7/16"	MATCH EXISTING		
PL-1	PORCELAIN PAVEMENT TILE	LAUFEN		MINERVA CREAM LIP	12" X 12"			
LVT-1	LUXURY VINYL TILE	INTERFACE		24000 GREY OILY	12" X 12"			
SC-1	SEALED CONCRETE	REF. SPECIFICATIONS			17.4" X 17.4"	MATCH EXISTING		
VCT-1	VINYL COMPOSITE TILE	JARMSTRONG		3180 CAMEL BEIGE	12" X 12"			
WOC-1	WALL COVERING	MOCLLEN-TEX	EMERALD TEXTURE EXCELLEN	EDDYSTYLE				
MILLWORK								
ML-1	PLASTIC LAMINATE	WILSONART	STANDARD HPL	4442-60 CANYON ZEPHYR, MATTE		REF TO DRAWINGS		
ML-2	PLASTIC LAMINATE	NEWMAR	STANDARD HPL 30008	BIRCH MANTIC, TEXTURED/SUEDE FINISH				
PL-3	PLASTIC LAMINATE	FRONTE	STANDARD HPL AT111	CANAMEL GREY, TEXTURED/SUEDE FINISH				
PL-4	PLASTIC LAMINATE	NEWMAR	STANDARD HPL S3022	DEEP BLUE, TEXTURED/SUEDE FINISH				
BS-1	BOLD SURFACE	WILSONART	GIBRALTAR	9009A, ARCTIC MELANGE		ALTERNATE FOR DISCONTINUED 9009-ML (RUREKA MELANGE)		
PAINT								
PA-1	PAINT	SHERWIN-WILLIAMS	PAINT ON GYPSUM WALL BOARD	MATCH EXISTING (CC 2002 BONE)				
WALL TILE AND PANELS								
CG-1	CORNER GUARD	INPRO	STAINLESS STEEL CORNER GUARD		1 1/2" X 1 1/2" X .48"			
WT-1	CERAMIC TILE	AMERICAN OLEAN	BRIGHT	0011 VANILA, GLAZED	12" X 6"			
WT-2	CERAMIC TILE	AMERICAN OLEAN	MATTE	1007 ALMOND, MATTE GLAZED	12" X 6"			

- ### GENERAL FINISH NOTES
- UPON COMPLETION OF THE WORK, THE GEN. CONTRACTOR SHALL REMOVE FROM THE PREMISES ALL WASTE MATERIALS, RUBBISH, WRAPPINGS AND CARTONS, ETC. AS GENERATED BY FINISH MATERIALS.
 - ANY SURFACE MOUNTED PLUG MOLD AND CONDUIT TO BE PAINTED TO MATCH ADJACENT WALL.
 - ALL GENERAL WALL PAINT TO BE "P1" AND BASE "B1" UNLESS OTHERWISE NOTED. ONE PRIME COAT AND TWO FINISH COATS.
 - CONTRACTOR SHALL INSPECT ALL SURFACES TO RECEIVE PAINTING AND CORRECT ALL DEFECTS BEFORE START OF WORK.
 - CARPET INSTALLATION METHOD ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS. CUT AROUND ALL POWER IN FEEDS AS REQUIRED.
 - ALL CARPET INSTALLATIONS TO BE APPROVED BY THE ARCHITECT. ANY DOMING, CUPPING OR EXAGGERATED SEAMS ARE UNACCEPTABLE. GC TO SUBMIT SEAMING PLAN TO ARCHITECT FOR APPROVAL.
 - CARPET CONTRACTOR SHALL REMOVE ALL SPOTS AND ADHESIVE SMears FROM SURFACE WITH MANUFACTURER'S APPROVED CLEANING AGENT.
 - RESILIENT FLOORING TILES ARE TO BE ROTATED INSTALLATION METHOD U.N.O.
 - ALL RESILIENT FLOORING TO BE INSTALLED AS PER THE MANUFACTURER'S SPECIFIC REQUIREMENTS.
 - CONTRACTOR TO PROVIDE AND INSTALL VINYL REDUCING STRIPS TO MATCH CARPET BETWEEN THE CARPETED AND VINYL TILED AREAS. ARCHITECT TO APPROVE COLOR. JOHNSONITE OR EQUAL.
 - ALL BASE ON CARPET TO BE STRAIGHT. INSTALL COVE BASE ON V.C.T.
 - CONTRACTOR TO VERIFY STOCK OF ALL EXISTING FINISHES.
 - PAINTING CONTRACTOR TO TOUCH UP WORK AFTER ALL TRADES.
 - SUPPLY 10% ATTIC STOCK OF CARPET TO RE-CARPET AT FUTURE TIME AS REQUIRED. PROVIDE BREAKOUT COST OF ATTIC STOCK.
 - CONTRACTOR TO INCLUDE OVERTIME AS NECESSARY TO COMPLETE NOXIOUS WORK (FUMES) SO AS NOT TO DISRUPT OTHER TRADES/ ADJOINING OCCUPIED AREAS.
 - UNDERSIDE OF CONCRETE SLAB, EXPOSED BEAMS AND COLUMNS EQUIPMENT, ELECTRIC CONDUIT AND ANY MISCELLANEOUS ITEMS ARE TO BE PROPERLY PREPARED AND PRIMED TO RECEIVE A PAINT FINISH. SEE WALL AND CEILING/SLAB LEGEND.



REVISIONS

REV	DESCRIPTION	DATE
A	RELEASE FOR BID SET	05/15/2020

BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION

PROJECT NO: C18-2709-AP
 DRAWN: R. SMOTHERS
 CHECKED: K. MCGILBERRY
 SCALE: As indicated

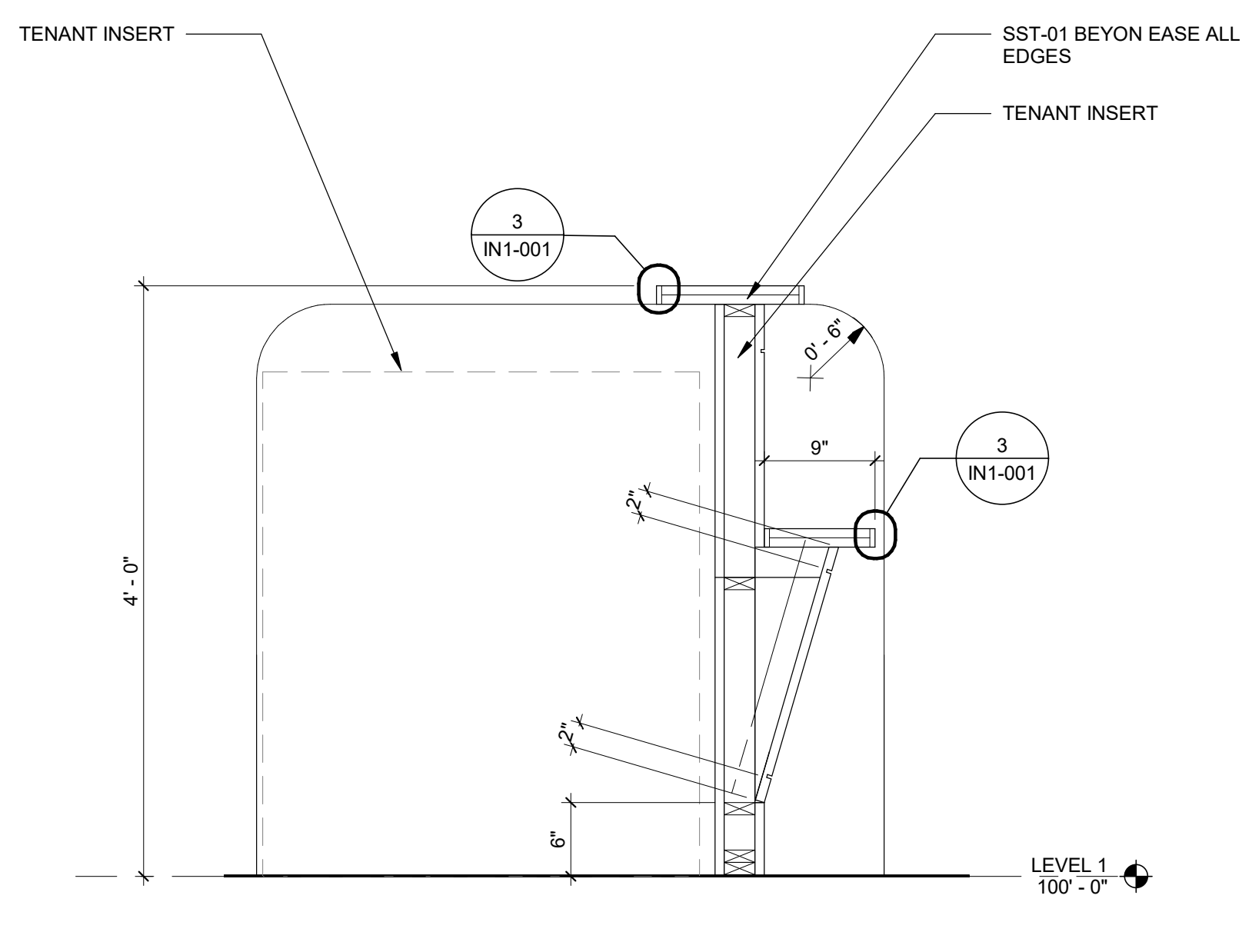
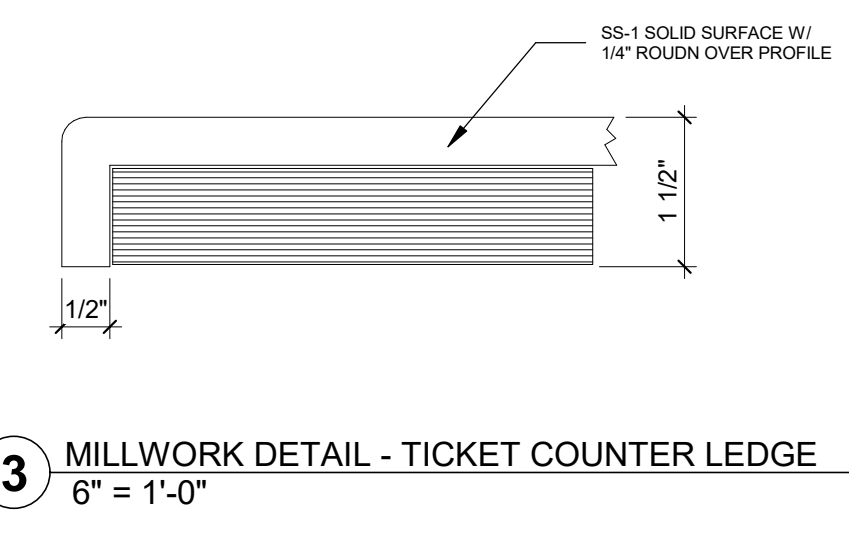
RELEASE FOR BID SET
 05/15/20

FINISH FLOOR LEGEND

AFM-1	VCT-1	T-1
CPT-1	LVT-1	

SHEET TITLE:
FINISH FLOOR PLAN - SECTOR 01

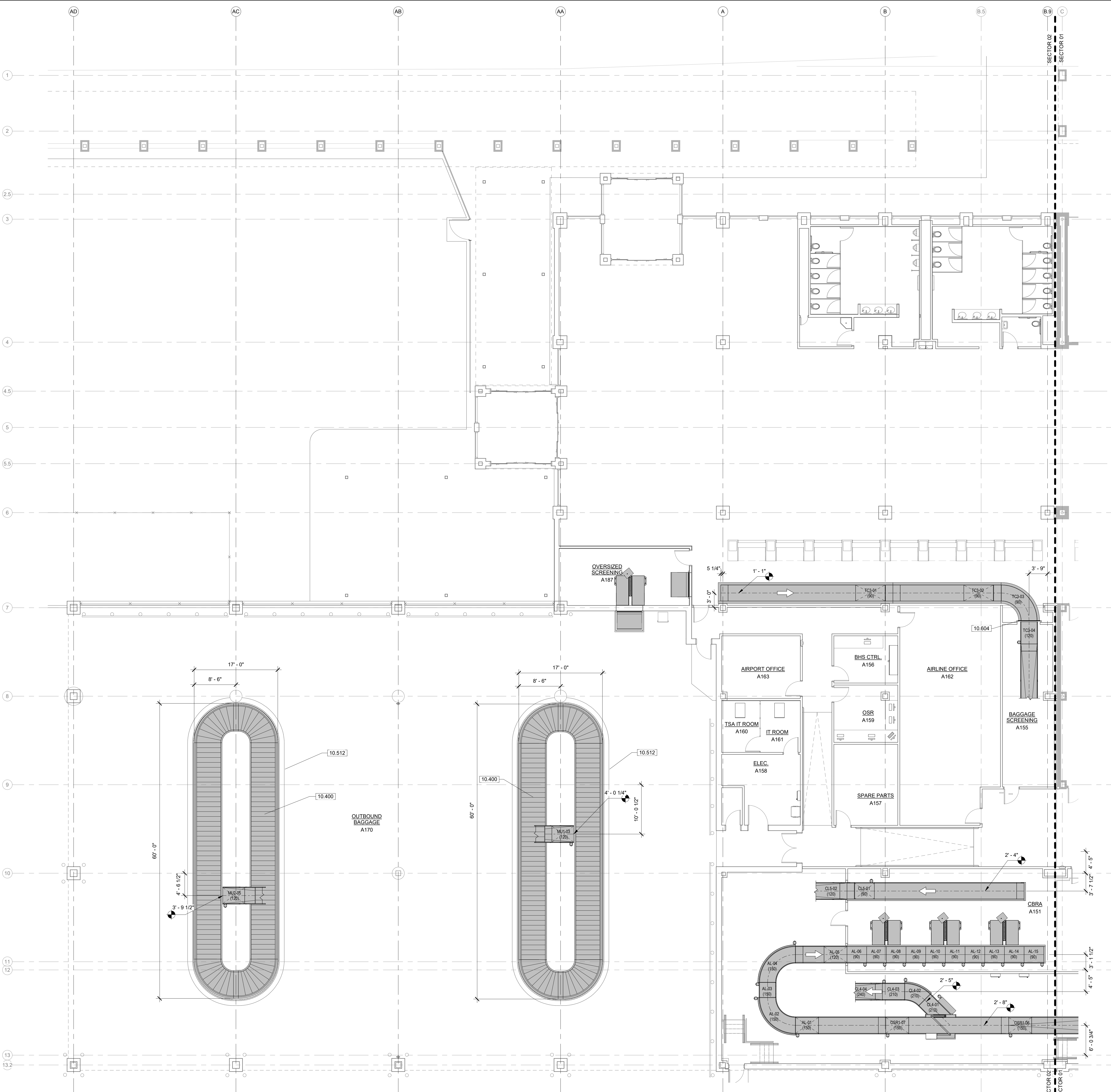
SHEET NUMBER:
IN1-001



1 FINISH FLOOR PLAN
 1/8" = 1'-0"

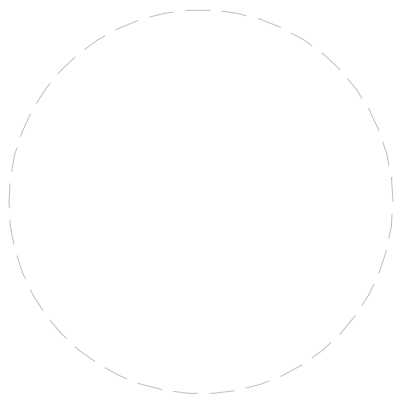
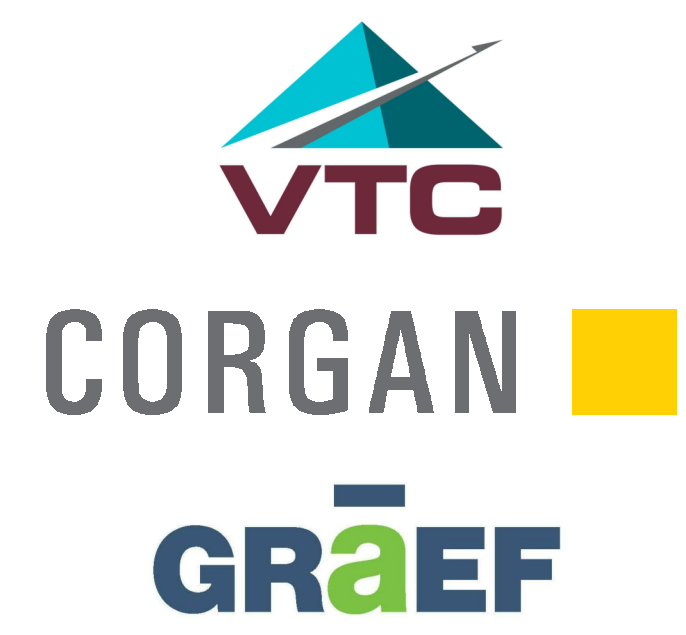
2 MILLWORK SECTION - TICKETING COUNTER, TYP
 1" = 1'-0"

3 MILLWORK DETAIL - TICKET COUNTER LEDGE
 6" = 1'-0"

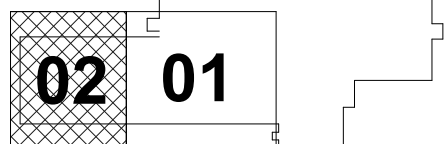


KEYNOTES

- 10.400 SLOPE PLATE MAKE-UP UNIT
- 10.512 CONVEYOR IMPACT PROTECTION
- 10.604 FIRE DOOR - FULL PENETRATION



KEY PLAN:



REVISIONS

REV	DESCRIPTION	DATE
A	RELEASE FOR BID SET	05/15/2020

BAGGAGE HANDLING SYSTEM AND WEST TERMINAL EXPANSION

PROJECT NO: C18-2709-AP
 DRAWN: R. CREWS
 CHECKED: M. HEDMAN
 SCALE: 1/8" = 1'-0"

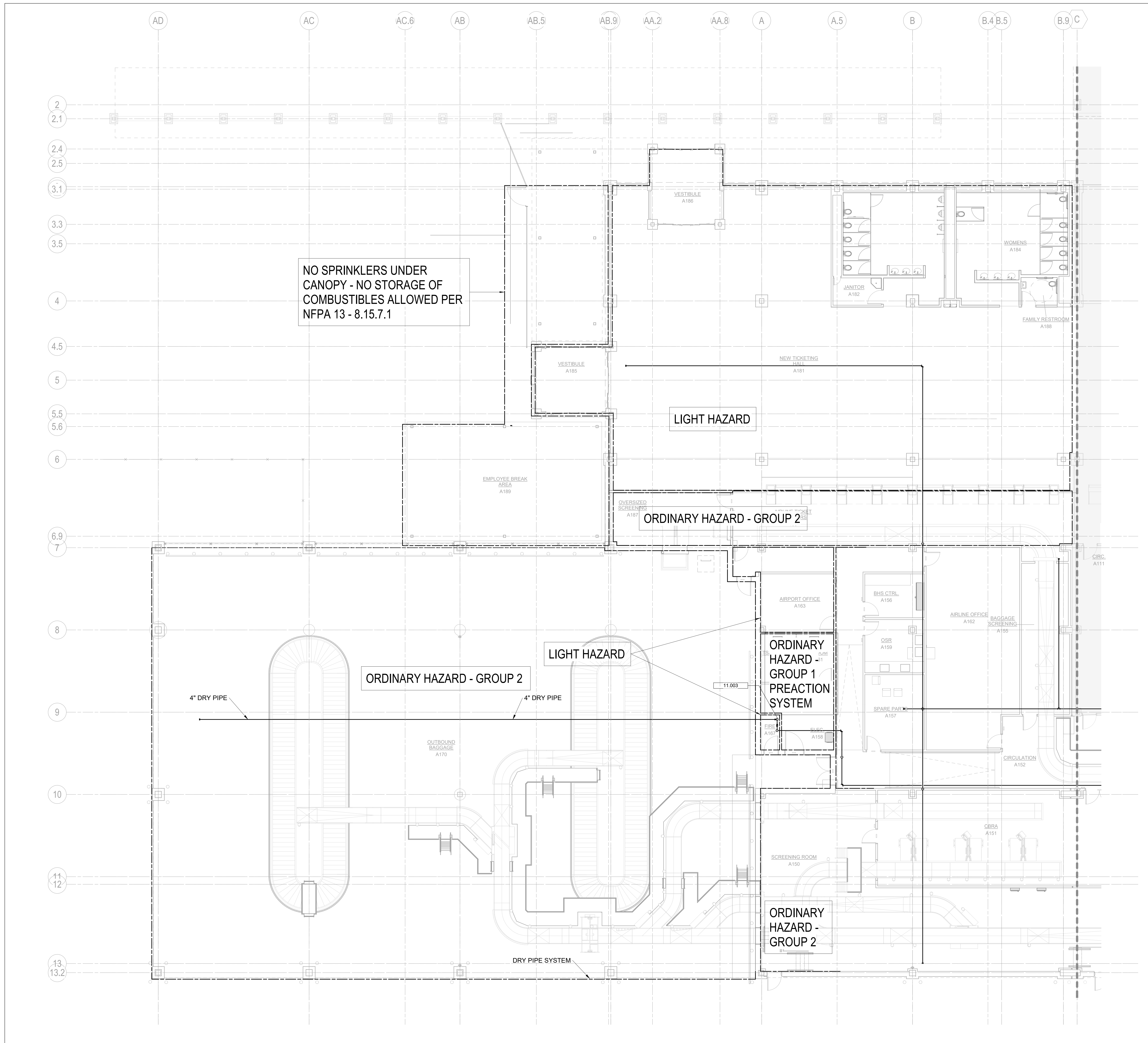
RELEASE FOR BID SET

05/15/2020

SHEET TITLE:
BHS MECH PLAN - LEVEL 01 - SECTOR 02 - LOWER

SHEET NUMBER:
QM1-102.1

CONVEYOR MANIFEST																		
Unit Label	Type	Comments	PT / Merge Degree	Inc / Dec Degree	Total CL Length	Length 1	Length 2	Between Guards (in)	Guard Height Left (in)	Guard Height Right (in)	Belt Width (in)	Low Nominal Belt (fpm)	High Nominal Belt (fpm)	HP	FLA	Shaft Encoder	VFD	Brake
AL-01	STD				18' - 3 3/4"	18' - 3 3/4"		39	12	12	36		150	2	3.4	X	X	
AL-02	PTF	CW 48C39	90.0°		8' - 10"			39	12	12	36		150	2	3.4	X	X	
AL-03	QUEUE				3' - 0"	3' - 0"		39	12	12	36		150	2	3.4	X	X	
AL-04	PTF	CW 48C39	90.0°		8' - 10"			39	12	12	36		150	2	3.4	X	X	
AL-05	STD				10' - 5 1/4"	10' - 5 1/4"		39	12	12	36		120	2	3.4	X	X	
AL-06	QUEUE	SHROUDED LEFT SIDE			4' - 0"	4' - 0"		39	0	12	36		90	2	3.4	X	X	
AL-07	QUEUE	SHROUDED LEFT SIDE			4' - 0"	4' - 0"		39	0	12	36		90	2	3.4	X	X	
AL-08	QUEUE	SHROUDED LEFT SIDE			4' - 0"	4' - 0"		39	0	12	36		90	2	3.4	X	X	
AL-09	QUEUE	SHROUDED LEFT SIDE			4' - 0"	4' - 0"		39	0	12	36		90	2	3.4	X	X	
AL-10	QUEUE	SHROUDED LEFT SIDE			4' - 0"	4' - 0"		39	0	12	36		90	2	3.4	X	X	
AL-11	QUEUE	SHROUDED LEFT SIDE			4' - 0"	4' - 0"		39	0	12	36		90	2	3.4	X	X	
AL-12	QUEUE	SHROUDED LEFT SIDE			4' - 0"	4' - 0"		39	0	12	36		90	2	3.4	X	X	
AL-13	QUEUE	SHROUDED LEFT SIDE			4' - 0"	4' - 0"		39	0	12	36		90	2	3.4	X	X	
AL-14	QUEUE	SHROUDED LEFT SIDE			4' - 0"	4' - 0"		39	0	12	36		90	2	3.4	X	X	
AL-15	QUEUE	SHROUDED LEFT SIDE			4' - 0"	4' - 0"		39	0	12	36		90	2	3.4	X	X	
BMU-01	SLOPE				60' - 0"	44' - 0"	1' - 0"										X	
BMU-02	SLOPE				60' - 0"	44' - 0"	1' - 0"							10	16		X	
CL-01	QUEUE	SIDEGUARD CUT-OUT, LEFT SIDE			4' - 6"	4' - 6"		39	12	12	36		150	2	3.4	X	X	
CL-02	QUEUE	INC	45.0°	5.8°	4' - 6"	4' - 6"		39	12	12	36		180	2	3.4	X	X	
CL-03	QUEUE	INC		5.8°	4' - 6"	4' - 6"		39	12	12	36		210	2	3.4	X	X	
CL-04	STD				13' - 0"	13' - 0"		39	12	12	36		240	2	3.4	X	X	
CL-05	STD				15' - 0"	15' - 0"		39	12	12	36		240	2	3.4	X	X	
CL-06	INC			3.6°	25' - 0"	25' - 0"		39	12	12	36		240	2	3.4	X	X	
CL-07	STD				30' - 0"	30' - 0"		39	12	12	36		240	2	3.4	X	X	
CL-08	STD				28' - 3 1/4"	28' - 3 1/4"		39	12	12	36		240	2	3.4	X	X	
CL-08-FD	DOOR	FIRE RATED, FULL PENETRATION												0.5	2			
CL-09	STD				19' - 9"	19' - 9"		39	12	12	36		240	2	3.4	X	X	
CL-10	STD				13' - 0"	13' - 0"		39	12	12	36		240	2	3.4	X	X	
CL-11	QUEUE				4' - 6"	4' - 6"		39	12	12	36		240	2	3.4	X	X	
CL-12	QUEUE				4' - 6"	4' - 6"		39	12	12	36		240	2	3.4	X	X	
CL-13	STD				8' - 11 3/4"	8' - 11 3/4"		39	12	12	36		240	2	3.4	X	X	
CL-14	PTF	CW 48C39	90.0°		8' - 10"			39	12	12	36		240	2	3.4	X	X	
CL-15	STD				23' - 0"	23' - 0"		39	12	12	36		210	2	3.4	X	X	
CL3-01	QUEUE	SIDEGUARD CUT-OUT, RIGHT SIDE			4' - 6"	4' - 6"		39	12	12	36		150	2	3.4	X	X	
CL3-02	PTS	INC	45.0°		4' - 5"			39	12	12	36		180	2	3.4	X	X	
CL3-03	QUEUE	INC		2.1°	6' - 10 1/4"	6' - 10 1/4"		39	12	12	36		210	2	3.4	X	X	
CL3-04	QUEUE				4' - 6"	4' - 6"		39	12	12	36		240	2	3.4	X	X	
CL3-05	QUEUE				4' - 6"	4' - 6"		39	12	12	36		240	2	3.4	X	X	
CL3-06	QUEUE				4' - 6"	4' - 6"		39	12	12	36		240	2	3.4	X	X	
CL3-07	MERGE	RIGHT			5' - 0"	5' - 0"		39	12	12	36	240	339	3	4.8	X	X	
CL4-00-HSD	HSU				15' - 0"	15' - 0"		39	12	12	36		212	0	10.1		X	
CL4-01	DIVERT	RIGHT			4' - 2"	4' - 2"		39	12	12	36		212	3	4.8	X	X	
CL4-02	PTF	CW 48C39	45.0°		4' - 5"			39	12	12	36		210	2	3.4	X	X	
CL4-03	QUEUE	SIDEGUARD CUT-OUT, LEFT SIDE			4' - 6"	4' - 6"		39	12	12	36		210	2	3.4	X	X	
CL4-04	INC			16.0°	24' - 3 1/4"	19' - 7 3/4"	4' - 7 1/2"	39	12	12	36		240	2	3.4	X	X	
CL4-05	QUEUE				4' - 6"	4' - 6"		39	12	12	36		240	2	3.4	X	X	
CL4-06	QUEUE				4' - 6"	4' - 6"		39	12	12	36		240	2	3.4	X	X	
CL4-06-FD	DOOR	FIRE RATED, FULL PENETRATION												0.5	2			
CL4-07	QUEUE				4' - 6"	4' - 6"		39	12	12	36		240	2	3.4	X	X	
CL4-08	PTF	CW 48C39	45.0°		4' - 5"			39	12	12	36		240	2	3.4	X	X	
CL4-09	MERGE	RIGHT			5' - 0"	5' - 0"		39	12	12	36	240	339	3	4.8	X	X	
CL5-01	STD	SHROUDED LEFT SIDE			36' - 0"	36' - 0"		39	12	21	36		90	2	3.4	X	X	
CL5-02	INC			15.0°	26' - 0 1/4"	21' - 3"	4' - 9 1/4"	39	12	12	36		120	2	3.4	X	X	
CL5-02-FD	DOOR	FIRE RATED, FULL PENETRATION												0.5	2			
CL5-03	STD				13' - 3 3/4"	13' - 3 3/4"		39	12	12	36		150	2	3.4	X	X	
CL5-04	PTF	CW 48C39	90.0°		8' - 10"			39	12	12	36		180	2	3.4	X	X	
CL5-05	QUEUE				7' - 10 1/4"	7' - 10 1/4"		39	12	12	36		210	2	3.4	X	X	
CL5-06	QUEUE				4' - 6"	4' - 6"		39	12	12	36		240	2	3.4	X	X	
CL5-07	PTF	CW 48C39	45.0°		4' - 5"			39	12	12	36		240	2	3.4	X	X	
CL5-08	MERGE	RIGHT			5' - 0"	5' - 0"		39	12	12	36	240	339	3	4.8	X	X	
MU1-01	QUEUE				4' - 6"	4' - 6"		39	12	12	36		180	2	3.4	X	X	
MU1-02	PTF	CW 48C39	90.0°		8' - 10"			39	12	12	36		150	2	3.4	X	X	
MU1-03	DEC			18.0°	21' - 8"	3' - 11 1/4"	17' - 8 3/4"	39	12	12	36		120	2	3.4	X	X	
MU2-00-HSD	HSU				15' - 0"	15' - 0"		39	12	12	36		296	0	10.1		X	
MU2-01	DIVERT	LEFT			5' - 0"	5' - 0"		39	12	12	36	210	296	3	4.8	X	X	
MU2-02	PTF	CW 48C39	45.0°		4' - 5"			39	12	12	36		210	2	3.4	X	X	
MU2-03	QUEUE				4' - 6"	4' - 6"		39	12	12	36		180	2	3.4	X	X	
MU2-04	QUEUE				4' - 6"	4' - 6"		39	12	12	36		150	2	3.4	X	X	
MU2-05	DEC			18.0°	26' - 10 1/4"	9' - 2 1/4"	17' - 8"	39	12	12	36		120	2	3.4	X	X	
OG-00-HSD	HSU				15' - 0"	15' - 0"		39	12	12	36		339	0	10.1		X	
OG-01	DIVERT	RIGHT			5' - 0"	5' - 0"		39	12	12	36	240	339	3	4.8	X	X	
OG-02	PTF	CW 48C39	45.0°		4' - 5"			39	12	12	36		210	2	3.4	X	X	
OG-03	STD				30' - 0"	30' - 0"		39	12	12	36		210	2	3.4	X	X	
OG-04	DEC			2.8°	27' - 7 1/2"	27' - 7 1/2"		39	12	12	36		210	2	3.4	X	X	
OG-05	QUEUE				4' - 6"	4' - 6"		39	12	12	36		210	2	3.4	X	X	
OG-06	PTF	CW 48C39	45.0°		4' - 5"			39	12	12	36		210	2	3.4	X	X	
OG-07	QUEUE	INC		2.1°	4' - 6"	4' - 6"		39	12	12	36		210	2	3.4	X	X	
OG-08	MERGE	RIGHT			5' - 0"	5' - 0"		39	12	12	36		212	3	4.8	X	X	
OS-01-FD	DOOR	SECURITY												0.5	2			
OS-02-FD	DOOR	FIRE RATED												0.5	2			
OSR1-01	QUEUE	SIDEGUARD CUT-OUT, LEFT SIDE			4' - 6"	4' - 6"		39	12	12	36		150	2	3.4	X	X	
OSR1-02	QUEUE	INC			4' - 6"	4' - 6"		39	12	12	36		150	2	3.4	X	X	
OSR1-03	QUEUE	INC			4' - 6"	4' - 6"		39	12	12	36		150	2	3.4	X	X	
OSR1-04	STD				13' - 0"	13' - 0"		39	12	12	36		150	2	3.4	X	X	
OSR1-05	STD				15' - 0"	15' - 0"		39	12	12	36		150	2	3.4	X	X	
OSR1-06	INC			2.3°	25' - 0"	25' - 0"		39	12	12	36		150	2	3.4	X	X	
OSR1-07	STD				25' - 0"	25' - 0"		39	12	12	36		150	2	3.4	X	X	
OSR3-01	QUEUE	SIDEGUARD CUT-OUT, RIGHT SIDE			4' - 6"	4' - 6"		39	12	12	36		150	2	3.4	X	X	
OSR3-02	PTF	CW 48C39	45.0°		4' - 5"			39	12	12	36		150	2	3.4	X	X	
OSR3-03	QUEUE			1.4°	6' - 10 1/4"	6' - 10 1/4"		39	12	12	36		150	2	3.4	X	X	
OSR3-04	QUEUE				4' - 6"	4' - 6"		39	12	12	36		150	2	3.4	X	X	
OSR3-05	QUEUE				4' - 6"	4' - 6"		39	12	12	36		150	2	3.4	X	X	
OSR3-06	QUEUE				4' - 6"	4' - 6"		39	12	12	36		180	2	3.4	X	X	
OSR3-07	MERGE	RIGHT			5' - 0"	5' - 0"		39	12	12</								



NO SPRINKLERS UNDER CANOPY - NO STORAGE OF COMBUSTIBLES ALLOWED PER NFPA 13 - 8.15.7.1

LIGHT HAZARD

ORDINARY HAZARD - GROUP 2

ORDINARY HAZARD - GROUP 1 PREACTION SYSTEM

ORDINARY HAZARD - GROUP 2

LIGHT HAZARD

ORDINARY HAZARD - GROUP 2

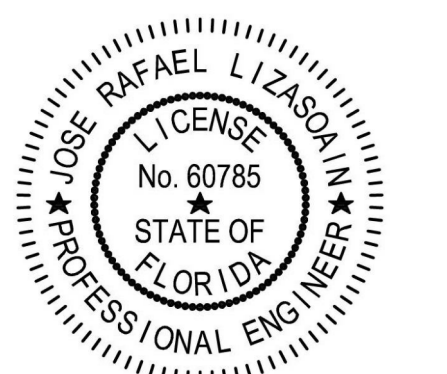
DRY PIPE SYSTEM

GENERAL NOTES

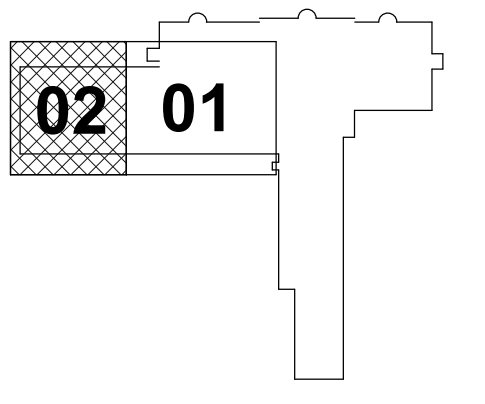
- ALL WORK SHALL COMPLY WITH THE REQUIREMENT OF THE FLORIDA BUILDING CODE, NFPA-13, NFPA-415 AND THE AUTHORITY HAVING JURISDICTION.
- CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING THE OWNER WITH ADVANCED NOTICE BEFORE DISCONNECTING THE FIRE PROTECTION SYSTEM.
- ALL WORK SHALL BE COORDINATED WITH ALL TRADES.
- WHEN DISCONNECTING THE SYSTEM CONTRACTOR SHALL COORDINATE FIRE WASH REQUIREMENTS WITH THE OWNER AND THE AUTHORITY HAVING JURISDICTION.
- REFER TO DETAILS AND SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
- IF THERE IS ANY DISCREPANCY BETWEEN THE DRAWINGS AND SPECIFICATIONS THE MOST STRINGENT REQUIREMENTS SHALL APPLY.
- PROVIDE SPRINKLER COVERAGE BELOW BHS OBSTRUCTION LARGER THAN 4 FEET. PERFORATED CATWALK PLATFORM IS CONSIDER PART OF AN OBSTRUCTION.

KEYNOTE LEGEND

11.003 DRY PIPE FIRE PROTECTION VALVE IN FIRE CLOSET. PROVIDE TAMPER SWITCH AND CONNECT TO FIRE ALARM. PROVIDE UNIT HEATER TO PREVENT VALVE FREEZE. SEE MECHANICAL DRAWINGS FOR DETAILS



GRAEF CERT # 4270 05/15/2020
KEY PLAN:



REVISIONS

REV	DESCRIPTION	DATE
A	RELEASE FOR BID SET	05/15/2020

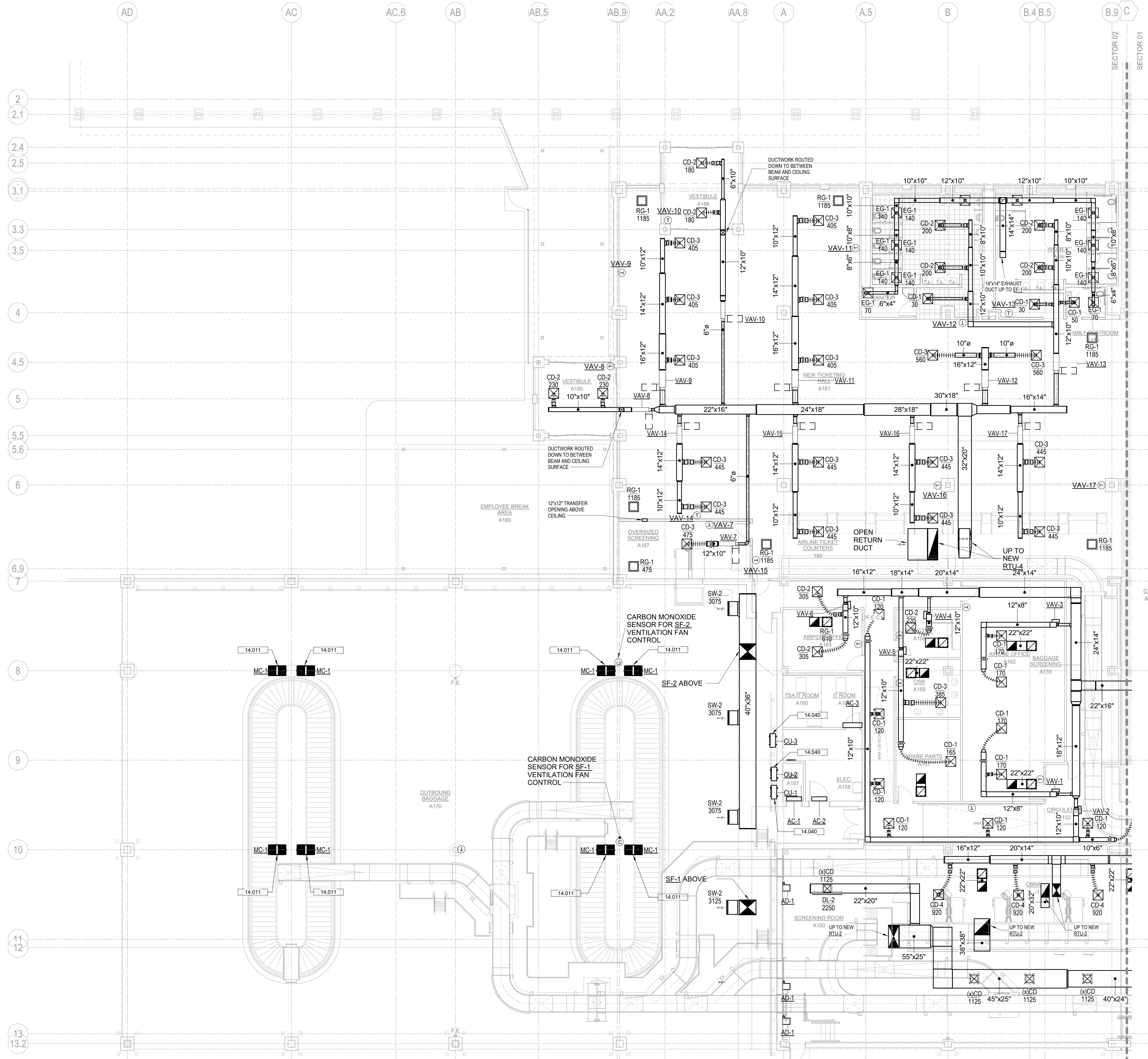
Baggage Handling System and West Terminal Expansion

PROJECT NO: C18-2709-AP
DRAWN: CSF
CHECKED: JRL
SCALE: 1/8" = 1'-0"

RELEASE FOR BID SET
05/15/2020

SHEET TITLE:
FIRE PROTECTION RENOVATION - LEVEL 01 - SECTOR 02

SHEET NUMBER:
F1-102



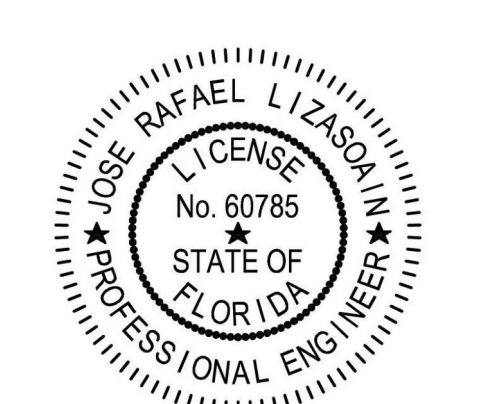
GENERAL NOTES

- ALL WORK SHALL COMPLY WITH THE REQUIREMENTS OF THE FLORIDA BUILDING CODE, FLORIDA MECHANICAL CODE, AND LOCAL ORDINANCES.
- CONTRACTOR SHALL COORDINATE WORK WITH ALL TRADES PRIOR TO COMMENCING ANY DEMOLITION.
- COORDINATE WITH OWNER PRIOR TO ANY UTILITY SHUT DOWN. DO NOT PROCEED WITHOUT OWNER'S AUTHORIZATION.
- REFER TO SPECIFICATIONS AND DETAILS FOR ADDITIONAL INFORMATION.
- IF THERE IS ANY DISCREPANCY BETWEEN DRAWINGS AND SPECIFICATIONS THE MOST STRINGENT REQUIREMENT SHALL APPLY.
- ANY EQUIPMENT REMOVED IS PROPERTY OF THE OWNER. CONSULT OWNER PRIOR TO EQUIPMENT DISPOSAL.
- CLEAN AND REBALANCE ALL EXISTING DIFFUSERS TO CFM VALUES LISTED ON PLANS.

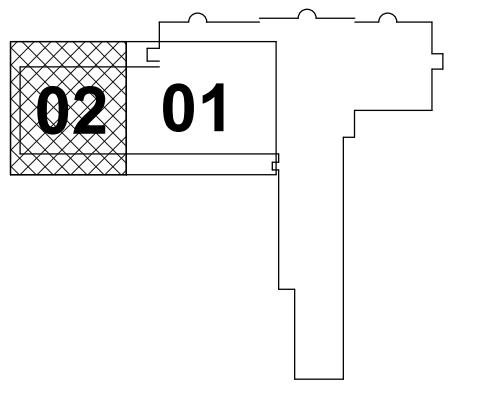
KEYNOTE LEGEND

14.011 NEW MANCOOLERS TO BE WIRED ON ONE ON/OFF SWITCH. COORDINATE WITH ELECTRICAL PLANS.

14.040 INSTALL CONDENSING UNIT HIGH ON WALL.



GRAEF
CERT # 4270
KEY PLAN:



REVISIONS

REV	DESCRIPTION	DATE
A	RELEASE FOR BID SET	05/15/2020

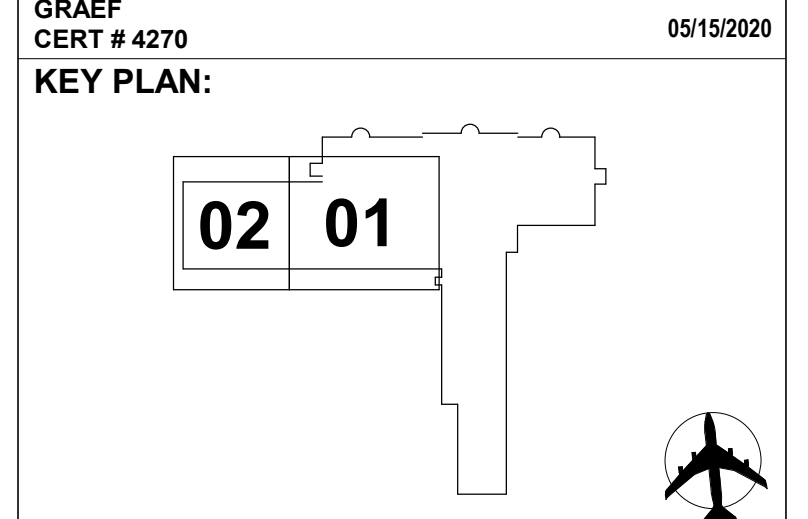
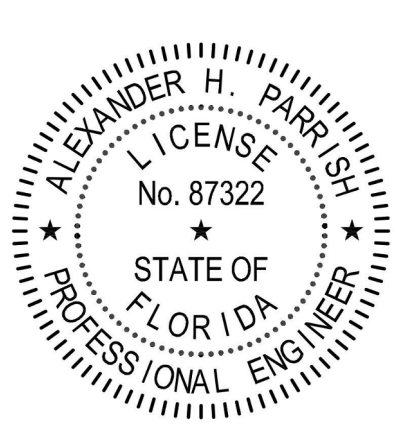
Baggage Handling System and West Terminal Expansion

PROJECT NO: C18-2709-AP
DRAWN: KRS
CHECKED: JRL
SCALE: 1/8" = 1'-0"

Release for Bid Set
05/15/2020

SHEET TITLE:
MECHANICAL RENOVATION - LEVEL 01 - SECTOR 02

SHEET NUMBER:
M1-102



REV	DESCRIPTION	DATE
A	RELEASE FOR BID SET	05/15/2020

REV	DESCRIPTION	DATE
A	RELEASE FOR BID SET	05/15/2020

Baggage Handling System and West Terminal Expansion

PROJECT NO: C18-2709-AP
DRAWN: AV
CHECKED: AHP
SCALE: NONE

RELEASE FOR BID SET

05/15/2020

SHEET TITLE:

PANEL SCHEDULES

SHEET NUMBER: E6-002

Name: EH1A
Status: EXISTING
Project Name: VPS BHS/TERM...
Project Number: 2018-4115.00
Fed From: MSB-A VIA ATS-LA

MAIN BREAKER: 225 AMPS
VOLTAGE: 480Y/277V
PHASE: 3
WIRE: 4

AIC: 35 K... FULLY RATED
MOUNTING: SURFACE
MANUFACTURER: SQUARE D

NOTES	CIRCUIT #	CIRCUIT DESCRIPTION	LOADPHASE (KVA)			CIRCUIT BREAKER			LOADPHASE (KVA)			CIRCUIT DESCRIPTION	CIRCUIT #	
			A	B	C	TRIP	POLES	TRIP	A	B	C			
	1	PANEL EH1A (EXISTING)				100	3	3	50			PANEL EL21 (EXISTING)	2	
	3	EXISTING LOAD				20	1	1	20			EXISTING LOAD	6	
	9	EXISTING LOAD				20	1	1	20			EXISTING LOAD	10	
	11	EXISTING LOAD				20	1	1	20			EXISTING LOAD	12	
	13	EXISTING LOAD				20	1	1	20			EXISTING LOAD	14	
	15	EXISTING LOAD				20	1	1	20		0.4	L EM LIGHTING - SCREENING ROOM #A150	16	
	17	EXISTING LOAD				20	1	1	20		1.1	L EM LIGHTING - OFFICES/TICKET/INSTR. SEC. 2	18	
	19	PANEL EL1A (EXISTING)				125	3	3	20		0.2	L EM LIGHTING - O. BAGGAGE #A170	20	
	21	SPARE										SPARE	22	
	22	SPARE									0.2	0.4	1.1	24

CONN. LOAD (KVA)	ADJUST. FACTOR	DEMAND FACTOR	DEMAND LOAD (KVA)
1.7	1.00	1.25	2.1
0.0	---	NEC	0.0
0.0	1.00	1.25	0.0
0.0	1.00	1.00	0.0
0.0	1.00	1.00	0.0
0.0	1.00	1.00	0.0
0.0	1.00	1.00	0.0
0.0	1.00	1.00	0.0
0.0	1.00	1.00	0.0
0.0	1.00	1.00	0.0
0.0	1.00	1.00	0.0

TOTAL CONNECTED... 1.7 KVA
TOTAL DEMAND... 2.1 KVA
DEMAND AMPS: 2.6 AMPS
PERCENT... 81.8 %
PANEL EQUIPMENT:
PER NEC ARTICLE 220

Name: MSB-B
Status: EXISTING
Project Name: VPS BHS/TERM. EXPANSION
Project Number: 2018-4115.00
Fed From: SERVICE TRANSFORMER

MAIN BREAKER: 3000 AMPS
VOLTAGE: 480Y/277V
PHASE: 3
WIRE: 4

AIC: 100 K AMPS FULLY RATED
MOUNTING: FLOOR
MANUFACTURER: SQUARE D

NOTES	CIRCUIT #	CIRCUIT DESCRIPTION	LOADPHASE (KVA)			CIRCUIT BREAKER			LOADPHASE (KVA)			CIRCUIT DESCRIPTION	CIRCUIT #		
			A	B	C	TRIP	POLES	TRIP	A	B	C				
	1	SPACE				3	3	600	370.0			PANEL H1B	2		
	3	SPACE				3	3	125	75.0			PANEL L2P2 (VIA XFMR T-1-P2P)	4		
	5	ATS PB (PANEL EHPIC) (EXISTING)				EX	400	3	3	200	104.0		PANEL POP-1	6	
	7	SURGE SUPPRESSOR (EXISTING)				EX	60	3	3	200	77.0		PANEL POP-2	8	
	9	SPACE ONLY							3	3	200	110.0		PANEL POP-3	10
	11	SPACE ONLY							3	3				12	
	13	PANEL H1A (EXISTING)				EX	400	3	3					14	
	15	SPACE							3	3	225	EX		16	
	17	PANEL HPI0 (EXISTING)				EX	800	3	3			ATS-LB (PANEL EN5C) (EXISTING)	18		
	19	PANEL HPI0 (EXISTING)				EX	800	3	3					20	
	21	SPACE ONLY							3	3				22	
	23	SPACE ONLY							3	3				24	

CONN. LOAD (KVA)	ADJUST. FACTOR	DEMAND FACTOR	DEMAND LOAD (KVA)
8.8	1.00	1.25	10.9
43.4	---	NEC	26.7
87.4	1.00	1.25	109.3
194.5	1.00	1.00	194.5
41.9	1.00	1.00	41.9
0.0	1.00	1.00	0.0
98.0	1.00	1.00	98.0
3.0	1.00	1.25	3.8
0.0	1.00	1.00	0.0
0.0	1.00	1.00	0.0

TOTAL COGN. LOAD: 1287.0 KVA
TOTAL DEMAND LOAD: 1295.1 KVA
TOTAL DEMAND AMPS: 1559.8 AMPS
PERCENT... 1.9 %
PANEL EQUIPMENT:
PER NEC ARTICLE 220

Name: MSB-A
Status: EXISTING
Project Name: VPS BHS/TERM. EXPANSION
Project Number: 2018-4115.00
Fed From: SERVICE TRANSFORMER

MAIN BREAKER: 3000 AMPS
VOLTAGE: 480Y/277V
PHASE: 3
WIRE: 4

AIC: 100 K AMPS FULLY RATED
MOUNTING: FLOOR
MANUFACTURER: SQUARE D

NOTES	CIRCUIT #	CIRCUIT DESCRIPTION	LOADPHASE (KVA)			CIRCUIT BREAKER			LOADPHASE (KVA)			CIRCUIT DESCRIPTION	CIRCUIT #	
			A	B	C	TRIP	POLES	TRIP	A	B	C			
	1	WEST CHILLER (EXISTING)				EX	700	3	3	30	EX		2	
	3	EAST CHILLER (EXISTING)				EX	700	3	3	30	EX		4	
	5	ATS LA (PANEL EHP1A) (EXISTING)				EX	225	3	3	225	EX		6	
	7	PANEL HPIA (EXISTING)				EX	400	3	3	225	EX		8	
	9	SURGE SUPPRESSOR (EXISTING)				EX	60	3	3	225	EX		10	
	11	SPACE ONLY							3	3			12	
	13	SPACE ONLY							3	3	225	EX	14	
	15	PANEL HPIA (EXISTING)				EX	400	3	3	200	88.0		16	
	17	PANEL HPI0 (EXISTING)				EX	400	3	3	200	103.0		18	
	19	PANEL HPI0 (EXISTING)				EX	400	3	3	200	103.0		20	
	21	SPACE							225	3	3	60	40.0	22
	23	SPACE ONLY							3	3			24	

CONN. LOAD (KVA)	ADJUST. FACTOR	DEMAND FACTOR	DEMAND LOAD (KVA)
0.0	1.00	1.25	0.0
0.0	---	NEC	0.0
0.0	1.00	1.25	0.0
0.0	1.00	1.00	0.0
0.0	1.00	1.00	0.0
0.0	1.00	1.00	0.0
0.0	1.00	1.00	0.0
0.0	1.00	1.00	0.0
0.0	1.00	1.00	0.0
0.0	1.00	1.00	0.0
0.0	1.00	1.00	0.0

TOTAL COGN. LOAD: 1263.0 KVA
TOTAL DEMAND LOAD: 1263.0 KVA
TOTAL DEMAND AMPS: 1521.0 AMPS
PERCENT... 4.4 %
PANEL EQUIPMENT:
PER NEC ARTICLE 220

Name: EL1A
Status: EXISTING
Project Name: VPS BHS/TERM...
Project Number: 2018-4115.00
Fed From: EH1A VIA T-ELTA

MAIN BREAKER: 225 AMPS
VOLTAGE: 208Y/120V
PHASE: 3
WIRE: 4

AIC: 10 K... FULLY RATED
MOUNTING: SURFACE
MANUFACTURER: SQUARE D

NOTES	CIRCUIT #	CIRCUIT DESCRIPTION	LOADPHASE (KVA)			CIRCUIT BREAKER			LOADPHASE (KVA)			CIRCUIT DESCRIPTION	CIRCUIT #
			A	B	C	TRIP	POLES	TRIP	A	B	C		
	1	RECEPTACLE TICKET COUNTER (EX.)				30	1	1	30			R RECEPTACLE TICKET COUNTER (EX.)	2
	3	RECEPTACLE TICKET COUNTER (EX.)				30	1	1	30			R RECEPTACLE TICKET COUNTER (EX.)	4
	5	RECEPTACLE TICKET COUNTER (EX.)				30	1	1	30			R RECEPTACLE TICKET COUNTER (EX.)	6
	7	RECEPTACLE TICKET COUNTER (EX.)				30	1	1	30			R RECEPTACLE TICKET COUNTER (EX.)	8
	9	RECEPTACLE TICKET COUNTER (EX.)				30	1	1	30			R RECEPTACLE TICKET COUNTER (EX.)	10
	11	RECEPTACLE TICKET COUNTER (EX.)				30	1	1	30			R RECEPTACLE TICKET COUNTER (EX.)	12
	13	RECEPTACLE TICKET COUNTER (EX.)				30	1	1	30			R RECEPTACLE TICKET COUNTER (EX.)	14
	15	RECEPTACLE TICKET COUNTER (EX.)				30	1	1	30			R RECEPTACLE TICKET COUNTER (EX.)	16
	17	RECEPTACLE TICKET COUNTER (EX.)				30	1	1	30			R RECEPTACLE TICKET COUNTER (EX.)	18
	19	RECEPTACLE TICKET COUNTER (EX.)				30	1	1	30			R RECEPTACLE TICKET COUNTER (EX.)	20
	21	RECEPTACLE TICKET COUNTER (EX.)				30	1	1	30			R RECEPTACLE TICKET COUNTER (EX.)	22
	23	RECEPTACLE TICKET COUNTER (EX.)				30	1	1	30			R RECEPTACLE TICKET COUNTER (EX.)	24
	25	POWER POLE (EX.)				20	1	1	20			R RECEPTACLE E-TICKET K (COLUMN) (EX.)	26
	27	RECEPTACLE CHECKPOINT (EX.)				20	1	1	20			R RECEPTACLE E-TICKET K (COLUMN) (EX.)	28
	29	CAMPAE ELECTRICAL ROOM 107A (EX.)				20	1	1	20			R RECEPTACLE E-TICKET K (COLUMN) (EX.)	30
	31	CAMPAE BOX BAGGAGE (EX.)				20	1	1	20			R ACCESS CTRL. TICKET CHECK 'A' SEC. (EX.)	32
	33	EVDS (EX.)				20	1	1	20			R ACCESS CTRL. TICKET CHECK 'B' SEC. (EX.)	34
	35	RECEPTACLE MONITOR LB SECTION 'A' (EX.)				20	1	1	20			O SECURITY CAMERA BAGGAGE (EX.)	36
	37	RECEPTACLE BAGGAGE CLAIM OFFICE (EX.)				20	1	1	20			O ACCESS CONTROL BAGGAGE 'B' SECTION' (EX.)	38
	39	RECEPTACLE MONITOR LB BAGGAGE CLAIM				20	1	1	20			O K. MACHINE (DELTA) (EX.)	40
	41	SPARE				20	1	1	20			SPARE	42
	43	RECEPTACLE TO OFFICE (EX.)				20	1	1	20			R RECEPTACLE TO TTB (EX.)	44
	45	RECEPTACLE TO TTB (EX.)				20	1	1	20			R RECEPTACLE TO TTB (EX.)	46
	47	RECEPTACLE TO TTB (EX.)				20	1	1	20			R RECEPTACLE TO OFFICE (EX.)	48
	49	RECEPTACLE TO TTB (EX.)				20	1	1	20			R RECEPTACLE TO OFFICE (EX.)	50
	51	RECEPTACLE TO TTB (EX.)				20	1	1	20			R RECEPTACLE TO OFFICE (EX.)	52
	53	RECEPTACLE TO OFFICE CO (EX.)				20	1	1	20			R SPARE	54
	55	RECEPTACLE TO OFFICE (EX.)				20	1	1	20			R RECEPTACLE COMM. RAOK (EX.)	56
	57	SPARE				20	1	1	20			R RECEPTACLE COMM. RAOK (EX.)	58
	59	FAIR AIR COMPRESSOR POWER (EX.)				20	1	1	20			R RECEPTACLE COMM. RAOK (EX.)	60
	61	RECEPTACLE BAGGAGE ESDICTY ROOM (EX.)				20	1	1	20			R RECEPTACLE COMM. RAOK (EX.)	62
	63	RECEPTACLE BAGGAGE ESD (EX.)				20	1	1	20			R PHONE BOARD BAGGAGE CLAIM (EX.)	64
	65	RECEPTACLE TTB-A (EX.)				20	1	1	20			O CAMERA POWER (EX.)	66
	67	RECEPTACLE TTB-A (EX.)				20	1	1	20			SPARE	68
	69	RECEPTACLE CONTINENTAL (EX.)				20	1	1	20			R NEW EXT. DOORS FRONT TV'S (EX.)	70
	71	RECEPTACLE CONTINENTAL (EX.)				20	1	1	20			O NEW DOOR - TSA MONITOR (EX.)	72
	73	RECEPTACLE CONTINENTAL (EX.)				20	1	1	20			R SERVER FOR NEW DOOR (EX.)	74
	75	RECEPTACLE CONTINENTAL UPS (EX.)				20	1	1	20			O FIRE ALARM PANEL POWER (EX.)	76
	77	RECEPTACLE CONTINENTAL (EX.)				20	1	1	20			O FIRE ALARM PANEL/FIRE AIR COMP. (EX.)	78
	79	SPARE				60	1	1	20			O FIRE ALARM (EX.)	80
	81	SPARE				20	1	1					

