

Bid & Construction Documents
December 18th, 2025

PROJECT MANUAL

FOR

State Center Fire Department
Renovation & Addition- Redesign

115 Main Street E
State Center, Iowa 50247

OWNER

City of State Center
118 Main Street E
State Center, IA 50247

ARCHITECT

Studio Melee
139 4th Street
West Des Moines, Iowa 50265



SECTION 000001 – PROJECT INFORMATION

STATE CENTER FIRE DEPARTMENT – RENOVATION & ADDITION – REDESIGN

PROJECT ADDRESS:

115 Main Street E
State Center, IA 50247

DESIGN PROFESSIONALS:

Architect:

Studio MELEE
139 4th Street
West Des Moines, Iowa 50265
515-460-5431

Structural Engineer:

StructureFy
5550 Wild Rose Lane, Ste. 400
West Des Moines, IA 50266
515-321-6833

Mechanical & Electrical Engineers:

Modus Engineering
130 East 3rd Street, Ste. 300
Des Moines, Iowa 50309
515-412-5308

Civil Engineer:

Clapsaddle-Garber Associates, Inc. (CGA)
16 East Main Street
Marshalltown, IA 50158
641-752-6701 x229

END OF SECTION 000001

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**STATE CENTER FIRE DEPARTMENT
RENOVATION & ADDITION – REDESIGN**

**SEALS & CERTIFICATIONS
Section 000100 Page 1**

ARCHITECT'S CERTIFICATION:

I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly licensed architect under the laws of the state of Iowa.



Christopher P. Wernimont, AIA 07211 18 December 2025
Reg. No. Date
License Expires: June 30th, 2027
Pages or sheets covered by this seal: Divisions 00-13



STRUCTURAL ENGINEER'S CERTIFICATION:

I hereby certify that the Specifications contained herein were prepared by me or under my direct supervision and that I am a duly licensed professional engineer under the laws of the State of Iowa.

18967
Brant J. Bristow, PE, SE Reg. No. Date
License Expires: December 31st, 2027
Pages or sheets covered by this seal: Divisions 03-05

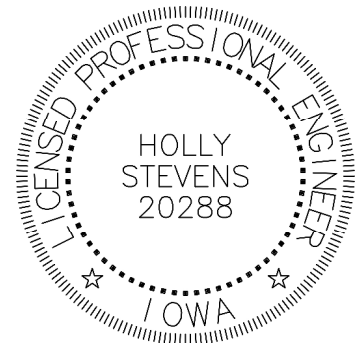


MECHANICAL/ELECTRICAL/PLUMBING ENGINEER'S CERTIFICATION:

I hereby certify that the Specifications contained herein were prepared by me or under my direct supervision and responsible charge. I am a duly licensed professional engineer the laws of the State of Iowa.



Holly M. Stevens, PE 20288 12/18/2025
Reg. No. Date
License Expires: December 31st, 2026
Pages or sheets covered by this seal: Divisions 21-26



**STATE CENTER FIRE DEPARTMENT
RENOVATION & ADDITION – REDESIGN**

**SEALS & CERTIFICATIONS
Section 000100 Page 2**

CIVIL ENGINEER'S CERTIFICATION:

I hereby certify that the Specifications contained herein were prepared by me or under my direct supervision and that I am a duly licensed professional engineer under the laws of the State of Iowa.

	25470	
Brad A. Freeman, PE	Reg. No.	Date
License Expires: <u>December 31st, 2026</u>		
Pages or sheets covered by this seal: <u>Divisions 31-33</u>		



End of Section 000100.

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**STATE CENTER FIRE DEPARTMENT
RENOVATION & ADDITION – REDESIGN**

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DOCUMENT 000110 - ADVERTISEMENT FOR BIDS

1.1 PROJECT INFORMATION

- A. Notice to Bidders: Qualified bidders may submit bids for project as described in this Document. Submit bids according to the Instructions to Bidders.
 - 1. Regulatory Requirements: Chapter 26 of the Iowa Code 'Iowa Construction Bidding Procedures' shall govern submittal, opening, and award of bids.
- B. Project Identification:
 - 1. **State Center Fire Department – Renovation & Addition – Redesign**
Project Location: 115 Main Street East, State Center, Iowa, 50247
- C. Owner:
 - 1. City of State Center; 118 Main Street East, State Center, Iowa, 50247
Owner's Representative: Brad Pfantz, Fire Chief
- D. Design Professionals:
 - 1. Studio MELEE, StructureFy Engineering, Inc., Modus Engineering, Clapsaddle-Garder Associates, Inc.
- E. Project Description: The project includes but is not limited to renovation of the existing fire station and construction of a new addition. Work will involve site improvements, new utility connections, and removal and replacement of paving. Renovation scope includes interior and exterior updates to convert the existing building into administrative & training spaces. The new addition will provide a fire apparatus garage along with a connector linking it to the existing structure.
- F. Construction Contract: Single Contract for General Construction will be awarded.

1.2 BID SUBMITTAL AND OPENING

- A. Owner will receive sealed lump sum bids until the bid time and date at the location given below. Owner will consider bids prepared in compliance with the Instructions to Bidders issued by Owner, and delivered as follows:
 - 1. Bid Date: **Thursday, January 15th, 2026**
 - 2. Bid Time: **2:00pm Local Time**
 - 3. Location: **118 Main Street East, State Center, Iowa 50247**
 - 4. Attention: **Lori Bearden, State Center City Clerk**
- B. Bids will be thereafter publicly opened and read aloud.

1.3 BID BOND

- A. Each bid must be accompanied, in a separate envelope, by a bid bond for 5% of the bid amount with a certified check or bank draft. Performance and payment bonds in the amount of 100% of the contract amount will also be required. No bids may be withdrawn for a period of forty-five (45) days after opening of bids. Owner reserves the right to reject any and all bids and to waive informalities and irregularities.

1.4 PREBID MEETING

- A. Pre-bid Meeting: A Pre-bid meeting for all bidders will be held on **December 30th, 2025, at 10:00am Local Time** at the project site. Prospective bidders are requested to attend; however, the meeting is not mandatory.
 - 1. Bidders' Questions: For additional information contact Chris Wernimont at Studio MELEE by phone at (515) 460-5431 or by email at chris@studiomelee.com.
 - 2. Architect will provide responses to bidder questions via addenda.

1.5 DOCUMENTS

- A. Printed or Online Procurement and Viewing of Contracting Documents:
 - 1. The Contract Documents, including Plans, Specifications, and Form of Contract will be available after **December 18, 2025**, at qualified plan rooms and at the Iowa Reprographics Online Plan Distribution website (iowarepro.com/plan-distributions). Physical copies are available at Iowa Reprographics Print Shop, located at 3 College Avenue, Suite 3; Des Moines, Iowa 50314. Qualified plan houses receive sets free of charge, provided they log all usage of the documents and return them, in a reusable condition, within fourteen (14) days after award of the project. Sets are available for bidding contractors for a deposit of \$200.00 USD, payable to the City of State Center, which shall be refunded, provided that the documents are returned, in a reusable condition, within fourteen (14) days after award of the project. If the Plans, Specifications, and Form of Contract are not returned in a timely manner or in a reusable condition, the deposit shall be forfeited.

1.6 TIME OF COMPLETION

- A. Successful bidder shall begin the Work on receipt of the Notice to Proceed and shall complete the Work within the Contract Time outlined in the project manual.

1.7 BIDDER'S QUALIFICATIONS

- A. Bidders must be properly licensed under the laws governing their respective trades and be able to obtain insurance and bonds required for the Work. A Performance Bond, separate Labor and Material Payment Bond, and Insurance in a form acceptable to Owner will be required of the successful Bidder.

- B. Bidders may be required to provide evidence of experience with similar projects. Before submitting a bid, every bidder must review carefully the Project Manual and Drawings and inspect the site of the proposed work. The City of State Center reserves the right to conduct such investigations as it deems necessary to assist in the evaluation of any bid and to establish the responsibility, qualifications and financial ability of the bidders, proposed subcontractors, and other organizations to perform the work in accordance with the contract documents to its satisfaction within the prescribed time.

1.8 NOTIFICATION

- A. This Advertisement for Bids document is issued by the City of State Center.

END OF DOCUMENT 000110

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DOCUMENT 000115 - NOTICE OF HEARING AND LETTING

Notice of Public Hearing

Notice is hereby given that the City of State Center will hold a public hearing on the proposed Plans, Specifications, and Form of Contract for the construction of the State Center Fire Department – Renovation & Addition – Redesign project. The public hearing will be held at the normally scheduled City Council meeting at 5:30 PM (Central Time) on December 16, 2025, at State Center City Hall located at 118 Main Street East, State Center, Iowa, 50247. Any person interested may appear and file objections to the proposed Plans, Specifications, and Form of Contract for the project described below.

Time and Place for Filing and Opening of Sealed Bid Proposals

Sealed bid proposals will be received by the City of State Center until 2:00 PM (Central Time) on January 15, 2026, at State Center City Hall, located at 118 Main Street East, State Center, Iowa, 50247 for the project described below. Bid Proposals will be opened and read aloud at that time. Only single bid proposals for General Construction will be accepted.

Time and Place Bid Proposals will be Considered

Bid Proposals will be Considered and acted upon by the City of State Center at the normally scheduled City Council meeting at 5:30 PM (Central Time) on January 20, 2026, (or at such later time and place as may then be fixed), at State Center City Hall located at 118 Main Street East, State Center, Iowa, 50247. The Board reserves the right to reject any or all bids, and to waive any or all technicalities or irregularities.

Project Description

The project includes but is not limited to renovation of the existing fire station and construction of a new addition. Work will involve site improvements, new utility connections, and removal and replacement of paving. Renovation scope includes interior and exterior updates to convert the existing building into administrative & training spaces. The new addition will provide a fire apparatus garage along with a connector linking it to the existing structure.

Time for Commencement and Completion of the Project

The Project site will be available to commence work starting on February 2, 2026. The project shall be substantially complete by October 30, 2026, with final completion on or before November 20, 2026.

Documents

The Contract Documents, including Plans, Specifications, and Form of Contract will be available after December 18, 2025, at qualified plan rooms and at the Iowa Reprographics Online Plan Distribution website (iowarepro.com/plan-distributions). Physical copies are available at Iowa Reprographics Print Shop, located at 3 College Avenue, Suite 3; Des Moines, Iowa 50314. Qualified plan houses receive sets free of charge, provided they log all usage of the documents and return them, in a reusable condition, within fourteen (14) days after award of the project. Sets are available for bidding contractors for a deposit of \$200.00 USD, payable to the City of State Center, which shall be refunded, provided that the documents are returned, in a reusable condition, within fourteen (14) days after award of the project. If the Plans, Specifications, and Form of Contract are not returned in a timely manner or in a reusable condition, the deposit shall be forfeited.

Bid Security

Bid Proposals must be accompanied by a bid security of five percent (5%) from bid bond, cashier's check, or certified check in the same amount. The bid security shall be provided to the City of State Center as security that if the bidder is awarded the contract, the bidder will enter into a contract on the form provided by the City of State Center at the price bid and shall furnish the required performance bond, payment bond, and Certificate of Insurance. If the bidder fails to execute the contract and to furnish an acceptable performance bond, payment bond or Certificate of Insurance within ten (10) days after acceptance of the bid, the bid security may be forfeited or cashed by the City of State Center as liquidated damages.

Bidder's Qualifications

Bidders must be properly licensed under the laws governing their respective trades. Bidders may be required to provide evidence of experience with similar project types of similar scale. The City of State Center reserves the right to conduct such investigations as it deems necessary to assist in evaluation of bid proposals and to establish the responsibilities, qualifications, and financial abilities of the proposed bidders, subcontractors, suppliers, or other organizations. By virtue of statutory authority, preference will be given to products and provisions grown and produced within the State of Iowa, and to Iowa domestic labor.

Pre-Bid Meeting and Walkthrough

A Pre-Bid Meeting will be held at 10:00 AM on December 30, 2025, at the Fire Department building located at 115 Main Street East, State Center, Iowa, 50247. It is requested that all prospective bidders visit the project site prior to bid submission, but a site visit is not mandatory. Site visits shall be coordinated with the State Center Fire Department prior to the visit.

1. Bidders' Questions: For additional information contact Chris Wernimont at Studio MELEE by phone at (515) 460-5431 or by email at chris@studiomelee.com.
2. Architect will provide responses to bidder questions via addenda.

Published this 11th day of December, by order of the City of State Center, Iowa.

END OF DOCUMENT 000115

DOCUMENT 000200 - INSTRUCTIONS TO BIDDERS

1.1 INSTRUCTIONS TO BIDDERS

- A. The City of State Center, hereinafter called the “Owner,” has advertised for bids to be submitted for the construction work specified in the advertisement. Proposals to be entitled to consideration shall be in accordance with the following:

1.2 DEFINITIONS

- A. Bids are sums stipulated in Proposals for which Bidders propose to perform the Work.
- B. Unit Prices are sums included in Proposals as Bids per unit measure of materials and/or services, as required in the Bidding Documents.
- C. Proposals are complete, properly executed forms including all information requested by the Owner.
- D. Bidders are qualified contractors who submit Proposals to the Owner for Work as Prime Contractors on the Project.
- E. Bids shall include all applicable costs associated with providing a free and clear product to the owner including, but not restricted to, taxes, crating, shipping costs, delivery to site and installation costs. Also included in the bid costs shall be all demolition and incidental removal of site materials.

1.3 EXAMINATION OF SITE and DOCUMENTS

- A. Each Bidder shall visit the site of the proposed work and shall completely inform themselves related to construction hazards, procedures, labor, and all other conditions and factors, local and otherwise, which would affect prosecution and completion of the work and its cost. All visits to the site shall be coordinated through the Owner. Such considerations shall include, without limitations, the arrangement and condition of existing structures and facilities; the procedure necessary for maintenance of uninterrupted, safe operation, use and occupancy of existing facilities; the availability and cost of labor; and facilities for transportation, handling and storage of materials and equipment. All such factors shall be properly investigated and considered in the preparation of the bid.
- B. Each bidder shall so fully examine the plans and specifications and acquaint themselves with their requirements and with the conditions surrounding the construction on the site that they shall be fully familiar with and informed of all facilities, difficulties, and problems associated with or which might be incurred in the prosecution of the work. In case of disagreement between drawings and specifications or within either document itself, the better quality or greater quantity of work shall be figured in the bid. It shall be the responsibility of the Bidder to direct the attention of the Architect and Owner in writing and at least seventy-two (72) hours prior to the time set for the opening of the bids, any seeming inconsistencies, ambiguous requirements, omissions, or any other matter which seems to require explanation, and to request clarification.

- C. The submission of a bid shall be taken as evidence of compliance with this requirement and as an acknowledgment that the Bidder has received all the required documents and has visited the site. There will be no subsequent financial adjustment for lack of such prior information.

1.4 QUESTIONS & INTERPRETATION

- A. No oral interpretations will be made by anyone to any Bidder as to the true meaning or requirements of any part of the drawings, specifications or other proposed Contract Documents. Every request for an interpretation shall be made in writing and addressed and forwarded to the Architect not later than seven (7) calendar days before the date fixed for opening of bids. The person submitting the request shall be responsible for its prompt delivery.
- B. Every interpretation made to a Bidder will be in the form of an addendum to the Contract Documents, which, if issued, will be sent as promptly as is practicable to all persons to whom the drawings, specifications, and other proposed Contract Documents have been issued. All such addenda shall become part of the Contract Documents and their receipt shall be acknowledged in the Bid Proposal. The Owner will not be responsible for any other explanations or interpretations of the proposed Contract Documents.

1.5 SUBSTITUTIONS

- A. Substitutions of products will be considered in accordance with 016300, and as follows.
- B. Where Bidding Documents stipulate a specific product, a substitute product will be considered when written request is received by Architect by date specified or as follows:
 - 1. Prior to the bid date, substitution requests will be considered if received 10 business days prior to bid date. The approved products will be listed in Addenda.
 - 2. If circumstances do not permit a request to be substituted prior to bid date, the proposed substitution may be submitted after the contract is awarded only under circumstances set forth in Section 016300. All substitution requests shall include the value of additions to or deductions from the contract amount, including the value of revisions to other work required to accommodate the substitution.
- C. Each request shall clearly describe the product for which approval is asked and shall include all data necessary to demonstrate acceptability as outlined in Section 016300.

1.6 PROPOSAL FORMS

- A. Proposal forms included in the specification may be copied and used for submitting proposals. Proposals shall be made upon the forms provided herein. Any Proposal NOT submitted on required forms may be rejected.
- B. Attention is directed to the fact that the Contract Documents contain one complete set of bidding and contract forms; these are sample forms included for the information of Bidders. They are not to be detached from the Contract Documents, filled out or executed.

- C. Special attention is directed to the Form of Bid Bond included in the bidding documents. Additional copies of this form may be secured from the Owner's Representative, but the use of this particular form is not mandatory. Any similar standard form of a recognized responsible surety which contains the same stipulations and guarantees, the same execution of the contract and indemnification of the Owner in case of default, will be acceptable.

1.7 PREPARATION OF PROPOSAL FORMS

- A. All proposal forms must be prepared in single copy and in conformity with and be based upon and submitted subject to all requirements of the Contract Documents. They must be fully completed with all blanks appropriately filled in. Each bid shall be legibly written or printed in ink on the separate form provided. No alterations in bids, or in the printed forms therefore, by erasures, interpolations, or otherwise will be acceptable unless each such alteration is signed or initialed by the Bidder; if initialed, the Owner may require the Bidder to identify any alteration so initialed. No alteration in any bid, or in the form on which it is submitted, shall be made after the bid has been submitted.
- B. It will be the Bidder's responsibility to secure any and all addenda from the Architect. The Bidder will be required to acknowledge receipt of all addenda. Owner reserves the right to reject any bid which is received which has not been based upon all addenda issued by the Architect.
- C. No Bidder may submit more than one bid. Multiple bids under different names will not be accepted from one firm or association.

1.8 BID PERFORMANCE GUARANTIES

- A. Bid security (single copy) in the form of a certified or cashier's check, certified share draft, money or surety bond in the amount of at least five (5%) percent of the bid price, payable without condition or qualification to the City of State Center shall accompany each bid in the OUTER envelope, as evidence of good faith and as a guarantee that if awarded the contract, the Bidder will execute the Contract and give bond as required. The Bidder assumes all responsibility for furnishing acceptable bid security.
- B. Bid security in the form of a bond will be accepted only if from a regularly established firm licensed to write such surety in the State of Iowa.
- C. The bid security of each unsuccessful Bidder will be returned when the Construction Agreement is fully executed. The bid security will be voided but retained by the Owner, if, after the Notice of Contract Award, the Bidder shall enter into a Contract and file a satisfactory performance bond, labor and material payment bond, and certificates of required insurance, all within ten (10) calendar days after the date such notice is given by the Owner. The bid security of the second and third lowest responsible Bidders may be retained for not to exceed forty-five (45) days after opening, pending the execution of the Construction Agreement and submission of bond by the successful Bidder.

- D. This bid security may be retained by the Owner as liquidated damages, if the bid is accepted and a contract thereon is awarded but the successful Bidder fails to enter into a contract in the form prescribed with legally responsible sureties, within ten (10) calendar days after date of Notice of Contract Award is given by the Owner.
- E. The Owner shall require the Bidder to whom a Contract is awarded to furnish to the Owner both Performance and Payment (Labor and Material) bonds in the amount of one hundred (100%) percent of the Contract price, covering the faithful performance of the Contract and the payment of all obligations arising thereunder, and the Bidder will further provide warranties as required by the specifications or General Conditions. Bidder shall include all costs for Performance and Payment (Labor and Material) bonds in the bid amount.
- F. The bonds shall be executed on the forms included with the Contract Documents (forms shall not be removed from the Contract Documents; Bidders may use copies of the bond forms included in the specifications). Accompanying each bond form shall be a "Power of Attorney" authorizing the attorney in fact to bind the surety company and certified to include the date of the bond.
- G. The cost of bonds shall be included in the proposed contract sum.

1.9 LIST OF SUBCONTRACTORS AND SUPPLIERS OF LABOR AND MATERIAL

- A. The bidder is specifically advised that any person, firm or other party to whom it is proposed to award a subcontract under this contract:
 - 1. Must be acceptable to the owner.
 - 2. Must comply with the Bidding Requirements, Conditions of the Contract, and the applicable technical specifications and drawings.
- B. The lowest bidder for each contract shall, within twenty-four (24) hours following the bid opening, provide the Owner with a signed List of Subcontractors and Suppliers of Labor and Material. Subcontractor is any entity performing 1-1/2% or more of the contract value.
- C. The List shall detail the quotations used in the preparation of the bid and whose services are proposed to be used in construction of the project. The List must be complete showing all sections in the Construction Documents. Failure to submit the List may preclude the bid from further consideration by the Owner. The Owner reserves the right to either disclose or not disclose the List of the successful Bidder.
- D. Each Bidder shall identify and fully disclose on the List all those subcontractors and suppliers proposed for the work with which the Bidder is connected either directly or indirectly as part owner, participant in profits and losses or in any other manner financially or economically.

1.10 BACKGROUND INFORMATION

- A. The lowest bidder for each contract shall, within twenty-four (24) hours following the bid opening, provide the Owner with the Background Information included in the Instructions to Bidders. The Contractor must complete and fully disclose all information requested in the Background Information. Failure to submit the Background Information may preclude the bid from further consideration by the Owner.
- B. The Owner may make such investigations as deemed necessary to determine the ability and qualification of the Bidder. Bidders shall submit within twenty-four (24) hours, if requested by the Owner, such evidence of the Bidder's competency and practical knowledge to do the particular work covered by his proposal and of the Bidder's financial responsibility, resources, experience, organization and equipment to complete the proposed work. Failure to comply with this requirement may result in the rejection of consideration of such bid.
- C. In determining the Bidder's qualifications, the following factors, among others, will be considered: work previously completed by the Bidder; the qualifications of the proposed subcontractors for their work; Bidder references; and whether the Bidder (a) maintains a permanent place of business; (b) has adequate plant and equipment to do the work properly and expeditiously; (c) has the financial resources to meet all obligations incident to the work; (d) has appropriate technical experience; and (e) has adequate, competent, experienced staff and supervisors who will be committed to the work until completion.
- D. Each Bidder may be required to show that he has handled former work and that no just claims have been prosecuted or are pending against such work. No bid will be accepted from a Bidder who is engaged on any work which would impair his ability to perform or finance this work or other work in progress.
- E. The Owner reserves the right to reject any bid if the Owner determines, in its sole and absolute discretion, that the Bidder is not properly qualified to carry out the obligations of the Contract and/or to complete the work contemplated by the contract. Conditional bids will not be accepted.

1.11 PERMITS AND FEES

- A. The Contractor shall secure and pay for the general building permit and associated inspection fees required for the execution of the work. Trade contractors will be responsible to obtain and pay for their specialty permits. The Owner may be exempt from paying certain fees and it will be the contractor's responsibility to acquaint themselves with the laws and regulations governing said fees. Attention is directed to the requirements of the General Conditions regarding obtaining permits.

1.12 TAXES

- A. The City of State Center is considered a Designated Exempt Entity by the Iowa Department of Revenue. Suppliers or Subcontractors shall clearly state the EXCLUSION of Iowa Sales and Use Taxes as well as Local Option Sales Taxes (when applicable), as part of their quotations to the Bidding Contractor. Upon request, the Owner will provide the subcontractor or supplier with exemption certificates.

1.13 SIGNATURE OF BIDDERS

- A. Each Bidder shall sign and notarize the proposal form, on the last page of the form, the bid bond, the verification that the contractor can provide the necessary insurance, and the Non-Collusion Affidavit in the places indicated, using its usual signature and giving its full business address. If the Bidder is an individual, the Bidder must sign in individual capacity. Bids by partnerships shall be signed with the partnership name followed by the signature and designation of one of the partners or other authorized representative(s). Bids by corporations shall be signed with the name of the corporation followed by the signature and designation of the president or other person authorized to bind the corporation and attested to by the secretary with corporate seal (if available). Bids by joint ventures shall be signed by each participant in the joint venture or by an authorized agent of each participant. The names of all persons signing should also be typed or printed below the signature. A bid by a person who affixes to his signature the word “president,” “secretary,” “agent,” or other designation without disclosing his principal may be held to be the bid of the individual signing. When requested by the Owner, evidence of the authority of the person signing shall be furnished.

1.14 SUBMISSION OF BIDS

- A. Bid Documents shall be enclosed in two envelopes (OUTER and INNER), each of which shall be sealed and clearly labeled “BID DOCUMENTS” and identified with the description of the work to which the proposal applies; the name of the project; the name and address of the Bidder; and the time of opening bids; all in prominent lettering so as to guard against opening prior to the stipulated time.
- B. The INNER envelope shall include the form of proposal ONLY and shall be marked “BID ENCLOSED”.
- C. The “OUTER envelope” shall include the Bid Bond, the verification that the contractor can provide the necessary insurance, and the Non-Collusion Affidavit along with the INNER envelope.
- D. If the OUTER envelope does NOT include the required documents, the INNER “BID ENCLOSED” envelope will NOT be opened. No responsibility shall attach to any employee of the Owner for the premature opening of any bid not prominently identified. The Bidder shall be responsible for placing his firm name and the name and number, if applicable, of the project and the time of the bidding on the outside of such bid envelope.

- E. The Bid Documents shall be submitted at the time and location as noted in the Invitation to Bid. Bids received after the specified time of closing will be returned unopened.

1.15 WITHDRAWAL OF BIDS

- A. Any Bidder may withdraw his bid if written request for withdrawal signed in the same manner and by the same person who signed the Proposal Form is received by the individual of the City requesting the bids prior to the time established for the opening of the bids.
- B. No Bidder may withdraw his bid for forty-five (45) days after the scheduled time set for the opening thereof, or before award of the Contract, unless said award is delayed for a period exceeding forty-five (45) calendar days.

1.16 MODIFICATIONS

- A. No oral, telephonic, or telegraphic modifications will be considered.

1.17 ACCEPTANCE OF BIDS

- A. Bid opening will be a public letting. Bidders will be informed of the bid results.
- B. The Owner reserves the right to accept the bid which in its judgment is the most responsive responsible and best bid or to reject any and all bids and alternatives and to waive or disregard irregularities or informalities in any bid as it may deem to be in the best interest of the City. The City or its designees may consider as irregular any bid on which there is an alteration of, or departure from, the Proposal Form. All proposals received after the specified time of closing shall be returned unopened.
- C. Final determination of compliance with specifications will rest with the Owner.
- D. Contract shall be considered awarded when the selected bidder receives a written notice from the Owner.

1.18 FORM OF AGREEMENT

- A. The agreement for the work will be written on AIA Form A101-2007 as amended, Standard Form of Agreement between Owner and Contractor, where payment is a stipulated sum.
- B. The contract form is included in Section 000600 Project Forms for bidders to review. Submission of bid indicates bidder's acceptance with said contract format.

1.19 APPLICABLE LAWS AND REGULATIONS

- A. Each Bidder shall familiarize himself with all state and local laws, codes, ordinances, and regulations which might in any manner affect the work to be done; the materials to be supplied; the taxes, permits and fees to be paid; or the labor to be employed in and about the work. Any claim of misunderstanding or ignorance on the part of any successful Bidder will not in any way excuse such Bidder from the necessity of full compliance with every such law, code, ordinance, or regulations. All state laws, codes and regulations and local ordinances, which are applicable, shall be complied with including but not limited to those specified in these documents.

1.20 INSURANCE

- A. Contractors shall include the following insurance:
1. Contractor's Liability Insurance: \$1,000,000 per claim, \$2,000,000 aggregate.
 2. Worker's Compensation Insurance: Contractor shall provide Worker's Compensation Insurance to cover the statutory limits of the Worker's Compensation laws of the state in which any work is to be performed.
 3. Employer's Liability Insurance:
 - a. Accident for bodily Injury: \$500,000 per occurrence
 - b. Accident for bodily Injury by disease: \$500,000 per occurrence
 - c. Policy limit for bodily injury by disease: \$500,000
 - d. Policy should include "all states" coverage
 4. Automotive Liability Insurance: \$1,000,000 combined single limit each accident
 - a. Includes owned, non-owned and hired vehicles.
 - b. Covers both property damage and bodily injury.
- B. Throughout the life of the contract, the Contractor will be required to carry the types and amounts of insurance named in the General Conditions, as described above and as described in section 000600.

1.21 CONTRACTOR'S LICENSE

- A. Any successful Bidder may be required by the Owner to obtain the necessary and applicable Contractor's License from all appropriate governmental authorities and if required, shall not allow any subcontractor to commence work on his subcontract until all similar provisions required of the subcontractor have been obtained and approved.

1.22 POST-BID INTERVIEWS

- A. Bidders in contention for contract awards may be asked to attend Post-Bid Interviews, submit Post-Bid Submittals in rough draft for review.

END OF DOCUMENT 000200

**STATE CENTER FIRE DEPARTMENT
RENOVATION & ADDITION – REDESIGN**

**FORM OF PROPOSAL
Section 000210 - Page 1**

DOCUMENT 000210 – FORM OF PROPOSAL

PROJECT NAME: State Center Fire Department – Renovation & Addition – Redesign
115 Main Street East
State Center, Iowa 50247

TO: City of State Center
118 Main Street East
State Center, Iowa 50247

SUBMITTED BY: _____
Name of Bidder

City of State Center:

The undersigned has carefully examined the site, the proposed Contract Documents prepared by Studio MELEE, StructureFy Engineering, Inc., Modus Engineering, Clapsaddle-Garber Associates, Inc. pertinent to the construction of the above referenced Project. Further, being familiar with all other conditions affecting the Work, the undersigned hereby proposes and agrees to furnish and provide all labor, materials, supervision, transportation, tools, equipment, services and other facilities necessary and required for the expeditious completion of the Work indicated above in strict conformity with said conditions and documents.

The undersigned has reviewed the work outlined in the documents and fully understands the scope of work required in this Proposal. The undersigned acknowledges that the Proposal includes the work of all trades required for the work. The undersigned understands that each bidder who is awarded a Contract shall be in fact a Prime Contractor, not a Subcontractor to the City of State Center.

The undersigned agrees to complete the work required within the time indicated in the documents.

Enclosed **in a separate envelope** is a Non-Collusion Affidavit, verification that the contractor can provide the necessary insurance, and a Bid Security for five percent (5%) of the amount of the Base Bid, made payable to the order of the City of State Center. It is to be left in escrow with the Owner as a guarantee that the undersigned will enter into a Contract and will furnish the specified insurance and bonds. The undersigned has notified the Owner Representative of any discrepancies or omissions, or of any doubt about the meaning of any of the Contract Documents and has contacted the Owner Representative before bid date to verify the issuing of any clarifying Addenda.

The undersigned further acknowledges receipt of the following Addenda:

NO. _____ DATE _____

NO. _____ DATE _____

NO. _____ DATE _____

(Bidder must acknowledge All Addenda issued)

Contractor Name

PROPOSAL FORM TO BE SUBMITTED IN INNER ENVELOPE

BASE BID – General Construction

BASE BID: _____ Dollars (\$ _____)

The undersigned proposes to provide and construct the Work required, in accordance with said Contract Documents for the lump sum price indicated above and agrees to complete the work in accordance with the schedule requirement to achieve Substantial Completion no later than the date indicated in the Project Manual Section 000310. (Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern).

SCHEDULE OF BID ALTERNATES

ALTERNATE NO 1: XXX.

The undersigned proposes to provide work under this alternate as described for the lump sum price of:

(DEDUCT) _____ Dollars

(\$ _____), **EXCLUDING SALES TAXES.**

Contractor Name

PROPOSAL FORM TO BE SUBMITTED IN INNER ENVELOPE

LIST OF SUBCONTRACTORS AND SUPPLIERS OF LABOR AND MATERIAL

The lowest bidder for each contract shall, within twenty-four (24) hours following the bid opening, provide the Owner with the List of Subcontractors and Suppliers of Labor and Material. Subcontractor is any entity performing 1-1/2% or more of the contract value. The List shall detail the quotations used in the preparation of the bid and whose services are proposed to be used in construction of the project. The List must be complete showing all sections in the Construction Documents. Failure to submit the List may preclude the bid from further consideration by the Owner. The Owner reserves the right to either disclose or not disclose the List of the successful Bidder.

Each Bidder shall identify and fully disclose on the List all those subcontractors and suppliers proposed for the work with which the Bidder is connected either directly or indirectly as part owner, participant in profits and losses or in any other manner financially or economically.

The forms for the List of Subcontractors and Suppliers of Labor and Materials are included in the Instructions to Bidders, Section 000200.

AGREEMENT

It is understood and agreed that if written notice of the Owner's acceptance of this proposal is mailed, telegraphed, or delivered to the undersigned after the opening of the bid, and within forty-five (45) days, or at any time thereafter before this bid is withdrawn, the undersigned will execute and deliver to the Owner an Agreement in accordance with the bid as accepted. The undersigned will also furnish and deliver to the Owner the Payment Bond, Performance Bond and Certificate of Insurance as specified in the Contract Documents, all within ten (10) working days after receipt of Notice of Contract Award. The work under the Contract shall be commenced by the undersigned bidder, if awarded the Contract, on the date to be stated in a Notice to Proceed, issued to the Contractor and shall be completed by the Contractor in the time specified in the Contract Documents. In the event the bidder to whom an award is made fails or refuses to execute the Contract within the specified time frame; the Owner may declare the bidder's bid security forfeited as damages caused by the failure of the bidder to enter into the Contract.

If this proposal is determined to be (preliminarily) the lowest responsible bid, the undersigned shall submit a listing of subcontractors and major materials suppliers in accordance with the Instructions to Bidders, Section 000200 within 24 hours of being notified of such finding by the Owner Representative.

The undersigned acknowledges the fact that the Owner reserves the right to accept or reject any and all proposals, to waive any informality in receipt of this proposal, with or without cause or reason, and award the Contract on the basis stated in the Instructions to Bidders.

The bidder is () or is not () an Iowa resident bidder as defined in Section 73A.21 of the Iowa code. If not a resident bidder, the bidder states that it is a non-resident bidder from the state of _____. This state does () or does not () provide for a bidder preference for resident bidders. This state does () or does not () provide a labor preference for resident labor. If the state in which your company is a resident allows for either a bidder preference or a labor preference, please provide the citation to the code section, and the details of each preference allowed in your resident state.

NOTE: If bidder is a corporation, the legal name of the corporation shall be set forth below, together with the signatures of authorized officers or agents. If bidder is a partnership, the true name of the firm shall be set forth below together with the signature of the partner or partners authorized to sign contracts on behalf of the partnership. If bidder is an individual, his signature shall be placed below.

Contractor Name

PROPOSAL FORM TO BE SUBMITTED IN INNER ENVELOPE

**STATE CENTER FIRE DEPARTMENT
RENOVATION & ADDITION – REDESIGN**

**FORM OF PROPOSAL
Section 000210 - Page 4**

PROPOSAL SUBMITTED BY: _____
(Name of Bidder)

Address: _____

Phone #: _____ Email: _____

Contractors, License No.: _____
Signature

License Expiration Date: _____
Position

If Corporation: State of Incorporation: _____

AFFIX CORPORATE SEAL HERE
(IF APPLICABLE)

THIS STATEMENT MUST BE NOTARIZED.

STATE OF IOWA, _____ COUNTY, ss:

Subscribed and sworn to before me by the said _____ on this
_____ day of _____, 20__.

Notary Public in and for the State of Iowa

Contractor Name

END OF DOCUMENT 000210

PROPOSAL FORM TO BE SUBMITTED IN INNER ENVELOPE

NON-COLLUSION AFFIDAVIT
Section 000220 - Page 1

State Center Fire Department – Renovation & Addition – Redesign
Copyright Studio MELEE 2025

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DOCUMENT 000230 – BIDDER STATUS FORM

PART A - To be completed by all bidders.

Please circle **YES** or **NO** for each of the following:

YES	NO	My company is authorized to transact business in Iowa. (To help you determine if your company is authorized, please review the “Authorization to Transact Business Worksheet” document 000240).

YES	NO	My company has an office to transact business in Iowa.

YES	NO	My company’s office in Iowa is suitable for more than receiving postal mail, telephone calls, and e-mails.

YES	NO	My company has been conducting business in Iowa for at least 3 years prior to the first request for bids on this project.

YES	NO	My company is not a subsidiary of another business entity or my company is a subsidiary of another business entity that would qualify as a resident bidder in Iowa.

If you answered “YES” for each question above, your company
qualifies as a resident builder. Please complete Parts B & D of this form.

If you answered “NO” to one or more questions above, your company is a
non-resident bidder. Please complete Parts C & D of this form.

PART B - To be completed by all resident bidders.

My company has maintained offices in Iowa during the past 3 years at the following addresses:

Dates: ____ / ____ / ____ to ____ / ____ / ____ Address: _____

City, State, Zip: _____

Dates: ____ / ____ / ____ to ____ / ____ / ____ Address: _____

City, State, Zip: _____

Dates: ____ / ____ / ____ to ____ / ____ / ____ Address: _____

City, State, Zip: _____

You may attach additional sheet(s) if needed.

PART C - To be completed by all non-resident bidders.

1. Name of the home state or foreign country reported to the Iowa Secretary of State:

2. Does your company's home state or foreign country offer preferences to resident bidders, resident labor force preferences or any other type of preference to bidders or laborers?

YES NO

3. If you answered "YES" to question 2, identify each preference offered by your company's home state or foreign country and the appropriate legal citation.

You may attach additional sheet(s) if needed.

PART D - To be completed by all bidders.

I certify that the statements made on this document are true and complete to the best of my knowledge and I know that my failure to provide accurate and truthful information may be a reason to reject my bid.

First Name: _____

Signature: _____ Date: _____

You must submit the completed form to the governmental body requesting bids per 875 Iowa Administrative Code Chapter 156. This form has been approved by the Iowa Labor Commissioner.

END OF DOCUMENT 000230

DOCUMENT 000310 - PRELIMINARY SCHEDULE

1.1 PROJECT SCHEDULE

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Contractor convenience and are intended to supplement rather than serve in lieu of Contractor's own investigations. They are made available for Contractor's convenience and information, but do not affect Contract Time requirements. This Document and its attachments are not part of the Contract Documents.

B. Preliminary Project Schedule is as follows:

1. Contractor Procurement:

a.	Dec. 11, 2025:	Notice of Hearing & Letting
b.	Dec. 16, 2025: @ 5:30 PM	Public Hearing & Approval to Release Bid Documents
c.	Dec. 18, 2025:	Bid Documents Issued
d.	Dec. 30, 2025: @ 10:00 AM	Pre-Bid Meeting and Walkthrough
e.	Jan. 15, 2026: @ 2:00 PM	Bids Submittal and Public Opening
f.	Jan. 20, 2026: @ 5:30 PM	Notice of Award of Selected Contractor(s)

2. Construction:

a.	Feb. 02, 2026:	Commencement of Work
b.	Oct. 30, 2026:	Substantial Completion
c.	Nov. 20, 2026:	Final Completion of Work

END OF DOCUMENT 000310

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DOCUMENT 000330 - EXISTING CONDITIONS

1.1 EXISTING CONDITION INFORMATION

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of the Bidders' own investigations. They are made available for Bidders' convenience and information but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.
- B. Existing drawings that include information on existing conditions, including previous construction at the Project site, are available electronically by reaching out to Studio MELEE's Office at 139 4th Street, West Des Moines, IA. These drawings were used in coordinating the design as presented in the bid documents.
- C. Information on existing conditions including previous construction at Project site is available for electronic viewing by reaching out to Studio MELEE's Office at 139 4th Street, West Des Moines, IA.
- D. Each bidder shall visit the site and be familiar with the existing conditions as described in the Instructions to Bidders. Project site visits outside of the Pre-Bid Walkthrough can be scheduled with the District up until the week of bidding.
- E. Related Requirements:
 - 1. Document 000200 "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.
- F. No representation or warranty is made by the Architect or the owner of the adequacy or contents of this information available to bidders. Information available to the bidders is not part of the contract documents. The Architect has no responsibility for the discovery, presence, handling, disposal of, or exposure to, hazardous materials or toxic substances, in any form, on the project site. If unanticipated hazardous materials are encountered, do not proceed with demolition. Immediately contact the owner.
- G. END OF DOCUMENT 000330

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DOCUMENT 000430 - BID SECURITY FORMS

1.1 PROPOSAL FORM SUPPLEMENT

- A. A completed bid bond form is required to be attached to the Proposal Form.

1.2 BID BOND FORM

- A. AIA Document A310, "Bid Bond," is the recommended form for a bid bond. A bid bond acceptable to Owner, or other bid security as described in the Instructions to Bidders, is required to be attached to the Proposal Form as a supplement.
- B. Copies of AIA standard forms is attached and may be obtained from The American Institute of Architects; www.aia.org/contractdocs/purchase/index.htm;

Email: docspurchases@aia.org; 1 (800) 942-7732.

END OF DOCUMENT 000430

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DOCUMENT 000431 – PERFORMANCE AND PAYMENT BOND FORMS

1.1 BID BOND FORM

- A. AIA Document A312, "Performance Bond" and "Payment Bond" are the recommended forms for a Performance and Payment (Labor and Material) Bond. A bid bond acceptable to Owner, or other bid security as described in the Instructions to Bidders, is required to be attached to the Proposal Form as a supplement.
- B. Copies of AIA standard forms are attached and may be obtained from The American Institute of Architects; www.aia.org/contractdocs/purchase/index.htm;

Email: docspurchases@aia.org; 1 (800) 942-7732.

END OF DOCUMENT 000431

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DOCUMENT 000435 - SCHEDULE OF VALUES

1.1 BID FORM SUPPLEMENT

- A. A completed Proposed Schedule of Values form is required to be provided within five (5) days of project award.

1.2 PROPOSED SCHEDULE OF VALUES FORM

- A. Proposed Schedule of Values Form: Provide a breakdown of the bid amount, in enough detail to facilitate continued evaluation of bid. Provide separate line items for Labor and Material for each item of content. Coordinate with the Project Manual Table of Contents. Provide multiple line items for principal material and subcontract amounts in excess of (5%) Five percent of the Contract Sum.
- B. Arrange schedule of values consistent with format of AIA Document G702 or similar form approved by Owner.
 - 1. Copies of AIA standard forms may be obtained from the American Institute of Architects; <http://www.aia.org/contractdocs/purchase/index.htm>;

Email: docspurchases@aia.org; 1 (800) 942-7732.

END OF DOCUMENT 000435

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DOCUMENT 000440 - BID SUBMITTAL CHECKLIST

1.1 BID INFORMATION

- A. Bidder: _____
- B. Project Name: State Center Fire Department – Renovation & Addition – Redesign
- C. Project Locations: 115 Main Street East, State Center, Iowa, 50247
- D. Owner: City of State Center, 118 Main Street East, State Center, Iowa, 50247
- E. Design Professionals: Studio MELEE, StructureFy Engineering, Inc., Modus Engineering, Clapsaddle-Garder Associates, Inc.

1.2 BIDDER'S CHECKLIST

- A. In an effort to assist the Bidder in properly completing all documentation required, the following checklist is provided for the Bidder's convenience. The Bidder is solely responsible for verifying compliance with bid submittal requirements.

B. Attach this completed checklist to the outside of the Submittal envelope:

- ☐ Label the inner bid envelope: "BID ENCLOSED" and include the Proposal Form.
- ☐ Prepare the Proposal Form as required by the Instructions to Bidders.
- ☐ Indicate on the Proposal Form all the Addenda received.

Label both inner and outer bid envelope with:

- ☐ Description and name of the Project.
- ☐ Name, Contractor's License Number, and Address of the Bidder.
- ☐ Time and date of opening bids.

Outer bid envelope includes the inner bid envelope along with:

- ☐ Bid bond (bid security) to verify that the Bidder can provide an executed Performance Bond and Payment Bond after the Notice of Award.
- ☐ Documentation to verify that the Bidder can provide Certificates of Insurance in the types and amounts indicated.
- ☐ Non-collusion affidavit.

END OF DOCUMENT 000440

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DOCUMENT 000510 - NOTICE OF AWARD

1.1 BID INFORMATION

- A. Bidder: _____
- B. Bidder's Address: _____
- C. Project Name: State Center Fire Department – Renovation & Addition – Redesign
- D. Project Location: 115 Main Street East, State Center, Iowa, 50247
- E. Owner: City of State Center, 118 Main Street East, State Center, Iowa, 50247
- F. Design Professionals: Studio MELEE, StructureFy Engineering, Inc., Modus Engineering, Clapsaddle-Garder Associates, Inc.

1.2 NOTICE OF AWARD OF CONTRACT

- A. Notice: The above Bidder is hereby notified that their bid, dated _____ for the above Contract has been considered and the Bidder is hereby awarded a contract for the State Center Fire Department – Renovation & Addition – Redesign – Base Bid.
- B. Contract Sum: _____ dollars
(amount in written form)
\$ _____
(amount in number form)

1.3 EXECUTION OF CONTRACT

- A. Contract Documents: Copies of the documents will be made available to the Bidder immediately. The Bidder must comply with the following conditions precedent within (10) ten days of the above date of issuance of the Notice:
 - 1. Deliver to Owner (3) three sets of fully executed copies of the documents.
 - 2. Deliver with the executed Bonds and Certificates of Insurance required by the documents.
- B. Compliance: Failure to comply with conditions of this Notice within the time specified will entitle Owner to consider the Bidder in default, annul this Notice, and declare the Bidder's Bid security forfeited.
 - 1. Within (10) ten days after the Bidder complies with the conditions of this Notice, Owner will return to the Bidder one fully executed copy of the documents.

1.4 NOTIFICATION

A. This Notice is issued by:

Owner: City of State Center

Authorized
Signature:

(Handwritten signature)

Signed By:

(Type or print name)

Title:

(Mayor of State Center)

END OF DOCUMENT 000510

SECTION 000600 - PROJECT FORMS

1.1 FORM OF AGREEMENT AND GENERAL CONDITIONS

- A. The following form of Owner/Contractor Agreement and form of the General Conditions shall be used for Project:
 - 1. AIA Document A102-2017, "Standard Form of Agreement between Owner and Contractor where the basis of payment is the Cost of the Work Plus a Fee with a Guaranteed Maximum Price."
 - 2. AIA Document A201-2017, "General Conditions of the Contract for Construction"

1.2 ADMINISTRATIVE FORMS

- A. Administrative Forms: Additional administrative forms are specified in Division 01 General Requirements.
- B. Copies of AIA standard forms may be obtained from the American Institute of Architects; <http://www.aia.org/contractdocs/purchase/index.htm>; Email: docspurchases@aia.org; 1 (800) 942-7732.
- C. Contract Performance Bond & Contract Payment Bond:
 - 1. Performance Bond Forms: AIA Document A312-2010, "Performance Bond"
 - 2. Payment Bond Forms: AIA Document A312-2010, "Payment Bond"
- D. Information and Modification Forms: *Similar approved forms may be used.*
 - 1. Change Order Form: AIA Document G701-2017, "Change Order."
 - 2. Request for Information: Created by Contractor.
 - 3. Construction Change: AIA Document G714-2017 "Construction Change Directive"
 - 4. Substitution Request Form: Document 016300: "Substitution Request Form"
- E. Payment Forms: *Similar approved forms may be used.*
 - 1. Schedule of Values Form: AIA Document G702GMP-2021, "Application and Certificate for Cost of the Work Projects with a Guaranteed Maximum Price" and Continuation Sheet for Cost of the Work Projects.

END OF SECTION 000600

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SECTION 011000 - SUMMARY

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:

1. Project information.
2. Work Covered by Documents.
3. Work by Owner.
4. Work Under Separate Contracts.
5. Work NOT Covered by Documents.
6. Owner-furnished products.
7. Access to the Site.
8. Coordination with Occupants.
9. Work restrictions.
10. Specification and drawing conventions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification:

1. State Center Fire Department – Renovation & Addition – Redesign
Project Location: 115 Main Street East, State Center, Iowa, 50247

B. Owner:

1. City of State Center; 118 Main Street East, State Center, Iowa, 50247
Owner's Representative: Brad Pfantz, Fire Chief

C. Design Professionals:

1. Studio MELEE, StructureFy Engineering, Inc., Modus Engineering, Clapsaddle-Garder Associates, Inc.

1.4 WORK COVERED BY DOCUMENTS

- A. Project Description: The project includes but is not limited to renovation of the existing fire station and construction of a new addition. Work will involve site improvements, new utility connections, and removal and replacement of paving. Renovation scope includes interior and exterior updates to convert the existing building into administrative & training spaces. The new addition will provide a fire apparatus garage along with a connector linking it to the existing structure.
- B. Type of Contract:
 - 1. Project will be constructed under prime general contractor.

1.5 WORK BY OWNER

- A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.
- B. Subsequent Work: Owner will perform the following additional work at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.
 - 1. Installation of marker boards, tackboards, and other admin furnishings.
 - 2. Installation of washer & dryer equipment.
 - 3. Installation of kitchen equipment.
 - 4. Installation of apparatus bay gear lockers.
 - 5. Installation of apparatus bay work bench.
 - 6. Installation of apparatus bay fire department & EMS free-standing equipment (air compressor, tank fill, equipment drying cabinet, mini-split mechanical unit)

1.6 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products.
- B. Owner-Furnished Products:
 - 1. Locker room storage lockers.

1.7 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

- B. Concurrent Work: Owner will award a separate contract for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract:
1. Installation of A/V equipment, devices, TVs, and low-voltage cabling, unless otherwise indicated in the documents.
 2. Installation of access controls and security camera systems, unless otherwise indicated in the documents.
 3. Plymovent, Direct-Capture Exhaust System by Air Cleaning Technologies, Inc.
 4. Exterior building signage.
- C. Note that the contractor is responsible for coordinating with Owner's A/V contractor/installer, security & access controls contractor/installer, Signage contractor & installer (for exterior signage only) and Direct-Capture Exhaust System (Plymovent) installer, and the State Center Fire Department to determine the project's overall timing, schedule, and phasing.

1.8 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Use of Site: Limit use of Project site to work in areas or areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
1. Limits: Confine construction operations to areas designated.

Note: the Union-Pacific railroad owns and maintains the tracks and adjoining easements just north of the fire station property. It is recommended that work does not interfere with this property unless necessary. If deemed necessary, it will be the Contractor's responsibility to notify and obtain permission in writing from the railroad to access and/or gain use of the property.
 2. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
 - c. Schedule work & deliveries around Owner's scheduled events & activities.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.9 COORDINATION WITH OCCUPANTS

- A. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
 - 1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
 - 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
 - 3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
 - 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.10 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work to typical business working hours of 7:30 AM to 5:30 PM, Monday through Friday, unless otherwise agreed upon with Owner.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than (48) forty-eight hours in advance of proposed utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
 - 1. Notify Owner not less than (48) forty-eight hours in advance of proposed disruptive operations.
- E. Controlled Substances: Use of tobacco or nicotine products (smoking and vaping) and other controlled substances is not permitted on City property. Smoking and vaping shall be taken to the street front ROW.
- F. Employee Identification: Provide identification tags or apparel with company identification for Contractor personnel working on Project site. Personnel shall have some form of visible identification at all times while on the job site.

- G. Employee Screening: Comply with Owner's requirements for drug, sex-offender, and background screening of Contractor personnel working on Project site.
 - 1. Maintain list of approved screened personnel with Owner's representative.

1.11 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The 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. Imperative mood and streamlined language are generally used in the Specifications. 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.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and/or as scheduled on Drawings.
 - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

END OF SECTION 011000

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SECTION 012100 - ALLOWANCES

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 governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Contingency, Lump-sum allowance.
- C. Related Requirements:
 - 1. Section 012200 "Unit Prices" for procedures for using unit prices.
 - 2. Section 01400 "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.

1.3 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

1.4 ACTION SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.5 INFORMATIONAL SUBMITTALS

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.7 UNIT-COST AND QUANTITY ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include, freight, and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - 1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.8 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
 - 3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.

4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
 5. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- A. Allowance No. 1: Contingency Allowance: General Contractor shall include a lump-sum allowance of thirty-thousand dollars (\$30,000.00) for removal & disposal of unsatisfactory soil and replacement with imported fill.
1. This allowance includes removal & disposal of unsatisfactory materials, cost of new materials, receiving, handling, and installation, and Contractor overhead and profit.

END OF SECTION 012100

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SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This project may require extended work hours in order to meet the completion date. See Specification Section 00210 for Phasing and Schedule Requirements.
- B. 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 unit prices.
- B. Related Requirements:
 - 1. Section 01280 for procedures for submitting and handling Change Orders.
 - 2. Section 01400 "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

- A. Unit price is a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price 1: Removal of Unsatisfactory Soils.

1. Description: Removal & disposal of unsatisfactory soil and replacement with imported fill. Fill material shall be provided as recommended by geotechnical engineer in subsoil investigation report, attached for reference.
2. Unit of Measurement: Per cubic yard, based on quantity removal & replacement required.

END OF SECTION 012200

SECTION 012300 - ALTERNATES

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 administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A schedule of alternates is included at the end of this Section.

1. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Add Alternate No. 1: Remove & Replace Mid-Section of PCC Pavement in Main Street.

1. On Civil sheets C.110 Existing Conditions & Demolition Plan and C.200 Site Layout & Utility Plan, remove existing PCC pavement and all associated curbs to extents indicated. Provide new 7" PPC pavement and curbs over prepared granular subbase and subgrade as indicated and detailed.

END OF SECTION 012300

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

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 handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.

- d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Quotation Form: Use forms acceptable to Owner & Architect.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Include costs of labor and supervision directly attributable to the change.
 - 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - 6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
 - 7. Proposal Request Form: Use form acceptable to Owner & Architect.

1.5 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.7 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

END OF SECTION 012600

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SECTION 012900 - PAYMENT PROCEDURES

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 necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of Contractor's construction schedule.

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Construction Manager at earliest possible date, but no later than (5) five days before the date scheduled for submittal of initial Applications for Payment.

- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one-line item for each Specification Section.
1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Contractor's name and address.
 - d. Date of submittal.
 2. Arrange schedule of values consistent with format of AIA Document G702 and its corresponding continuation sheet.
 3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
 4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of (5%) five percent of the Contract Sum.
 5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
 6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
 7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
 8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

- a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
- 9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.
- 10. Submit updated project schedule with each Application for Payment.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by Owner.
 - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Application for Payment Forms: Use of AIA Document G702 or other forms acceptable to the Architect and Owner for Applications for Payment. Submit forms for approval with initial submittal of schedule of values.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 - 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 - 3. Include amounts of Change Orders and Construction Change Directives issued before the last day of construction period covered by application.
 - 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored but not yet installed. Differentiate between items stored on-site and items stored off-site.
 - 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.

2. Provide supporting documentation that verifies the amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Transmittal: Submit (1) One signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt. Transmittals shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. Submittal schedule (preliminary if not final).
 6. List of Contractor's staff assignments.
 7. List of Contractor's principal consultants.
 8. Copies of building permits.
 9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 10. Initial progress report.
 11. Report of preconstruction conference.
 12. Certificates of insurance and insurance policies.

13. Performance and payment bonds.
14. Data needed to acquire Owner's insurance.
- I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
 1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
 1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

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SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

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 provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
 - 1. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 2. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

- A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.

- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
 - 1. Post copies of list in project meeting room, in temporary field office, by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in 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 ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in 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 with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Pre-installation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.
- E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationships of various systems and components.
 - b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - f. Indicate required installation sequences.
 - g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate sub framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
7. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
8. Fire-Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
 1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
 2. File Preparation Format: DWG, operating in Microsoft Windows operating system.
 3. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format OR PDF format.
 4. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.

1.7 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Architect.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

- a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: AIA Document G716 OR Software-generated form with substantially the same content as indicated, acceptable to Architect.
 - 1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow 5 working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
 - 1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 - 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 - 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
 - 1. Project name.
 - 2. Name and address of Contractor.
 - 3. Name and address of Architect.
 - 4. RFI number including RFIs that were returned without action or withdrawn.
 - 5. RFI description.
 - 6. Date the RFI was submitted.
 - 7. Date Architect's response was received.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within 5 days if Contractor disagrees with response.
 - 1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.8 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 5 days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
 1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Lines of communications.
 - f. Procedures for processing field decisions and Change Orders.
 - g. Procedures for RFIs.
 - h. Procedures for testing and inspecting.
 - i. Procedures for processing Applications for Payment.
 - j. Distribution of the Contract Documents.
 - k. Submittal procedures.
 - l. Historical Tax Credit & LIHTC requirements.
 - m. Preparation of record documents.
 - n. Use of the premises and existing building.
 - o. Work restrictions.
 - p. Working hours.
 - q. Owner's occupancy requirements.
 - r. Responsibility for temporary facilities and controls.
 - s. Procedures for moisture and mold control.

- t. Procedures for disruptions and shutdowns.
 - u. Construction waste management and recycling.
 - v. Parking availability.
 - w. Office, work, and storage areas.
 - x. Equipment deliveries and priorities.
 - y. Security.
 - z. Progress cleaning.
 - 4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Pre installation Conferences: Conduct a pre installation conference at Project site before each construction activity that requires coordination with other construction.
- 1. Attendees: 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 Architect of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
 - 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 30 days prior to the scheduled date of Substantial Completion.
 1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for completing Historic Tax Credit documentation.
 - e. Requirements for completing LIHTC documentation.
 - f. Requirements for preparing operations and maintenance data.
 - g. Requirements for delivery of material samples, attic stock, and spare parts.
 - h. Requirements for demonstration and training.
 - i. Preparation of Contractor's punch list.
 - j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - k. Submittal procedures.
 - l. Coordination of separate contracts.
 - m. Owner's partial occupancy requirements.
 - n. Installation of Owner's furniture, fixtures, and equipment.
 - o. Responsibility for removing temporary facilities and controls.
 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at regular intervals.
 1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or

behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

- 1) Review schedule for next period.
- b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Status of Historic Tax Credit and LIHTC documentation.
 - 6) Deliveries.
 - 7) Off-site fabrication.
 - 8) Access.
 - 9) Site utilization.
 - 10) Temporary facilities and controls.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Status of correction of deficient items.
 - 14) Field observations.
 - 15) Status of RFIs.
 - 16) Status of proposal requests.
 - 17) Pending changes.
 - 18) Status of Change Orders.
 - 19) Pending claims and disputes.
 - 20) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- F. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and pre installation conferences.
 1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
 - c. Review present and future needs of each contractor present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site utilization.
 - 9) Temporary facilities and controls.
 - 10) Work hours.
 - 11) Hazards and risks.
 - 12) Progress cleaning.
 - 13) Quality and work standards.
 - 14) Change Orders.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

END OF SECTION 013100

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SECTION 013300 - SUBMITTAL PROCEDURES

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 requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Section 012100 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled date of fabrication.
 - h. Scheduled dates for purchasing.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings.
 - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
 4. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- D. Paper OR Electronic Submittals: Place a permanent label or title block on each submittal item for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Include the following information for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Name of subcontractor.
 - f. Name of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Location(s) where product is to be installed, as appropriate.

- I. Other necessary identification.
- E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
 - 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 - 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
 - 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 - 4. Metadata: Include the following information as keywords in the electronic submittal file metadata:
 - a. Project name.
 - b. Number and title of appropriate Specification Section.
 - c. Manufacturer name.
 - d. Product name.
- F. Options: Identify options requiring selection by Architect.
- G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Submit electronic submittals via email as PDF electronic files.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - 2. Action & Informational Submittals: Submit 2 paper copies of each submittal unless otherwise indicated. Architect will return 1 copy.
 - 3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
 - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard published data is not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 - 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.

- d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.
 6. Submit Product Data in the following format:
 - a. PDF electronic file.
 - b. 2 paper copies of Product Data unless otherwise indicated. Architect will return 1 copy.
 - C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
 - b. 2 opaque (bond) copies of each submittal. Architect will return 1 copy.
 - D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.
 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity.

Sample sets may be used to determine final acceptance of construction associated with each set.

- a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit 1 full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit 2 sets of Samples. Architect will retain 1 Sample set; remainder will be returned.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least 3 sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 1. Type of product. Include a unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
 5. Submit product schedule in the following format:
 - a. PDF electronic file.
 - b. 2 paper copies of product schedule or list unless otherwise indicated. Architect will return 1 copy.

- F. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."
- I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
- K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

- T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and 2 paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

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 quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. Specific test and inspection requirements are not specified in this Section.
- C. Related Requirements:
 - 1. Section 012100 "Allowances" for testing and inspecting allowances.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
 - 1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of 5 previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two 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 conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

- B. 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 requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

- A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
 - 1. Indicate manufacturer and model number of individual components.
 - 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than 5 days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 - 1. Project quality-control manager may also serve as Project superintendent.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
 - 2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.

7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and re-inspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For 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.

1.9 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.
 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 2. Notify Architect 7 days in advance of dates and times when mockups will be constructed.
 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow 7 days for initial review and each re-review of each mockup.
 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 7. Demolish and remove mockups when directed unless otherwise indicated.
- L. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

1.10 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 - 2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
 - 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - 2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 - 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 - 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 - 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in pre-installation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.

- F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform any duties of Contractor.
- G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Engage a qualified testing agency and/or special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
 - 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
 - 2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 - 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
 - 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 - 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 - 6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ACCEPTABLE TESTING AGENCIES

- A. Agency shall be reviewed and approved by Owner and Architect prior to contract.

3.2 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.3 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

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SECTION 014100 - REFERENCES

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 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction 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 standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AGA	American Gas Association www.aga.org	(202) 824-7000
AHRI	Air-Conditioning, Heating, and Refrigeration Institute, The www.ahrinet.org	(703) 524-8800
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100

**STATE CENTER FIRE DEPARTMENT
RENOVATION & ADDITION – REDESIGN**

**REFERENCES
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AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)	
ASHRAE	American Society of Heating, Refrigerating and Air- Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (973) 882-1170
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9500
CSI	Construction Specifications Institute (The) www.csinet.org www.fluidsealing.com	(800) 689-2900 (703) 684-0300
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
ICBO	International Conference of Building Officials www.iccsafe.org	(888) 422-7233
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980

**STATE CENTER FIRE DEPARTMENT
RENOVATION & ADDITION – REDESIGN**

**REFERENCES
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UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577 (847) 272-8800

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100

ICC	International Code Council www.iccsafe.org	(888) 422-7233

ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543

END OF SECTION 014100

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

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 requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for limitations on work restrictions and utility interruptions.

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated.
- B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control (SWPPP) Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

- C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
 - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
 - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 - 3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
- E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
 - 1. Locations of dust-control partitions at each phase of work.
 - 2. HVAC system isolation schematic drawing.
 - 3. Location of proposed air-filtration system discharge.
 - 4. Waste handling procedures.
 - 5. Other dust-control measures.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails.
- B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts.
- C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
- D. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.
- E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner Architect and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Permanent HVAC System: Do not use permanent HVAC system for temporary use during construction, without permission from the owner.

- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
 - 1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
 - 1. Toilets: Use of Owner's existing toilet facilities will be prohibited.
- F. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- G. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- H. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- I. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
- J. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
- K. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel.
1. Provide superintendent with cellular telephone for use when away from field office.
- 3.3 SUPPORT FACILITIES INSTALLATION
- A. General: Comply with the following:
1. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits or as approved by Owner.

1. Provide dust-control treatment that is nonpolluting and non-tracking. Reapply treatment as required to minimize dust.
- C. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 312000 "Earth Moving."
 3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
 4. Delay installation of final paving until immediately before Substantial Completion.
- D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 2. Maintain access for fire-fighting equipment and access to fire hydrants.
 3. Provide all necessary informational and wayfinding signage for construction, Owner, and patron circulation, drop-off, closure, and delivery areas.
- E. Parking: Provide temporary parking within limits of construction fence. Existing parking lot may be used when scheduled around Owner operations, events, and activities.
- F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 2. Remove snow and ice as required to minimize accumulations.
- G. Project Signs: Provide Project signs for directional use only. Unauthorized signs showing company logos, banners, or other related marketing-style signage, are not permitted unless previous approved by Owner.
1. Identification Signs: Provide Project identification signs.
 2. Temporary Signs: Provide other signs as required to inform the public and individuals seeking entrance to the Building or Project Site.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 - b. Provide temporary closure and/or restricted access signs within the building during phased construction.
 - c. Provide temporary egress signage for exit pathways impeded by construction activities or for exits that egress through the construction site.

3. Maintain and touchup signs so they are legible at all times.
- H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017000 "Execution Requirements."
- I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- J. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.
- K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 1. Comply with work restrictions specified in Section 011000 "Summary."
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control (SWPPP) Drawings.
 1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
 2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.

4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- D. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- F. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 1. Extent of Fence: As approved by Owner and as required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
- G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide temporary signage to adequately identify egress routes and locations.
- J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

- L. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner and Patrons from fumes and noise.
 - 1. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
 - 2. Insulate partitions to control noise transmission to occupied areas.
 - 3. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 - 4. Protect air-handling equipment.
 - 5. Provide walk-off mats at each entrance through temporary partition.
- M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
 - 1. Prohibit smoking.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.5 MOISTURE AND MOLD CONTROL

- A. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
 - 1. Protect porous materials from water damage.
 - 2. Protect stored and installed material from flowing or standing water.
 - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 - 4. Remove standing water from decks.
 - 5. Keep deck openings covered or dammed.
- B. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
 - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into a partially enclosed building.
 - 2. Keep interior spaces reasonably clean and protected from water damage.
 - 3. Periodically collect and remove waste containing cellulose or other organic matter.
 - 4. Discard or replace water-damaged material.
 - 5. Do not install material that is wet.

6. Discard, replace, or clean stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- C. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use permanent HVAC system to control humidity.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Operate Project-identification-sign lighting daily from dusk until 12:00am midnight.
- D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with 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 Contractor. Owner reserves right to take possession of Project identification signs.

2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

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SECTION 01 5713
TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - SUMMARY

1.01 SECTION INCLUDES

- A. Temporary erosion and sedimentation control measures.
- B. Storm Water Pollution Prevention Plan (SWPPP)

1.02 PROJECT CONDITIONS

- A. Traffic:
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways. Refer to the IDOT Standard Road Plan TC Series and the current MUTCD for traffic control measures.
 - 3. All traffic control shall be installed, maintained, and removed by the contractor.
- B. Install temporary erosion and sedimentation control measures prior to beginning earth moving activities.
- C. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Foot traffic.
 - 4. Erection of sheds or structures.
 - 5. Impoundment of water.
 - 6. Excavation or other digging unless otherwise indicated.
 - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 Section "Earth Moving."
 - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

2.02 EROSION AND SEDIMENT CONTROL PRODUCTS

- A. FILTER MATERIAL: Material for use in filter socks, filter berms, and other areas, as specified.
 - 1. Use material derived from wood, bark, or other, non-toxic vegetative feedstocks.
 - 2. Use material with no visible admixture of refuse or other physical contaminants, nor any material toxic to plant growth.
 - 3. Use material meeting the following particle sizes:

Sieve Size	Percent Passing ¹
2"	100
1"	90-100
3/8"	0-30

B. FILTER SOCK

1. For slope and sediment control applications, use a continuous, tubular, knitted, mesh netting with 3/8-inch openings, constructed of 5-mil thickness, photodegradable HDPE.
2. For inlet protection, use a continuous, tubular, knitted, mesh netting with 3/8-inch openings, constructed of 500-denier polypropylene.
3. Use 1 inch by 2-inch (minimum) hardwood stakes or stakes of equivalent strength.

C. DUST CONTROL

1. Water: Use potable water or water from a source approved by the Engineer
2. Calcium Chloride: Shall meet requirements of AASHTO M 144. Unless otherwise provided in the contract documents, at the Contractor's Option, the calcium chloride may be furnished in either solid or liquid form.
 - a. Solid Form: Shall be flake, pellet, or other granular calcium chloride containing not less than 77% calcium chloride.
 - b. Liquid Form: Liquid form shall be a water solution of calcium chloride containing not less than 32% calcium chloride.
3. Lignosulfonate (Tree Sap): Use a commercially-available product with known lignin content.
4. Soapstock (Soybean Oil):
 - a. Use a commercially-available, undiluted, soybean oil soapstock emulsion.
 - b. Conform to specific storage, transportation, temperature, and application equipment requirements, as recommended by the manufacturer.

D. EROSION CONTROL MULCH

1. Conventional Mulch:
 - a. Use dry straw (oats, wheat barley, or rye) or hay (bromegrass, timothy, orchard grass, alfalfa, or clover).
 - b. Use material that is free of noxious weed, seed-bearing stalks, or roots and will be inspected and approved by the Engineer prior to use.
 - c. Other materials, subject to the approval of the Engineer may be used.
2. Hydromulch:
 - a. Wood Cellulose Mulch:
 - 1) Use material that is a natural or cooked cellulose fiber processed from whole wood chips, or a combination of up to 50% recycled paper (by volume).
 - 2) Product contains a colloidal polysaccharide tackifier adhered to the fiber to prevent separation during shipment and avoid chemical co-agglomeration during mixing.
 - 3) Form a homogeneous slurry of material, tackifier, and water.
 - 4) Use a slurry that can be applied with standard hydraulic mulching equipment.
 - 5) Dye the slurry green to facilitate visual metering during application.
 - 6) Do not use materials that have growth or germination-inhibiting factors or any toxic effect on plant or animal life when combined with seed or fertilizer.
 - b. Bonded Fiber Matrix (BFM):
 - 1) Produced from long-strand wood fibers, held together by organic tackifiers and bonding agents that, when dry, become insoluble and non-dispersible.
 - 2) Upon curing 24-48 hours, form a continuous, 100% coverage, flexible, absorbent, erosion-resistant blanket that encourages seed germination.

- 3) Manufactured to be applied hydraulically.
- 4) Physical Properties:
 - a) Fibers: Virgin wood, greater than 88% of total volume.
 - b) Organic Material: Greater than 96% of total volume.
 - c) Tackifier: 8-10%.
 - d) pH: 4.8 minimum.
 - e) Moisture Content: 12% +/- 3%.
 - f) Water-Holding Capacity: 1.2 gal/lb.
- c. Mechanically Bonded Fiber Matrix (MBFM):
 - 1) Produced from long-strand wood fibers and crimped, interlocking synthetic fibers.
 - 2) Within two hours of application, form a continuous, 100% coverage, flexible, absorbent, porous, erosion-resistant blanket that encourages seed germination.
 - 3) Manufactured to be applied hydraulically.
 - 4) Physical properties:
 - a) Wood Fibers: 73% minimum.
 - b) Tackifier: 10% +/- 1%.
 - c) Crimped, Interlocking Synthetic Fibers: 5% +/- 1%.
 - d) Moisture Content: 12% +/- 3%.

E. INLET PROTECTION

- 1. Drop-In Intake Protection:
 - a. Use a manufactured device that is inserted into the intake, and is capable of trapping or filtering sediment from runoff prior to entering the storm sewer.
 - b. All components must be contained entirely below the surface of the intake grate.
 - c. Incorporate means of emergency outflow to prevent flooding if plugged with sediment.
- 2. Surface-Applied Intake Protection:
 - a. Use devices or filter socks, placed around or over the intake, that are capable of trapping or filtering sediment from runoff prior to entering the storm sewer.
 - b. Do not allow the device to completely block or plug the intake, preventing inflow.

F. STABILIZED CONSTRUCTION ENTRANCE

- 1. Stabilized constructing entrance placed during Rough Grading Package shall be maintained. Keep rock with future street footprint.
- 2. Entrance Stone: shall be a Macadam stone base material and shall be a product of crushing limestone, dolomite, or quartzite and shall meet the following requirements:
 - a. Abrasion Loss: The percentage of wear, determined in accordance with AASHTO T 96, Grading A or B, shall not exceed 45%
 - b. Freeze Thaw Loss: When subjected to the freezing and thawing test, Iowa DOT Materials Laboratory Test Method 211, Method C, the percentage loss shall not exceed 10%.
- 3. Gradation: The aggregate for both base course and choke stone course may be produced from the same source. The coarse material shall be produced with a minimal maximum size of 3 inches, and screened over a ¾ inch screen. When specified in the contact documents, this material shall be screened over a 1 inch screen. The aggregate retained on the 3.4 inch or 1 inch screen shall be furnished as the macadam base course

material. The aggregate passing the ¾ inch or 1 inch screen may be furnished as the choke stone material however, the material shall have from 6" to 16" passing the No. 200 sieve.

4. Subgrade Stabilization Material:
 - a. Use woven, UV-stabilized geotextile.
 - b. Minimum tensile strength of 135 lb/ft.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Contractor shall notify Architect, Engineer, and Owner should any contaminated soils or foreign fill material be encountered during installation or maintenance of SWPPP controls.
- B. Protect and maintain benchmarks and survey control points from disturbance during construction.
- C. Note trees, shrubs, and other vegetation to remain as shown on the plan sheets.
- D. Protect existing site improvements to remain from damage during construction.
 1. Restore damaged improvements to their original condition, as acceptable to Owner. Damage outside of the work limits shall be repaired at the contractor's expense.

3.02 SWPPP MANAGEMENT

- A. A Stormwater Pollution Prevention Plan (SWPPP) according to the requirements of the Iowa DNR NPDES General Permit No. 2 has been prepared and provided to the Prime Contractor. The Prime Contractor shall sign the Certification Statement. The Prime Contractor shall provide the owner and all sub-contractors, with earth disturbing activities, the appropriate certification statements and place the signed documents in the SWPPP.
- B. Newspaper Notices have been published and the Notice of Intent has been submitted to the Iowa DNR and shall have approval prior to the beginning of construction. The Prime Contractor shall place copies of these documents into the SWPPP if they have not already been installed.
- C. The contractor shall maintain the SWPPP throughout the project duration including weekly inspections and maintenance measures.
- D. Ensure that controls utilized in the SWPPP conform to the type and quantity of erosion and sediment controls shown in the contract documents.
- E. Coordinate and carry out all requirements of Iowa DNR NPDES General Permit No. 2 and any local ordinance requirements, including:
 1. Update the SWPPP according to the requirements of the NPDES General Permit No. 2.
 2. Revise the SWPPP and implement changes, as necessary, to prevent sediment or hazardous materials from being transported off the site.
 3. Perform, and maintain records of, weekly erosion and sediment control site inspections, unless otherwise specified.
 4. Maintain records of transfer of responsibility under the NPDES General Permit No. 2.
 5. Retain all records on-site, or as required by the NPDES General Permit No. 2.
 6. After final stabilization, provide all records and documentation to the Owner. Retain a copy of all records for the period required under the Permit. Submit the Notice of Discontinuation to the Iowa DNR (a copy is located in the SWPPP).
 7. Continue to perform the work required under this item throughout the duration of the project, and until final stabilization is achieved.

3.03 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways,

according to the Pollution Prevention Plan. Furnish all materials; install, construct, maintain, and remove specified erosion control devices; at locations shown on the plans, or where specified by the Engineer, in accordance with the contract documents.

- B. Complete the required construction work on this project, while minimizing soil erosion and controlling water pollution. Maintain these features as specified, from initial construction stages to final completion of the project.
- C. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- D. Inspect, maintain, and repair erosion and sedimentation control measures during construction at the frequency required by the Iowa DNR NPDES General Permit No. 2 until permanent vegetation has been established.
- E. Schedule necessary maintenance or improvements for items that are included in the contract documents.
- F. Provide copies of the inspection reports to the Engineer upon request.
- G. Temporary stabilizing seeding and fertilizing shall be completed as disturbed areas are constructed. If construction activity is not planned to occur in a disturbed area for at least 21 days, the area shall be stabilized by temporary seeding or mulching within 14 days, including all soil stockpiles. No more than 750,000 square feet of exposed erodible area is allowed in any one grading spread without permission of the engineer. Temporary seeding and fertilizing shall be in accordance with the following:

Spring - March 1 to May 20

Oat - 2 bu. per acre

Winter Rye - 1 bu. per acre

Red Clover - 5 lbs per acre

Timothy - 5 lbs per acre

Summer - May 21 to July 20

Oat - 3 bu. per acre

Annual Rye - 35 bu. per acre

Red Clover - 5 lbs per acre

Timothy - 5 lbs per acre

Fall - July 21 to September 30

Oat - 2 bu. per acre

Winter rye - 2 bu. per acre

Red Clover - 5 lbs per acre

Timothy - 5 lbs per acre

Fertilizing for stabilizing crop seeding shall be chemically combined, commercial fertilizer applied to all seeded areas at the rate of 450 pounds per acre of 13-13-13 or equivalent.

- H. Prevent the accumulation of soil sediment or debris onto streets adjacent to project site. Remove any accumulation of earth or soil immediately, and take remedial actions for prevention.
- I. Prevent the accumulation of soil sediment or debris in any storm sewer including public, existing private facilities on site, and new private facilities on site.
- J. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

- K. If temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled, and are ordered by the Engineer; perform such work at the Contractor's expense.
- L. In case of repeated failures on the part of the Contractor to control erosion, pollution, and /or siltation, the Engineer reserves the right to employ outside assistance, or to use the Jurisdiction's own forces to provide the necessary corrective measures at the prime contractor's expense.
- M. All storm sewer with evidence of siltation in the structures and pipes shall be jetted clean upon final stabilization of the site or more frequently if deemed necessary by the Engineer.

3.04 TEMPORARY EROSION AND SEDIMENTATION CONTROL DEVICES

A. FILTER BERMS

- 1. Construct berm with filter material to the dimensions shown in contract documents or SUDAS Figure 9040.2, unless otherwise specified in the contract documents.
- 2. Install filter berm along the contour as specified in the contract documents, or as directed by the Engineer.
- 3. Turn the ends of the filter berm uphill to prevent runoff from flowing around the end of the berm.
- 4. When a vegetated berm is specified, apply seed to the surface of the berm.
- 5. Replace the berm when sediment accumulation reaches one-half of the height of the berm.

B. FILTER SOCKS

- 1. Installation:
 - a. Pneumatically fill mesh filter sock of size and length indicated in the contract documents, or as directed by the Engineer. Alternative methods of filling the sock may be allowed upon approval of the Engineer.
 - b. Fill socks with filter material.
 - c. Place the filter sock along the contour as specified in the contract documents, or as directed by the Engineer.
 - d. Place additional filter material or soil from the site, on the upstream side of the sock, in the seam between the tube and the ground.
 - e. Construct a "J-hook" at each end of a continuous run of filter sock, by turning the end of the sock uphill, as necessary to prevent runoff from flowing around the ends when water behind the sock ponds up to a level even with the top of the sock.
 - f. Drive stakes into the ground at a maximum spacing of 10 feet, and as required to secure the sock and prevent movement.
 - g. Construct according to SUDAS Figure 9040.2 for perimeter control and sediment control on grade.
- 2. Maintenance:
 - a. Repair or replace non-functioning filter socks that allow water to flow under the sock, are torn, or are otherwise damaged, due to inadequate installation.
 - b. Remove filter material from damaged socks that are located along streambanks, around intakes, in ditches, or in other locations where the material may be carried to surface waters.
- 3. Removal: When indicated in the contract documents, or as directed by the Engineer; remove the filter sock upon completion of the project, and after final stabilization is achieved; or as indicated in the SWPPP, if applicable.

- a. Upon completion of the project, completely remove socks and filter material that are located along streambanks, around intakes, in ditches, or in other locations where the filter material may be carried to surface waters if the sock degrades and/or tears.
 - b. Slice the sock longitudinally. Remove and dispose of the filter sock material and stakes.
 - c. Spread the filter material and accumulated sediment to match finished grade and to ensure proper drainage.
 - d. If the site has been brought to finished grade and prepared for permanent seeding, spread and incorporate the filter material into the surface by tilling, or as required to break up any large particles and provide a finished surface suitable for permanent seeding.
4. Replacement:
- a. When accumulated sediment reaches a level one-half the height of the sock, or when the sock becomes clogged with sediment and no longer allows runoff to flow through, remove the sock as described above, and replace according to the installation instructions above.
 - b. At the Engineer's option, the existing filter sock and accumulated sediment may be left in place, and a new filter sock installed up-slope from the existing filter sock.

C. DUST CONTROL

1. Water: Apply frequent light watering to ground surface, as required to control dust.
2. Calcium Chloride:
 - a. The calcium chloride may be applied in the solid form and the water applied separately, or a liquid form may be furnished or the solid form may be made into a solution and applied. Calcium chloride shall not be applied during rain or when, in the opinion of the Engineer, the weather is unsuitable for the application.
 - b. When calcium chloride is to be applied in the solid form, unless otherwise provided in the contract documents, water shall first be applied uniformly at a rate sufficient to produce the desired condition of moisture on the surface to be treated. It is anticipated that this will require 10,000 gallons of water per 1 mile of roadway, but this rate may be increased or decreased at the direction of the Engineer.
 - c. Unless otherwise provided in the contract documents, the solid form shall be spread at a rate which will deliver 1 pound (0.5 kg) of calcium chloride per square yard (square meter), computed on the anhydrous basis. When calcium chloride is applied in solid form, it shall be spread uniformly within 1 hour after application of water to that section.
 - d. When calcium chloride is to be applied in solution, water and calcium chloride shall be thoroughly mixed into a uniform solution completely dissolving any solid material before the solution is spread. The concentration of the solution and the rate of distribution of the solution shall be controlled to deliver to the surface the quantity of calcium chloride specified above.
 - e. Unless results of laboratory analysis of samples of material actually used are available, the rate of distribution may be computed on the following percentages for the respective material:

<u>Material</u>	<u>Assumed % Calcium Chloride by weight (mass) (anhydrous basis)</u>
Regular Flakes	77.0%

Conc. Flakes, Pellets, or other granular form	94.0%
Calcium Chloride Liquor	32.0%*
* Total calcium chloride. This percentage may be modified with the approval of the Engineer.	

3. Lignosulfonate (Tree Sap):

- Loosen the top 1 to 2 inches of the roadway surface.
- Apply solution with a 50% residual concentration, at a rate of 0.50 gal/yd², to deliver a 25% residual. For diluted solutions, increase the application rate, as required, to deliver an equivalent 25% residual.
- Allow product to penetrate through the loosened material.
- Tight-blade road surface.

4. Soapstock (Soybean Oil):

- Loosen the top 1 to 2 inches of the roadway surface.
- Apply undiluted soapstock at a rate of 0.70 gal/yd².
- Allow product to penetrate through the loosened material.
- Tight-blade surface.

D. TEMPORARY EROSION CONTROL SEEDING

- See Section 32 9200

E. EROSION CONTROL MULCHING

1. Conventional Mulching:

- Use conventional mulching when the surface cannot be stabilized by seeding, due to season or ground conditions.
- Uniformly distribute mulch over the required areas, at a rate of 2 tons/acre for dry cereal straw, or 2.5 tons/acre for prairie hay.
- Work the mulch into the soil with a mulch tucker, designed to anchor the mulch into the soil, by means of dull blades or disks.

2. Hydromulching:

- Place mulch and tackifier (if applicable) in equipment specifically manufactured for hydraulic mulching.
- Mix materials with fresh, potable water; using a combination of re-circulation through the equipment's pump, and mechanical agitation to form a homogeneous slurry.
- If necessary, dampen any dry, dusty soil, as required to prevent balling of the material during application.
- Apply hydromulch in multiple layers from opposing directions, where possible.
- Apply the slurry evenly over all specified areas, at the minimum component material rates specified:

1) Wood Cellulose Mulch:

- Mulch: 2600 lb/acre dry weight.
- Tackifier: 50 lb/acre.

2) Bonded Fiber Matrix: 3600 lb/acre dry weight.

3) Mechanically Bonded Fiber Matrix: 3600 lb/acre dry weight.

4) Retain and count empty bags of mulch to ensure final application rate.

F. SURFACE ROUGHENING

1. Directional Tracking:
 - a. Do not use on slopes steeper than 3:1.
 - b. Operate tracked equipment up and down exposed slope, to create ridges perpendicular to the slope.
 - c. Continue operation until the entire surface has been tracked.
2. Grooving/Furrowing:
 - a. May be used on all slopes.
 - b. Use rippers, disks, harrows, chisel plows, or other equipment, capable of operating on the slope and creating grooves a maximum of 15 inches apart and 3 inches deep.
 - c. Operate equipment along the contour of the slope, to create grooves that are perpendicular to the slope.
 - d. Perform over all exposed slopes as specified.

G. INLET PROTECTION

1. Install inlet protection devices according to the manufacturer's recommendations.
2. Remove the accumulated sediment, as required to maintain the inlet protection device in working order. Remove any accumulated sediment from streets open to traffic if it encroaches into the traveled roadway.

H. STABILIZED CONSTRUCTION ENTRANCE

1. Install a stabilized construction entrance at all locations where construction traffic leaving the site presents the potential for sediment track-out.
2. Construct the entrance according to SUDA Figure 9040.20, or as specified in the contract documents
3. Remove the accumulated sediment and install new stone, as required to prevent track-out.

3.05 EXISTING UTILITIES

- A. Existing utilities have been identified on the drawings from available surveys, records and deeds. Therefore, their locations must be considered approximate only. There may be others, the existence of which is presently not known. It is the contractor's responsibility to verify the location and depth of these utilities.
- B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
 1. Arrange with utility companies to shut off indicated utilities.
- C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 1. Notify Engineer not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Engineer's written permission.
- D. Removal of underground utilities is included in Division 22 Sections.

END OF SECTION

SECTION 016000 - PRODUCT REQUIREMENTS

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 selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012300 "Alternates" for products selected under an alternate.
 - 2. Section 014100 "References" for applicable industry standards for products specified.
 - 3. Section 016300 "Substitution Procedures" for requests for substitutions.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit a request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
 - 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weather tight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 3. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience may be considered per Owner and Architects review and approval.
 - b. Non-restricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:

- a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience may be considered per Owner and Architects review and approval.
- b. Non-restricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 016300 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.

4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 016300 - SUBSTITUTION PROCEDURES

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 substitutions.
- B. Related Requirements:
 - 1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.

- b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
- c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effects, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
- e. Samples, where applicable or requested.
- f. Certificates and qualification data, where applicable or requested.
- g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
- h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
- i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
- j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
- k. Cost information, including a proposal of change, if any, in the Contract Sum.
- l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
- m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
- a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
- a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Substitution request is fully documented and properly submitted.

- e. Requested substitution will not adversely affect Contractor's construction schedule.
- f. Requested substitution has received necessary approvals of authorities having jurisdiction.
- g. Requested substitution is compatible with other portions of the Work.
- h. Requested substitution has been coordinated with other portions of the Work.
- i. Requested substitution provides specified warranty.
- j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

END OF SECTION 016300

SUBSTITUTION REQUEST FORM

We hereby submit for your review & consideration the following product in lieu of the specified item for the following project:

PROJECT TITLE: State Center Fire Department – Renovation & Addition – Redesign

<u>SPECIFICATION</u>	<u>SECTION</u>	<u>TITLE</u>	<u>PARAGRAPH</u>	<u>ITEM</u>
<u>DRAWING</u>	<u>NUMBER</u>	<u>TITLE</u>	<u>ITEM</u>	

Proposed Substitution: _____.

Complete the attached information on changes to the Specifications and/or Drawings for the proposed substitution. Provide additional information for any changes required for proper installation of the proposed substitution.

Submit, as requested, all necessary samples and backup information to prove equal quality and performance to that which is specified. Clearly mark manufacturer's literature to indicate equality in performance. Failure to do so will result in a returned, non-reviewed substitution request form.

Substitutions of the materials and equipment described in the Bid Documents will be considered during the bidding period only. Substitution requests shall be reviewed and approved by the Design Professional prior to the date set for receipt of bids as described in the front end of the specification.

CERTIFICATION OF EQUAL PERFORMANCE AND ASSUMPTION OF LIABILITY FOR EQUAL PERFORMANCE

The undersigned states that the function, appearance, and quality are equivalent or superior to the specified item.

Submitted by: _____.

Signature: _____ Title: _____.

Organization: _____.

Address: _____.

Telephone: _____ Email: _____ Date: _____.

Signature shall be by person having authority to legally bind his firm to the above terms. Failure to provide legally binding signature will result in retraction of approval.

For Use by Design Professional:

_____ Approved	_____ Approved as Noted
_____ Not Approved	_____ Received Too Late

Signed by: _____ Date: _____.

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SECTION 017300 – EXECUTION REQUIREMENTS

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 general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Coordination of Owner-installed products.
 - 5. Progress cleaning.
 - 6. Starting and adjusting.
 - 7. Protection of installed construction.
 - 8. Correction of the Work.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for limits on use of Project site.
 - 2. Section 013300 "Submittal Procedures" for submitting surveys.
 - 3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor and/or professional engineer.
- B. Certificates: Submit certificate signed by land surveyor and/or professional engineer certifying that location and elevation of improvements comply with requirements.

1.5 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - 1. Description of the Work.
 - 2. List of detrimental conditions, including substrates.

3. List of unacceptable installation tolerances.
 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect and Owner promptly.
- B. General: Engage a land surveyor and/or professional engineer to lay out the Work using accepted surveying practices.
1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 2. Establish limits on use of Project site.
 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 4. Inform installers of lines and levels to which they must comply.
 5. Check the location, level and plumb, of every major element as the Work progresses.
 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of 2 permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces unless noted otherwise on drawings.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 2. Allow for building movement, including thermal expansion and contraction.
 3. Coordinate installation of anchorages. 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.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after construction operations requiring cutting are complete.
- H. 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 practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize 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 that are removed 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 in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather tight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.
 - B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 2. Pre-installation Conferences: Include Owner's construction personnel at pre-installation conferences covering portions of the Work that are to receive Owner's work. Attend pre-installation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
 - 4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

- J. 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.

3.9 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

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SECTION 017400 - DEMONSTRATION AND TRAINING

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 administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.

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.
- B. Attendance Record: For each training module, submit list of participants and length of instruction time.
- C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 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 in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.5 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 has been reviewed and approved by Owner.

PART 2 - PRODUCTS

2.1 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, or 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. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. 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.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017300 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

3.2 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.
 - 1. Owner will furnish Contractor with names and positions of participants.
- 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, with at least seven (7) 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 performance-based test.
- F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017400

DOCUMENT 017500 – CERTIFICATE OF SUBSTANTIAL COMPLETION

CERTIFICATE NUMBER:

DATE OF ISSUANCE:

CONTRACT INFORMATION:

Contract For: State Center Fire Department – Renovation & Addition – Redesign

Date:

PROJECT

State Center Fire Department –
Renovation & Addition – Redesign
115 Main Street East
State Center, Iowa 50247

OWNER

City of State Center
118 Main Street East
State Center, Iowa 50247

ARCHITECT

MELEE, LLC (dba: Studio MELEE)
139 4th Street
West Des Moines, Iowa 50265

CONTRACTOR

THE WORK IDENTIFIED BELOW HAS BEEN REVIEWED AND FOUND, TO THE ARCHITECT'S BEST KNOWLEDGE TO BE SUBSTANTIALLY COMPLETE. SUBSTANTIAL COMPLETION IS ATTAINED WHEN THE PROGRESS OF THE WORK IS SUFFICIENTLY COMPLETE IN ACCORDANCE WITH THE CONTRACT DOCUMENTS SO THAT THE OWNER CAN OCCUPY OR UTILIZE THE WORK FOR ITS INTENDED PURPOSE. THE DATE OF SUBSTANTIAL COMPLETION OF THE PROJECT OR PORTION DESIGNATED BELOW IS THE DATE ESTABLISHED BY THIS CERTIFICATE:

All work described in the documents for the project as prepared by Studio MELEE:

WARRANTIES:

The date of substantial completion of the Project or portion designated above is also the date of commencement of applicable warranties required by the contract documents, except as stated below:

WORK TO BE COMPLETED OR CORRECTED:

A list of items to be completed or corrected is attached hereto, or transmitted as agreed upon by the parties, and identified as follows:

The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment, whichever occurs first. The Contractor will complete or correct the Work on the list of items attached hereto within Twenty-Five (25) days from the above date of Substantial Completion.

Cost estimate of Work to be completed or corrected:

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work, insurance and other items identified below shall be as follows:

Owner's and Contractor's legal and insurance counsel should review insurance requirements and coverage.

The Owner and Contractor hereby accept the responsibilities assigned to them in this Certificate of Substantial Completion:

<u>Studio MELEE</u> ARCHITECT	<u>CONTRACTOR</u>	<u>City of State Center</u> OWNER
<u>BY (SIGNATURE)</u>	<u>BY (SIGNATURE)</u>	<u>BY (SIGNATURE)</u>
<u>PRINTED NAME</u>	<u>PRINTED NAME</u>	<u>PRINTED NAME</u>
<u>DATE</u>	<u>DATE</u>	<u>DATE</u>

END OF DOCUMENT 017500

SECTION 017700 - CLOSEOUT PROCEDURES

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 contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for progress cleaning of Project site.
 - 2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
 - 5. Submit test/adjust/balance records.
 - 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.
 - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.

5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
 6. Advise Owner of changeover in heat and other utilities.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements, including touchup painting.
 10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 012100 "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 - 1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
 - 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 - 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.

1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. 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.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.

- i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - 1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
 - p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - q. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
- 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.

- a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
- 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
- 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

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SECTION 017823 - OPERATION AND MAINTENANCE DATA

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 preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.
 2. Submit 2 paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return both copies.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
1. List of documents.
 2. List of systems.
 3. List of equipment.
 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- B. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor.
 - 6. Name and contact information for Construction Manager.
 - 7. Name and contact information for Architect.
 - 8. Name and contact information for Commissioning Authority.
 - 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 - 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
 - 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.

2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, vinyl-covered binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, **and** subject matter of contents. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
 4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.

- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 - 1. Fire.
 - 2. Flood.
 - 3. Gas leak.
 - 4. Water leak.
 - 5. Power failure.
 - 6. Water outage.
 - 7. System, subsystem, or equipment failure.
 - 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
 - 1. Instructions on stopping.
 - 2. Shutdown instructions for each type of emergency.
 - 3. Operating instructions for conditions outside normal operating limits.
 - 4. Required sequences for electric or electronic systems.
 - 5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 - 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 - 2. Performance and design criteria if Contractor has delegated design responsibility.
 - 3. Operating standards.
 - 4. Operating procedures.
 - 5. Operating logs.
 - 6. Wiring diagrams.
 - 7. Control diagrams.
 - 8. Piped system diagrams.
 - 9. Precautions against improper use.
 - 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
 - 1. Product name and model number. Use designations for products indicated on Contract Documents.
 - 2. Manufacturer's name.
 - 3. Equipment identification with serial number of each component.
 - 4. Equipment function.

5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.

4. Schedule for routine cleaning and maintenance.
5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 1. Standard maintenance instructions and bulletins.
 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 3. Identification and nomenclature of parts and components.
 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of operation and maintenance manuals.
 2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."
- G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

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SECTION 017839 - PROJECT RECORD DOCUMENTS

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 project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for final property survey.
 - 2. Section 017700 "Closeout Procedures" for general closeout procedures.
 - 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit 1 set of marked-up record prints.
 - 2. Number of Copies: Submit copies of record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit 1 paper-copy set of marked-up record prints.
 - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit 1 paper-copy set of marked-up record prints.
 - 2) Print each drawing, whether or not changes and additional information were recorded.

- B. Record Specifications: Submit 1 paper copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit as part of final Operations and Maintenance Manual.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit 1 paper copy of each submittal.
- E. Reports: Submit written report regularly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.

- I. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
 1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
 2. Format: DWG, Microsoft Windows operating system.
 3. Format: Annotated PDF electronic file with comment function enabled.
 4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 5. Refer instances of uncertainty to Architect for resolution.
 6. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
 - a. See Section 013300 "Submittal Procedures" for requirements related to use of Architect's digital data files.
 - b. Architect will provide data file layer information. Record markups in separate layers.
- C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
 1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
 5. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.
 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

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SECTION 019113 - GENERAL COMMISSIONING REQUIREMENTS

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 general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.
- B. Related Sections:
 - 1. Section 230800 "Commissioning of HVAC" for commissioning process activities for HVAC&R systems, assemblies, equipment, and components.

1.3 DEFINITIONS

- A. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.
- B. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- C. CxA: Commissioning Authority.
- D. OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.
- E. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 COMMISSIONING TEAM

- A. Members Appointed by Owner:

1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

1.5 OWNER'S RESPONSIBILITIES

- A. Provide the OPR documentation to the CxA and each Contractor for information and use.
- B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.
- C. Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxA and each Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.6 EACH CONTRACTOR'S RESPONSIBILITIES

- A. Each Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
 1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
 2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
 3. Attend commissioning team meetings held on a variable basis.
 4. Integrate and coordinate commissioning process activities with construction schedule.
 5. Review and accept construction checklists provided by the CxA.
 6. Complete electronic construction checklists as Work is completed and provide to the Commissioning Authority on a weekly basis.
 7. Review and accept commissioning process test procedures provided by the Commissioning Authority.
 8. Complete commissioning process test procedures.

1.7 CxA'S RESPONSIBILITIES

- A. Organize and lead the commissioning team.
- B. Provide commissioning plan.
- C. Convene commissioning team meetings.
- D. Provide Project-specific construction checklists and commissioning process test procedures.

- E. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.
- F. Prepare and maintain the Issues Log.
- G. Prepare and maintain completed construction checklist log.
- H. Witness systems, assemblies, equipment, and component startup.
- I. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 019113

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SECTION 024119 - SELECTIVE DEMOLITION

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. Demolition and removal of selected portions of building or structure.

- B. Related Requirements:

- 1. Section 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
 - 2. Section 017300 "Execution" for cutting and patching procedures.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner for reuse if indicated.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 PREINSTALLATION MEETINGS

- A. Pre-demolition Conference: Conduct conference at project 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.

1.6 INFORMATIONAL SUBMITTALS

- A. 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.
- B. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's 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. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- C. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
- D. Pre-demolition Photographs or Video: Submit before Work begins.
- E. 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.
- F. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

- B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.8 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.9 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding and contract purposes will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
 - 2. Architect has no responsibility for the discovery, presence, handling, disposal of, or exposure to, hazardous materials or toxic substances, in any form, on the project site. If unanticipated hazardous materials are encountered, do not proceed with demolition and construction. If materials suspected of containing hazardous materials are encountered, do not disturb. In either case, immediately contact and notify the owner. Stop work in the area of potential hazard. Contractor shall shut off fans and other air-handlers ventilating the area and rope off area until the questionable material is identified. Re-assign workers to continue work in unaffected areas. Resume work in the area of concern after safe working conditions are verified.
 - 3. This project shall meet all relevant federal and state regulations regarding regulated asbestos-containing building materials (ACMs), including but not limited to the following:
 - a. Notifying the EPA, DNR, and NESHAP.
 - b. Completing asbestos survey by a licensed asbestos building inspector in order to identify, classify and quantify all ACMs.
 - c. Submission of a demolition notification form to the DNR at least 10 working days prior to the start of demolition (regardless of whether ACMs were discovered).
 - d. Removal of ACMs by a permitted asbestos abatement contractor.
- E. Storage or sale of removed items or materials on-site is not permitted.

- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain smoke, fire sprinkler and fire-alarm facilities in service during selective demolition operations.

1.10 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding.
- 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. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, plumbing, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Survey of Existing Conditions: Record existing conditions by use of pre-construction photographs.

1. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL/PLUMBING SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
 1. Comply with requirements for existing services/systems interruptions specified in Section 015000 "Temporary Facilities and Controls"
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical/plumbing systems serving areas to be selectively demolished.
 1. Coordinate with owner's schedule to shut off any services, systems and utilities.
 2. Arrange to shut off indicated services, systems and 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 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.
 - 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.
- C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

- A. 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.
 - 1. Comply with requirements for access and protection Section 015000 "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other 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.
 - 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.
 - 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 specified in Section 015000 " Temporary Facilities and Controls."
- C. Temporary Shoring: 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. Temporary Partitions: Provide substantial construction designed by the contractor to provide effective protection of existing areas to remain as required.
 - 1. Isolate demolition operations from other areas. Provide adequate temporary partitions at doors, windows, clerestory windows, skylights, and other related fenestration to protect against passage of dust and dirt into interior spaces.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only 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, to minimize disturbance of adjacent surfaces. 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 fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on-site or off-site.
5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
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.

D. 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 cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Roofing:** Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Section 061000, 072200, 075323, 076200, 077200, and 079200 for new blocking, insulation, roofing, flashing, roof accessory, and sealant requirements.

1. Remove existing roof membrane, flashings, copings, and roof accessories as indicated on plans.
2. Remove existing roofing system down to substrate, down to structural roof deck, or as required for work as indicated on plans.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 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.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 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.

END OF SECTION 024119

SECTION 033000 - CAST-IN-PLACE CONCRETE

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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Foundations.
 - 3. Slabs-on-grade.
 - 4. Topping Slabs.
 - 5. Ramps.
- B. Related Sections:
 - 1. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.
 - 2. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.

- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure. Provide shops drawings identifying proposed joint layouts for review and approval.
 - 1. Location of construction joints is subject to approval of the Engineer & Architect.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Fiber reinforcement.
 - 6. Waterstops.
 - 7. Curing compounds.
 - 8. Floor and slab treatments.
 - 9. Bonding agents.
 - 10. Adhesives.
 - 11. Slip Sheets (Bond Breakers)
 - 12. Vapor retarders.
 - 13. Semirigid joint filler.
 - 14. Joint-filler strips.
 - 15. Repair materials.
- C. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- E. Field quality-control reports.
- F. Minutes of pre-installation conference.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated. (Testing provided by owner.)
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field-Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
 - 1. Note: This may include sourcing special aggregate for exposed polished concrete slabs.
- E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."
- F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specifications for Structural Concrete,"
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- G. Concrete Testing Service: Owner shall engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- H. Pre-installation Conference: Conduct conference at project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

- a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.
 - e. Special concrete finish subcontractor.
2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semi-rigid joint fillers, forms and form removal limitations, shoring and re-shoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Water stops: Store water stops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 1. Plywood, metal, or other approved panel materials.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

- F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive damp-proofing or waterproofing.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60, deformed bars, assembled with clips.
- D. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.
- E. Deformed-Steel Wire: ASTM A 496/A 496M.
- F. Plain-Steel Welded Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
 - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I/II OR 1L.
 - a. Fly Ash: ASTM C 618, Class F or C.
 - b. Ground Granulated Blast-Furnace Slag: Not Allowed.
- B. Silica Fume: Not Allowed.
- C. Natural sand fine aggregate and crushed limestone coarse aggregate: ASTM C33, clear, hard, durable and uncoated. Limit amounts of objectionable and deleterious materials per Iowa Department of Transportation standard specifications for highway and bridge construction, Series 2009, sections 4110, 4112 and 4115 for clay, coal, carbonaceous shale and chert. Aggregate shall meet IDOT specification 4115.01 for class 3i durability and 4115.01 for abrasion and objectionable materials. For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing substances. All interior slab on grade and topping concrete shall use fine aggregate from a source that has a successful history of producing concrete with little to no side effects related to lightweight particle pop-outs in slab on grade applications. Provide imported aggregate at all sealed slabs and ground & polished slabs.
 - 1. All aggregates to comply with IDOT Section 4112 and 4115 of standard specifications for highway construction.
 - 2. Maximum Coarse-Aggregate Size: 3/4-inch nominal at all areas for non-polished concrete floors.
 - 3. Maximum Coarse-Aggregate Size: 1/2-inch nominal chip mix size aggregate at all slab areas to receive polished concrete floors. Do not over vibrate this concrete so as to cause variations in appearance.
 - 4. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement. Use Imported Fine Aggregate.
 - 5. Aggregates for non-exposed footings may be gravel or limestone with maximum aggregate size of 1 1/2" inch.
- D. Water: ASTM C 94/C 94M and potable.

2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.6 SLIP SHEET (BOND BREAKER)

- A. Heavy-Duty Polyethylene (HDPE) Sheet, ASTM D 4397, not less than 8 mils thick.
- B. Contractor may submit options for review and approval by the architect and engineer.

2.7 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A, except with maximum perm rating of 0.02. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 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. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
 - b. Grace Construction Products, W. R. Grace & Co.; Florprufe 120.
 - c. Meadows, W. R., Inc.; Perminator 15 mil.
 - d. Stego Industries, LLC; Stego Wrap 15 mil Class A.
- B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.8 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces. At ground and polished slabs, use only product(s) that is approved for use at these types of slabs.
 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. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
 - b. Meadows, W. R., Inc.; LIQUI-HARD.

2.9 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 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. BASF Construction Chemicals - Building Systems; Confilm.
 - b. Dayton Superior Corporation; Sure Film (J-74).
 - c. Euclid Chemical Company (The), an RPM company; Eucobar.
 - d. Meadows, W. R., Inc.; EVAPRE.
 - e. Sika Corporation; SikaFilm.
 - f. SpecChem, LLC; Spec Film.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
 - 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. BASF Construction Chemicals - Building Systems; Kure 200.
 - b. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
 - c. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
 - d. Meadows, W. R., Inc.; 1100-CLEAR.
 - e. SpecChem, LLC; Spec Rez Clear.

2.10 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Reglets: Fabricate reglets of not less than 0.022-inch-thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 15 percent.
 - 2. Combined Fly Ash and Pozzolan: 15 percent.
 - 3. Ground Granulated Blast-Furnace Slag: 0 percent.
 - 4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 15 percent portland cement minimum, with fly ash or pozzolan not exceeding 15 percent.
 - 5. Silica Fume: 0 percent.
 - 6. Combined Fly Ash, Pozzolans, and Silica Fume: 15 percent with fly ash or pozzolans not exceeding 15 percent and silica fume not exceeding 0 percent.

7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 15 percent with fly ash or pozzolans not exceeding 15 percent and silica fume not exceeding 0 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: See Structural General Notes.
 2. Maximum Water-Cementitious Materials Ratio: See Structural General Notes.
 3. Slump Limit: See Structural General Notes.
 4. Air Content: 6 percent, plus or minus 1.5 percent.
- B. Foundation Walls: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: See Structural General Notes.
 2. Maximum Water-Cementitious Materials Ratio: See Structural General Notes.
 3. Slump Limit: See Structural General Notes.
 4. Air Content: 6 percent, plus or minus 1.5 percent.
- C. Topping Slabs: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: See Structural General Notes.
 2. Maximum Water-Cementitious Materials Ratio: See Structural General Notes.
 3. Slump Limit: See Structural General Notes.
 4. Design Air: Natural Air (3% max.)
- D. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: See Structural General Notes.
 2. Maximum Water-Cementitious Materials Ratio: See Structural General Notes.
 3. Slump Limit: See Structural General Notes.
 4. Design Air: Natural Air (3% max.)
 5. Aggregate: Sand shall be imported from a source with no known coal, shale, chert, lignite, or other lightweight particles that could cause problems with the

floor finish. No amount of these materials shall be included in the mix design.
Provide imported aggregate.

2.14 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.15 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
 - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

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 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 of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
 - 2. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.

- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at

not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
1. Lap joints 6 inches and seal with manufacturer's recommended tape.
- B. Granular Course below vapor retarder: Moisten and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.

3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Joints in Existing Slab-on-Grade: Existing slab is to receive a new topping slab.
 - 1. Fill large existing cracks and existing cuts with backer rod and sealant. Strike sealant joint flush with surrounding existing concrete.

2. Fill small existing cracks and existing cuts with sealant. Strike sealant joint flush with surrounding existing concrete.
- F. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view,.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces indicated.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces indicated.
 - 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 35; and of levelness, F(L) 20; for slabs-on-grade to be sealed, covered with epoxy floor coatings or to be covered with carpet or resilient floor coverings.
 - b. Specified overall values of flatness, F(F) 50; and levelness, F(L) 35; with minimum local values of flatness, F(F) 35 and of levelness, F(L) 20 for slabs-on-grade indicated to receive ground and polished finish.
 - 3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.
 - 4. Special testing for flatness F(F) and levelness F(L) to be by special inspections at all areas to receive ground and polished finish."
- D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.11 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings. Do not use plastic sheet cover on any concrete surface to be sealed or ground and polished.

- b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
- 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to 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.
 - a. 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.
- 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.
 - a. Coordinate use of the curing compound with the concrete ground and polished concrete contractor prior to concrete placement.

3.12 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions. Do not install at areas indicated to be exposed polished concrete unless approved in writing by the floor polishing contractor.
 - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - 2. Do not apply to concrete that is less than 28 days' old.
 - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semi-rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Steel reinforcement placement.
 2. Headed bolts and studs.
 3. Verification of use of required design mixture.
 4. Concrete placement, including conveying and depositing.
 5. Curing procedures and maintenance of curing temperature.
 6. Verification of concrete strength before removal of shores and forms from beams and slabs.
 7. Post-installed anchors in hardened concrete.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three-consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

- D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

3.16 PROTECTION OF LIQUID FLOOR TREATMENTS

- A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

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SECTION 040120 – MASONRY PATCHING & REPAIR

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 patching and maintenance of unit masonry consisting of brick and CMU masonry and cleaning as follows:
 - 1. Unused anchor removal.
 - 2. Repairing unit masonry, including replacing units.
 - 3. Painting steel uncovered during the work.
 - 4. Re-pointing joints.
 - 5. Cleaning exposed unit masonry surfaces.

1.3 INFORMATIONAL SUBMITTALS

- A. Preconstruction Test Reports: For replacement masonry units.
- B. Quality-Control Program.
- C. Restoration Program.
- D. Cleaning Program.

1.4 QUALITY ASSURANCE

- A. Chemical-Cleaner Manufacturer Qualifications: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, and with factory-trained representatives who are available for consultation and Project-site inspection and assistance at no additional cost.
- B. Source Limitations: Obtain each type of material for masonry restoration (face brick, cement, sand, etc.) from one source with resources to provide materials of consistent quality in appearance and physical properties.
- C. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage due to worker fatigue.

- D. Cleaning and Repair Appearance Standard: Cleaned and repaired surfaces are to have a uniform appearance as viewed from 20 feet away by Architect. Perform additional paint and stain removal, general cleaning, and spot cleaning of small areas that are noticeably different, so that surface blends smoothly into surrounding areas.
- E. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to masonry restoration and cleaning including, but not limited to, the following:
 - a. Construction schedule. Verify availability of materials, Restoration Specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Materials, material application, sequencing, tolerances, and required clearances.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry units to Project site strapped together in suitable packs or pallets or in heavy-duty cartons.
- B. Deliver each piece of terra cotta with code mark or setting number on unexposed face, corresponding to Shop Drawings, using nonstaining paint.
- C. Deliver other materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- D. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- E. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
- F. Store lime putty covered with water in sealed containers.
- G. Store sand where grading and other required characteristics can be maintained, and contamination avoided.

1.6 PROJECT CONDITIONS

- A. For manufactured repair materials, perform work within the environmental limits set by each manufacturer.
- B. Clean masonry surfaces only when air temperature is 40 deg F and above and is predicted to remain so for at least 7 days after completion of cleaning.

1.7 COORDINATION

- A. Coordinate masonry patching, repair and cleaning with circulation patterns at Project site. Plan and execute the Work accordingly.

1.8 SEQUENCING AND SCHEDULING

- A. Order replacement materials at earliest possible date to avoid delaying completion of the Work.
- B. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in masonry units to comply with "Masonry Unit Patching" Article. Patch holes in mortar joints to comply with "Repointing Masonry" Article.

PART 2 - PRODUCTS

2.1 MASONRY MATERIALS

- A. Concrete Masonry Units (CMUs): ASTM C 90, Normal Weight
 - 1. Exposed Faces: Provide color and texture matching the range represented by existing walls being patched.

2.2 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type II, white or gray where required for color matching of exposed mortar.
 - 1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Factory-Prepared Lime Putty: ASTM C 1489.
- D. Quicklime: ASTM C 5, pulverized lime.
- E. Mortar Sand: ASTM C 144 unless otherwise indicated.
 - 1. Color: Provide natural sand of color necessary to produce required mortar color.
 - 2. For pointing mortar, provide sand with rounded edges.
 - 3. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
- F. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.
- G. Water: Potable.

2.3 PAINT REMOVERS

- A. Low-Odor, Solvent-Type Paint Remover: Manufacturer's standard low-odor, water-rinsible solvent-type gel formulation, containing no methanol or methylene chloride, for removing paint coatings from masonry.

2.4 CLEANING MATERIALS

- A. Water: Potable.
- B. Hot Water: Water heated to a temperature of 140 to 160 deg F.
- C. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.

2.5 ACCESSORY MATERIALS

- A. Masonry Repair Anchors, Rod/Screen Tube Type: Stainless-steel screen tube with or without Type 316 stainless-steel rod, adhesive installed by injection with manufacturer's standard epoxy adhesive, complete with other devices required for installation.
- B. Sealant Materials:
 - 1. Provide manufacturer's standard chemically curing, elastomeric sealant(s) of base polymer and characteristics indicated below that comply with applicable requirements in Section 079200 "Joint Sealants."
 - a. Single-component, non-sag urethane sealant.
 - 2. Colors: Provide colors of exposed sealants to match colors of masonry adjoining installed sealant unless otherwise indicated.
 - 3. Ground-Mortar Aggregate: Custom crushed and ground pointing mortar sand or existing mortar retrieved from joints. Grind to a particle size that matches the adjacent mortar aggregate and color. Remove all fines passing the 100-sieve.
- C. Joint-Sealant Backing:
 - 1. Cylindrical Sealant Backings: ASTM C 1330, Type C; closed-cell material with a surface skin, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 - 2. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturers for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where acceptable.
- D. Setting Buttons: Resilient plastic buttons, nonstaining to masonry, sized to suit joint thicknesses and bed depths of masonry units without intruding into required depths of pointing materials.

- E. Masking Tape: Non-staining, non-absorbent material, compatible with pointing mortar, joint primers, sealants, and surfaces adjacent to joints; that will easily come off entirely, including adhesive.
- F. Miscellaneous Products: Select materials and methods of use based on the following, subject to approval of a mockup:
 - 1. Previous effectiveness in performing the work involved.
 - 2. Little possibility of damaging exposed surfaces.
 - 3. Consistency of each application.
 - 4. Uniformity of the resulting overall appearance.
 - 5. Do not use products or tools that could do the following:
 - a. Remove, alter, or in any way harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.
 - b. Leave a residue on surfaces.

2.6 MORTAR MIXES

- A. Preparing Lime Putty: Slake quicklime and prepare lime putty according to appendix to ASTM C 5 and manufacturer's written instructions.
- B. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
 - 1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.
- C. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's approval.
 - 1. Mortar Pigments: Where mortar pigments are indicated, do not exceed a pigment-to-cement ratio of 1:10 by weight.
- D. Do not use admixtures in mortar unless otherwise indicated.

2.7 CHEMICAL CLEANING SOLUTIONS

- A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended by chemical-cleaner manufacturers.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm resulting from masonry restoration work.
 - 1. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of restoration and cleaning work.
- B. Comply with chemical-cleaner manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical-cleaning solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
 - 1. Cover adjacent surfaces with materials that are proven to resist chemical cleaners used unless chemical cleaners being used will not damage adjacent surfaces. Use materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
 - 2. Keep wall wet below area being cleaned to prevent streaking from runoff.
 - 3. Do not clean masonry during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
 - 4. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.
 - 5. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
- C. Prevent mortar from staining face of surrounding masonry and other surfaces.
 - 1. Cover sills, ledges, and projections to protect from mortar droppings.
 - 2. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
 - 3. Immediately remove mortar in contact with exposed masonry and other surfaces.
 - 4. Clean mortar splatters from scaffolding at end of each day.

3.2 UNUSED ANCHOR REMOVAL

- A. Remove masonry anchors, brackets, wood nailers, and other extraneous items no longer in use unless indicated to remain.
 - 1. Remove items carefully to avoid spalling or cracking masonry.
 - 2. Where directed, if an item cannot be removed without damaging surrounding masonry, do the following:

- a. Cut or grind off item approximately 3/4 inch beneath surface and core drill a recess of same depth in surrounding masonry as close around item as practical.
 - b. Immediately paint exposed end of item with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended dry film thickness per coat. Keep paint off sides of recess.
3. Patch the hole where each item was removed unless directed to remove and replace the masonry unit.

3.3 MASONRY UNIT PATCHING

- A. Patch the following masonry units unless another type of replacement or repair is indicated:
 1. Units indicated to be patched.
- B. Patching Block:
 1. Remove loose material from masonry surface. Carefully remove additional material so patch will not have feathered edges but will have square or slightly undercut edges on area to be patched and will be at least 1/4 inch thick, but not less than recommended by patching compound manufacturer.
 2. Mask adjacent mortar joint or rake out for repointing if patch will extend to edge of masonry unit.
 3. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
 4. Rinse surface to be patched and leave damp, but without standing water.
 5. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
 6. Place patching compound in layers as recommended by patching compound manufacturer, but not less than 1/4 inch or more than 2 inches thick. Roughen surface of each layer to provide a key for next layer.
 7. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of the masonry unit. Shape and finish surface before or after curing, as determined by testing, to best match existing masonry unit.
 8. Keep each layer damp for 72 hours or until patching compound has set.

3.4 PAINT REMOVAL

- A. Paint Removal with Solvent-Type Paint Remover:
 1. Remove loose and peeling paint using scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 2. Apply thick coating of paint remover to painted masonry with natural-fiber cleaning brush, deep-nap roller, or large paint brush.

3. Allow paint remover to remain on surface for period recommended by manufacturer. Agitate periodically with stiff-fiber brush.
4. Rinse with hot water applied by low-pressure spray to remove chemicals and paint residue.

3.5 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, spray applied at low pressure.
 1. Do not use metal scrapers or brushes.
 2. Do not use acidic or alkaline cleaners.
- B. Wash adjacent woodwork and other non-masonry surfaces. Use detergent and soft brushes or cloths.
- C. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
- D. Sweep and rake adjacent pavement and grounds to remove mortar and debris. Where necessary, pressure wash pavement surfaces to remove mortar, dust, dirt, and stains.

END OF SECTION 040120

SECTION 042113 - BRICK MASONRY

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. Face brick.
- 2. Mortar and grout.
- 3. Ties and anchors.
- 4. Embedded flashing.
- 5. Miscellaneous masonry accessories.

- B. Related Sections:

- 1. Section 055000 "Metal Fabrications" for furnishing steel lintels and shelf angles for brick masonry.
- 2. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Shop Drawings: For the following:

- 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
- 2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

- C. Samples for Verification: For each type and color of the following:

- 1. Face brick, in the form of straps of five or more bricks.
- 2. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
- 3. Weep holes and vents.
- 4. Accessories embedded in masonry.

1.4 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
 - 1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- B. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include data on material properties and material test reports substantiating compliance with requirements.
 - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include test report for efflorescence according to ASTM C 67.
 - 2. Cementitious materials. Include brand, type, and name of manufacturer.
 - 3. Pre-blended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 4. Grout mixes. Include description of type and proportions of ingredients.
 - 5. Anchors, ties, and metal accessories.
- C. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup of typical wall area as shown on Drawings.

2. Build mockups for each type of exposed unit masonry construction in sizes approximately 48 inches long by 60 inches high by full thickness, including accessories.
 - a. Include a sealant-filled joint at least 16 inches long in each mockup.
 - b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
 - c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
 - d. Include masonry wall, air & water barrier, veneer anchors, flashing, cavity drainage material, and weep holes in mockup.
3. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
4. Clean exposed faces of mockups with masonry cleaner as indicated.
5. Protect accepted mockups from the elements with weather-resistant membrane.
6. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
 - 2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over 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 the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.
 - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 - 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 - 3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 - 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Face Brick: Facing brick complying with ASTM C 216
 - 1. Products: Subject to compliance with requirements, provide the following:
 - 2. Grade: SW
 - 3. Type: FBS
 - 4. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
 - 5. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 - 6. Application: Use where brick is exposed unless otherwise indicated.
 - 7. Brick (Field), Texture, Size and Pattern:

Autumn Clear Vertical Matt by Bowerston, Modular
(3-1/2 inches wide by 2-3/4 inches high by 7-5/8 inches long)

- 8. Provide Ash Grove Pro Mortar – Type N

Prism P2620 Camel by Spec Mix
(or as selected by Architect from manufacturer's full range of colors)

2.3 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C 91.

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. Lafarge North America Inc.; Magnolia Masonry Cement, Lafarge Masonry Cement
 - b. Lehigh Cement Company; Lehigh Masonry Cement
 - c. National Cement Company, Inc.; Coosa Masonry Cement.

E. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

F. Cold-Weather Admixture: Non-chloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

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. Euclid Chemical Company (The); Accelguard 80.
 - b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
 - c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

G. Water-Repellent Admixture: Liquid water-repellent mortar admixture, containing integral water repellent by same manufacturer.

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. ACM Chemistries, Inc.; RainBloc for Mortar.
 - b. BASF Aktiengesellschaft; Rheopel Mortar Admixture.
 - c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.

2.4 REINFORCEMENT

- A. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

2.5 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 641/A 641M, Class 1 coating.

2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
3. Stainless-Steel Wire: ASTM A 580/A 580M, Type 316.

B. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
 - a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
2. Contractor's Option: Unless otherwise indicated, provide any of the following types of anchors:
3. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
 - 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) Dayton Superior Corporation, Dur-O-Wal Division; D/A 213 or D/A 210 with D/A 700-708.
 - 2) Heckmann Building Products Inc.; 315-D with 316 or Pos-I-Tie.
 - 3) Hohmann & Barnard, Inc.; DW-10, DW-10HS, DW-10-X, or 2-Seal.
 - 4) Wire-Bond; 1004, Type III, RJ-711 or SureTie.
 - b. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches wide by 3 inches high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section.
 - c. Anchor Section: Sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom and with raised rib-stiffened strap, 5/8 inch wide by 5-1/2 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie.
 - d. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, 5/8 inch wide by 6 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.
 - e. Anchor Section: Corrosion-resistant, self-drilling, eye-screw designed to receive wire tie. Eye-screw has spacer that seats directly against framing and is same thickness as sheathing and has gasketed, washer head that covers hole in sheathing.

- f. Fabricate sheet metal anchor sections and other sheet metal parts from 1.05-inch-thick, steel sheet, galvanized after fabrication.
- g. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.25-inch- diameter, hot-dip galvanized steel wire.

2.6 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with Section 076200 "Sheet Metal Flashing and Trim" and as follows:

- 1. Copper: ASTM B 370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. weight or 0.0216 inch thick.
- 2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
- 3. Fabricate through-wall metal flashing embedded in masonry from copper with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
 - 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) Cheney Flashing Company; Cheney Flashing (Dovetail) or [Cheney 3-Way Flashing (Sawtooth).
 - 2) Keystone Flashing Company, Inc.; Keystone 3-Way Interlocking Thruwall Flashing.
 - 3) Sandell Manufacturing Co., Inc.; Mechanically Keyed Flashing.
- 4. Fabricate through-wall flashing with snap lock receiver on exterior face where indicated to receive counter flashing.
- 5. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
- 6. Fabricate through-wall flashing with sealant stop unless otherwise indicated. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
- 7. Fabricate metal drip edges and sealant stops for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam will shed water.
- 8. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
- 9. Metal Sealant Stop: Fabricate from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
- 10. Metal Expansion-Joint Strips: Fabricate from copper to shapes indicated.

B. Flexible Flashing: Use one of the following unless otherwise indicated:

1. Copper-Laminated Flashing: 7-oz./sq. ft. copper sheet bonded between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
 - 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) Dayton Superior Corporation, Dur-O-Wal Division; Copper Fabric Thru-Wall Flashing.
 - 2) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
 - 3) Phoenix Building Products; Type FCC-Fabric Covered Copper.
 2. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch.
 - 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) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
 - 2) Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier Thru-Wall Flashing.
 - 3) Grace Construction Products, W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
 - 4) Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
 - 5) Hohmann & Barnard, Inc.; Textroflash.
 - 6) W. R. Meadows, Inc.; Air-Shield Thru-Wall Flashing.
 - b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

C. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counter flashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge or flexible flashing with a metal drip edge.
4. Where flashing is fully concealed, use metal flashing or flexible flashing.

D. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."

1. Elastomeric Sealant: ASTM C 920, chemically curing urethane, polysulfide or silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

- E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Pre molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.
- B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- C. Weep/Vent Products: Use one of the following unless otherwise indicated:
 - 1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
 - 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) Advanced Building Products Inc.; Mortar Maze weep vent.
 - 2) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
 - 3) Heckmann Building Products Inc.; No. 85 Cell Vent.
 - 4) Hohmann & Barnard, Inc.; Quadro-Vent.
 - b. 1375: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Mortar Net USA, Ltd.; Mortar Net Weep Vents.
- D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - 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. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
 - b. Mortar Net USA, Ltd.; Mortar Net.
 - 2. Provide one of the following configurations:
 - a. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.

2.8 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
 - 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. Diedrich Technologies, Inc.
 - b. ProSoCo, Inc.

2.9 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar.
 - 2. Use portland cement-lime mortar unless otherwise indicated.
 - 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide Type N unless another type is indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

- B. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they are placed.
- D. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- E. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
 - 2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
 - 3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2-inch total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
 - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
 - 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 - 7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch; do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
2. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.
3. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on Drawings; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to concrete masonry unit backup with seismic masonry-veneer anchors to comply with the following requirements:
 1. Fasten screw-attached anchors with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.

2. Insert slip-in anchors in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.
3. Embed tie sections connector sections and continuous wire in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.
4. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
5. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches around perimeter.

3.7 EXPANSION JOINTS

- A. General: Install expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form expansion joints in brick as follows:
 1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
 2. Build flanges of factory-fabricated, expansion-joint units into masonry.
 3. Build in compressible joint fillers where indicated.
 4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

3.8 LINTELS

- A. Install steel lintels where indicated or at openings or penetrations in load-bearing walls.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.9 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 2. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under building paper or building wrap, lapping at least 4 inches.
 3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 4. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 5. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 6. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
 7. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
 8. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
1. Use specified weep/vent products to form weep holes.
 2. Space weep holes 24 inches o.c. unless otherwise indicated.
 3. Trim wicking material flush with outside face of wall after mortar has set.
- E. Place pea gravel in cavities as soon as practical to a height equal to height of first course above top of flashing, but not less than 2 inches to maintain drainage.
- F. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- G. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.
1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.10 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
- B. Inspections: Level 1 special inspections according to the "International Building Code."
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
- C. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

3.11 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel un-cleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean brick by bucket-and-brush hand-cleaning method described in "BIA Technical Notes 20."
 - 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - 7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
 - 8. Clean stone trim to comply with stone supplier's written instructions.

9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.12 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042113

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SECTION 042200 - CONCRETE UNIT MASONRY

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. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry joint reinforcement.
5. Ties and anchors.
6. Miscellaneous masonry accessories.

B. Related Sections:

1. Section 033000 "Cast-in-Place Concrete" for installing dovetail slots for masonry anchors.
2. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural-steel frame.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs experienced stonemasons and Stone Fitters.
- B. Perform masonry work in accordance with requirements of ACI 530.1/ASCE 6/TMS 602 unless indicated otherwise herein.
- C. Allowable Tolerances:
 1. Unit masonry shall be placed within 1/8-inch of dimensions indicated on drawings.

1.4 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.

1.6 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
 - 1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- B. Qualification Data: For testing agency.
- C. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include data on material properties.
 - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 - 2. Cementitious materials. Include brand, type, and name of manufacturer.
 - 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 4. Grout mixes. Include description of type and proportions of ingredients.
 - 5. Reinforcing bars.
 - 6. Joint reinforcement.
 - 7. Anchors, ties, and metal accessories.
- D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
 - 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

- E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Build mockups for each type of exposed unit masonry construction in sizes approximately 48 inches long by 60 inches high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches long in mockup.
 - b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
 - 3. Protect accepted mockups from the elements with weather-resistant membrane.
 - 4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
 - 5. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

- F. Preinstallation Conference: Conduct conference at project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over 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 the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry

damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 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. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.
 2. Density Classification: Normal weight, unless otherwise indicated.
 3. Size (Width): Manufactured to dimensions 3/8-inch less than nominal dimensions.
 4. Exposed Faces: Standard Smooth Natural Gray
 5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

2.3 MASONRY LINTELS

- A. General: Provide one of the following:

1. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from U-shaped CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C 91.
 1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Lafarge North America Inc.; Magnolia Masonry Cement or Lafarge Masonry Cement
 - b. Lehigh Cement Company; Lehigh Masonry Cement
 - c. National Cement Company, Inc.; Coosa Masonry Cement.
- E. Aggregate for Mortar: ASTM C 144.
 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. For joints less than 1/4-inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- F. Aggregate for Grout: ASTM C 404.
- G. Cold-Weather Admixture: Non-chloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 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. Euclid Chemical Company (The); Accelguard 80.
 - b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
 - c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.
- H. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
 - 1. Interior Walls: Hot-dipped galvanized, carbon steel.
 - 2. Exterior Walls: Hot-dipped galvanized steel.
 - 3. Wire Size for Side Rods: 0.148-inch diameter.
 - 4. Wire Size for Cross Rods: 0.148-inch diameter.
 - 5. Wire Size for Veneer Ties: 0.148-inch diameter.
 - 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 - 7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
 - 8. Ladder type joint reinforcement shall not interfere with vertical reinforcement.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.6 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
 - 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 641/A 641M, Class 1 coating.
 - 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
 - 3. Stainless-Steel Wire: ASTM A 580/A 580M, Type 316.
 - 4. Galvanized Steel Sheet: ASTM A 653/A 653M
 - 5. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
 - 6. Stainless-Steel Sheet: ASTM A 666, Type 316.
 - 7. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 8. Stainless-Steel Bars: ASTM A 276 or ASTM A 666, Type 316.
- B. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.
 - 2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.25-inch-diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.

2.7 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 325, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.
- B. Post-installed Anchors: Torque-controlled expansion anchors.
 - 1. Load Capacity: 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.
 - 2. 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.
 - 3. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.
- B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

2.9 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar.
 - 2. Use portland cement-lime mortar unless otherwise indicated.
 - 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 - 1. For masonry below grade or in contact with earth, use Type S.
 - 2. For reinforced masonry, use Type S.

3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type S.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2-inch or minus 1/4-inch.
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2-inch.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4-inch in a story height or 1/2-inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4-inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8-inch in 10 feet.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4-inch in 10 feet.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8-inch in 10 feet.
5. For lines and surfaces do not vary from straight by more than 1/4-inch in 10 feet.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4-inch in 10 feet.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations. No less-than-quarter-size units will be allowed except where indicated on the drawings.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on Drawings; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.
 - 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.

3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry concrete where masonry abuts or faces concrete to comply with the following:
 1. Provide an open space not less than 1/2 inch wide between masonry and concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 2. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
 3. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.9 LINTELS

- A. Install masonry lintels where indicated or at openings of more than 12 inches in width or at penetrations in load-bearing walls.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than 64 inches.

3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
- B. Testing Prior to Construction: One set of tests.
- C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- D. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- F. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
- H. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.12 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.13 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches in each dimension.
 - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
 - 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

SECTION 054000 - COLD-FORMED METAL FRAMING

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. Exterior walls.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for masonry shelf angles and connections.
 - 2. Section 092216 "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 PREINSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.
- B. Shop Drawings:
 - 1. Include sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.

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.

C. Research Reports: For non-standard cold-formed steel framing, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. AllSteel & Gypsum Products, Inc.
 2. Dietrich Metal Framing; a Worthington Industries Company.
 3. Nuconsteel; a Nucor Company.
 4. State Building Products, Inc.
 5. Steel Structural Systems.
 6. United Metal Products, Inc.
 7. United Steel Manufacturing.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed steel framing matching structural design drawings for size, spacing, connections. Notify engineer if additional information is necessary prior to construction.
 - 1. Design Loads: As indicated in the General Notes.
 - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Wall Framing: Horizontal deflection of 1/360 of the wall height for all façade materials (the 30% reduction in components and cladding wind load is permitted to be used to calculate deflections in comparison to the limit above EXCEPT where brick veneer is the exterior wall material).
 - 3. Wall studs: In some locations wall sheathing may not be provided on either the exterior face or interior face of wall studs to brace stud flanges. At any of these potential locations, provide blocking or strapping details as necessary to brace studs.
 - 4. Provide framing systems to allow 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 deg F.
 - 5. Provide 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 1 inch, unless noted otherwise.
 - 6. Provide exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- B. Cold-Formed Steel Framing Design Standards:
 - 1. Floor and Roof Systems: AISI S210.
 - 2. Wall Studs: AISI S211.
 - 3. Headers: AISI S212.
 - 4. Lateral Design: AISI S213.
- C. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

2.3 COLD-FORMED STEEL FRAMING, GENERAL

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - 1. Grade: ST33H minimum at 18 gauge or thinner.
 - 2. Grade: ST50H minimum at 12 to 16 gauge.

3. Coating: G60 minimum.

B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G60.

2.4 STRUCTURAL AND EXTERIOR WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Flange Width: 1-5/8 inches minimum.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges.

C. 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.

D. Vertical Deflection Clips: Manufacturer's standard 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. AllSteel & Gypsum Products, Inc.
- b. ClarkWestern Building Systems, Inc.
- c. Dietrich Metal Framing; a Worthington Industries company.
- d. MarinoWARE.
- e. SCAFCO Corporation.
- f. Steeler, Inc.
- g. Simpson StrongTie

E. Single Deflection Track: Manufacturer's 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.

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. Anchor clips.
 - 5. End clips.
 - 6. Foundation clips.
 - 7. Gusset plates.
 - 8. Stud kickers and knee braces.
 - 9. Joist hangers and end closures.
 - 10. Hole reinforcing plates.
 - 11. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

- C. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, non-staining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, and non-leaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.8 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's 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 according to Shop Drawings, with screw 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, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. 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 to ensure a uniform bearing surface on supporting concrete or masonry construction.
- B. Install sealer gaskets 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, GENERAL

- 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 and to 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.
- 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 and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

- 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 comparable in intensity 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 072100 "Thermal Insulation," in built-up exterior framing 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.
- J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 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. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 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 and manufacturer's written instructions.

- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

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SECTION 055000 - METAL FABRICATIONS

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. Steel Framing and Supports for Countertops.
 - 2. Shelf Angles.
 - 3. Steel Bollards.
 - 4. Steel Handrails.
 - 5. Loose Bearing and Leveling Plates for Applications not Specified in other Sections.
 - 6. Slotted channel framing (uni-strut).
 - 7. Miscellaneous Metal Fabrication Items.
- B. Products furnished, but not installed, under this Section:
 - 1. Loose steel lintels.
 - 2. Anchor bolts into cast-in-place concrete.
 - 3. Slotted-channel inserts.
 - 4. Steel pipe sleeves.

1.3 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Delegated Design: Design railings including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
 2. Copper Alloys: 60 percent of minimum yield strength.
 3. Stainless Steel: 60 percent of minimum yield strength.
 4. Steel: 72 percent of minimum yield strength.
 5. Glass: 25 percent of mean modulus of rupture (50 percent probability of breakage), as listed in "Mechanical Properties" in AAMA's Aluminum Curtain Wall Series No. 12, "Structural Properties of Glass."
- D. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Handrails:
 - a. Uniform load of 50 lbf/ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- F. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
1. Anchor bolts.
 2. Railing Brackets.
 3. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
1. Include plans, elevations, sections, and details of metal fabrications and their connections/attachments to other work. Show anchorage and accessory items.
- C. Samples for Verification: For each type of exposed finish required.
1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
 2. Fittings and brackets.
 3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
 - a. Show method of finishing and connecting members at intersections.

- D. Delegated-Design Submittal: For installed products 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: For qualified professional engineer.
- B. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including structural analysis, preconstruction testing, field testing, and in-service performance.
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of railings and are based on the specific system indicated. Refer to Section 016000 "Product Requirements."
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.6, "Structural Welding Code - Stainless Steel."
- 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.
- F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockups as shown on Drawings.

2. Build mockups for each form and finish of railing consisting of two posts, top rail, infill area, and anchorage system components that are full height and are not less than 24 inches in length.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.8 COORDINATION

- A. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including anchor bolts. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: 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. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500 Grade C, cold-formed steel tubing.
- C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
- D. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
1. Size of Channels: As required.
 2. Material: Galvanized steel, ASTM A 653/A 653M, structural steel, Grade 33, with G90 coating; 0.108-inch nominal thickness.

2.3 FASTENERS

- A. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- B. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- C. 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 (75 mm) 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.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. Shop Primers: Provide primers that comply with Section 099123 "Painting" for interior applications only.
- D. Intermediate Coats and Topcoats: Provide products that comply with Section 099123 "Painting" for interior applications only.
- E. Non-shrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- F. Anchoring Cement: Factory-packaged, non-shrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply 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. 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.
- F. 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.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. 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.
- J. Railings General: 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.
- K. Assemble railings in the 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. Use connections that maintain structural value of joined pieces.

- L. 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.
- M. Provide inserts and other 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.
- N. For railing posts set in concrete, provide galvanized steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. 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.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
- C. Hot-Dip Galvanize all miscellaneous framing and supports.

2.7 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches 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 larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.
- D. Prime shelf angles located in exterior walls with primer specified in Section 099600 "High-Performance Coatings."

- E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates.
- C. Prime plates with primer specified in Section 099600 "High-Performance Coatings."

2.9 LOOSE STEEL LINTELS

- A. 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.
- B. 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 unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.
- D. Prime loose steel lintels located in exterior walls with primer specified in Section 099600 "High-Performance Coatings."

2.10 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.11 SLOTTED CHANNEL FRAMING (UNI-STRUT)

- A. Slotted Channel Framing: Cold-formed metal box channels (uni-struts) complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 x 1-5/8.
 - 2. Material: Galvanized steel, ASTM A 653/A 653M, structural steel, Grade 33, with G90 coating; 0.108-inch nominal thickness.

2.12 COUNTERTOP SUPPORTS:

A. Mounting Brackets:

1. Product: A & M, Concealed Flat Brackets
 - a. Coordinate installation with kitchen wall finishes.
2. Size: CFLAT21, 21" Deep
3. Color: White

2.13 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 80 pipe, galvanized steel.
 1. Cap bollards with 1/4-inch-thick steel plate.
- B. Cast bollard into post footing, see Civil.
- C. Prime bollards with primer specified in Section 099600 "High-Performance Coatings."

2.14 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.15 STEEL AND IRON FINISHES

- A. 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.
 1. Hot-dip galvanize all items that are located outside of the building envelope (defined as outside of the doors, windows, and weather barrier at exterior walls, or above the vapor barrier/membrane at roofs).
 2. Hot-dip galvanize all items that are located within the apparatus bays, typical.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- 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. 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 masonry anchor bolts, through bolts, and other connectors.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into masonry, or similar construction.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.
- C. 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.
 - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
 - 1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. 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 grout.
 - 1. Use non-shrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- C. 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 beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.5 ATTACHING RAILINGS

- A. Anchor railing ends at walls with round flanges anchored to wall construction and connected to railing ends using non-welded connections.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and connected to railing ends using non-welded connections.
- C. Attach railings to wall with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
 - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. 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 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 fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

3.6 ADJUSTING AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.7 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 055000

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

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. Wood blocking and nailers.
 - 2. Plywood for electrical / telecom equipment mounting.

1.3 DEFINITIONS

- A. Exposed Framing: Framing not concealed by other construction.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. NHLA: National Hardwood Lumber Association.
 - 3. NLGA: National Lumber Grades Authority.
 - 4. SPIB: The Southern Pine Inspection Bureau.
 - 5. WCLIB: West Coast Lumber Inspection Bureau.
 - 6. WWPA: Western Wood Products Association.

1.4 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. Include data for fire-retardant treatment 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.
 - 2. For fire-retardant treatments, 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. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated lumber.
2. Power-driven fasteners.
3. Powder-actuated fasteners.
4. Expansion anchors.
5. Metal framing anchors.

1.6 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.

1.7 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, GENERAL

- ### 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. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

4. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that 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 nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
- E. Wood sills, sleepers, blocking, stripping, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, 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.
- 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. Use treatment that does not promote corrosion of metal fasteners.
 2. Exterior type is suitable for both exterior and interior applications. Interior type is only for interior applications.
 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. Retain option in "Design Value Adjustment Factors" Subparagraph below if applicable. Revise description of locations to suit Project. Verify adjustment factors with Project's structural engineer.
 5. 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 testing and inspecting agency acceptable to authorities having jurisdiction.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
- E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat all items indicated on Drawings, and the following:
1. Concealed framing for rooftop equipment bases and support curbs.
 2. Concealed blocking and nailers.
 3. Plywood for floor-ceiling assemblies.
 4. Plywood for electrical / telecom. equipment mounting

2.4 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.
1. Plywood 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 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article 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 with hot-dip zinc coating complying with ASTM A 153/A 153M or Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.

- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below 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 per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- D. Sort and select lumber so that natural characteristics will 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.
- E. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

- F. 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.
- G. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
 - 1. Comply with indicated fastener patterns where applicable. Before fastening, mark fastener locations, using a template made of sheet metal, plastic, or cardboard.
 - 2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
 - 3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

- A. 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.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 PROTECTION

- A. 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 061053

SECTION 061600 - SHEATHING

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. Wall sheathing.

- B. Related Requirements:

- 1. Section 061000 "Rough Carpentry" for plywood backing panels.
 - 2. Section 072500 "Weather Barriers" for water-resistive barriers applied over wall sheathing.
 - 3. Section 133400 "Engineered ladder Framed Structures" for sheathing related to engineered ladder framed structure & metal paneling that is intended to serve as shear strength for structure.

1.3 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. Include data for wood-preservative treatment from chemical treatment manufacturers and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturers and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
 - 3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For following products, from ICC-ES:

1. Preservative-treated plywood.

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 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.

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's "Fire Resistance Directory" or GA-600, "Fire Resistance Design Manual".

2.2 WOOD PANEL PRODUCTS

- A. Plywood: See structural general notes.
- B. Oriented Strand Board: See structural general notes.
- C. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- D. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWPAC U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.
- D. Plywood Wall Sheathing: See structural general notes.
- E. Oriented-Strand-Board Wall Sheathing: See structural general notes.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
 1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

2.5 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Framing: Formulation complying with ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- 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. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
 - 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."
- D. Use common wire 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. Install fasteners without splitting wood.
- E. Coordinate wall and roof 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.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. 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 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Wall Sheathing:
 - a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
 - b. Screw to cold-formed metal framing.
 - c. Space panels 1/8 inch apart at edges and ends.

END OF SECTION 061600

SECTION 072100 - THERMAL 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:
 - 1. Foam-plastic board insulation.
 - 2. Glass-fiber blanket insulation.
 - 3. Mineral-fiber blanket insulation.
 - 4. Loose Fill Insulation.
 - 5. Spray polyurethane foam insulation.
 - 6. Vapor retarders.
- B. Related Sections:
 - 1. Section 133400 "Engineered Ladder Framed Structures" for related components in ladder framed structure.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- B. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.6 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 as follows:
 - 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 before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation (Foundation & Underslab): ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
 - 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. Dow Chemical Company (The).
 - b. DuPont
 - c. Owens Corning.
 - 2. Type IV, 25 PSI
- B. R-Value: 0.75" = R5.0, min.
- C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
- D. Tape all board insulation joints, seams, and penetrations.

2.2 GLASS-FIBER BLANKET INSULATION

- 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. CertainTeed Corporation.
 2. Johns Manville.
 3. Owens Corning.
- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
- C. Kraft-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type II (non-reflective faced), Class C (faced surface not rated for flame propagation); Category 1.
- D. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

2.3 MINERAL-FIBER BLANKET INSULATION

- A. Unfaced, Mineral-Fiber Blanket Insulation: ASTM C 612, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
- B. 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. CertainTeed Corporation.
 2. Johns Manville.
 3. Owens Corning.

2.4 LOOSE-FILL INSULATION (IN ATTIC)

- A. Cellulosic-Fiber Loose-Fill Insulation: ASTM C 739, chemically treated for flame-resistance, processing, and handling characteristics.

2.5 SPRAY POLYURETHANE FOAM INSULATION

- A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
- B. 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. BASF Corporation.
 - b. Dow Chemical Company (The).
 - c. Jon Manville.

- C. Minimum density of 2.0 lb/cu. ft., thermal resistivity of 7.0 deg F x h x sq. ft./Btu x in. at 75 deg F.

2.6 RADIANT BARRIERS

- A. Interior Radiation Control Coating System: Non-thickness-dependent, low-emissivity, water-based coating; formulated for adherence to substrates indicated and with a surface emittance value of 0.25 or less as measured per ASTM C 1371.
- B. Provide radiant barrier compatible with Spray Polyurethane Foam Insulation Manufacturer at any exposed locations.

2.7 VAPOR RETARDERS

- A. Polyethylene Vapor Retarders: ASTM D 4397, 10 mils thick, with maximum permeance rating of 0.13 perm.
- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.
- D. Single-Component Non-sag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.
- E. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

2.8 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
 - 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. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
 - b. Gemco; Spindle Type.
 - 2. Plate: Perforated, galvanized carbon-steel sheet, 0.030-inch thick by 2 inches square.
 - 3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing 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 indicated.
- B. 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. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BELOW-GRADE INSULATION

- A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive or loosely laid according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation to full depth of foundation wall.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.
 - 1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

3.5 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. Glass-Fiber 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 clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 - 5. For metal-framed wall cavities where cavity heights exceed 96 inches support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 - 6. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:
 - a. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
 - b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
 - 7. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings and seal each continuous area of insulation to ensure airtight installation.
 - a. Exterior Walls: Set units with facing placed as indicated on Drawings.
 - b. Interior Walls: Set units with facing placed toward areas of high humidity or as indicated on Drawings.
- D. Spray-Applied 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.

- E. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

- 1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.6 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

- 3.7 Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions.

3.8 INSTALLATION OF VAPOR RETARDERS

- A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.
 - 1. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 o.c.
 - 2. Before installing vapor retarders, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
 - 3. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.
- C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.9 PROTECTION

- A. Protect installed insulation and vapor retarders 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 072100

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SECTION 072500 - WEATHER BARRIERS

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. Commercial weather barrier assemblies.
2. Flexible flashing.
3. Weather barrier flashing.
4. Fluid-applied flashing.
5. Weather barrier accessories.
6. Drainage material.

B. Related Requirements:

1. Section 061600 "Sheathing" for weather barrier substrates.
2. Section 072100 "Thermal Insulation" for installation of exterior insulation.
3. Section 133400 "Engineered Ladder-Framed Structures" for installation of exterior metal panels, anti-condensation measures, & other thermal and moisture protection associated with the ladder framed structure.

1.3 DEFINITIONS

A. Weather Barrier: A combination of materials and accessories that do the following:

1. Prevents the accumulation of water as a water-resistive barrier.
2. Minimizes the air leakage into or out of the building envelope as a continuous air barrier.
3. Provides sufficient water vapor transmission to enable drying as a vapor-permeable membrane.

B. Water-Resistive Barrier: A combination of materials and accessories that prevent the accumulation of water within the wall assembly per International Building Code Section 1403.2.

C. Continuous Air Barrier: The combination of interconnected materials, assemblies, and sealed joints and components of the building envelope that minimize air leakage into or out of the building envelope per ASHRAE 90.1 section 5.4.3.1.

- D. Vapor Diffusion: A slow movement of individual water vapor molecules from regions of higher to lower water vapor concentration (higher to lower vapor pressure).
- E. Vapor Permeable Membrane: The property of having a water-vapor permeance rating of 10 perms or greater, when tested in accordance with the desiccant method using Procedure A of ASTM E 96 per definition in International Building Code. Vapor permeable material permits the passage of moisture vapor through vapor diffusion.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Manufacturer's Certified Installer, weather barrier manufacturer's designated field representative, and installers of work that interfaces with or affects weather barrier.
 - 2. Review methods and procedures related to weather barrier installation, including manufacturer's written instructions.
 - 3. Review and finalize construction, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Examine substrate conditions and finishes for compliance with requirements.
 - 5. Review flashings, special weather barrier details, weather barrier penetrations, and condition of other construction that affects weather barrier.
 - 6. Review weather barrier manufacturer's Project Registration and Observation process.
 - 7. Review temporary protection requirements for weather barrier during and after installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For weather barrier, include data on air and water-vapor permeance based on testing in accordance with referenced standards.
- B. Sustainable Design Submittals:
 - 1. Test Reports: Envelope testing and verification of the following:
 - a. Water-Spray Test.
 - b. Air Infiltration Test.
 - c. Water Penetration Test.
- C. Shop Drawings: Show details of weather barrier at terminations, openings, and penetrations. Show details of flexible flashing applications.
- D. Preconstruction Laboratory Mockup Testing Submittals:
 - 1. Engage in a third-party testing program: Developed specifically for Project.

2. Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.
3. Record Drawings: As-built drawings of preconstruction laboratory mockups showing changes made during preconstruction laboratory mockup testing.

1.6 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For weather barrier and flexible flashing, from ICC-ES.
- B. Manufacturer's Instructions: For installation of each product specified.
- C. Qualification Data: For Installer and field-testing agency.
- D. Sample Warranty: For manufacturer's warranty.
- E. Reports: Field test and inspection reports.
- F. Installer's weather barrier manufacturer-training certificate.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is certified by weather barrier system manufacturer to install manufacturer's product.
- B. Laboratory Mockup Testing Agency Qualifications: Qualified in accordance with ASTM E 699 for testing indicated.
- C. Mockups: Build mockups to set quality standards for materials and execution.
 1. Build integrated mockups of exterior wall assembly as shown on Drawings, 150 sq. ft., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of weather barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
 - a. Include junction with roofing membrane building corner condition, foundation wall intersection and fenestration and wall interface.
 - b. If Architect determines mockups do not comply with requirements, reconstruct mockups, and apply weather barrier until mockups are approved.
 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.

- D. Manufacturer's Field Service: Contractor shall register project with weather barrier manufacturer prior to installation of weather barrier and comply with weather barrier manufacturer's Project registration and manufacturer's observation and certification process.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not store near heat source or open flame.

1.9 WARRANTY

- A. Manufacturer's Product Warranty: To repair or replace weather barrier product that fails in materials within specified warranty period.
 - 1. Warranty Period: 10 years from substantial completion.
- B. Manufacturer's Product and Labor Warranty: Manufacturer agrees to repair or replace weather barrier that fails in materials within specified warranty period, including removal and replacement of affected construction up to manufacturer's limits.
 - 1. Warranty Period: 10 years from substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain weather barrier assembly components, including weather barrier flashing from same manufacturer as weather barrier or manufacturer approved by weather barrier manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed weather barrier and accessories shall withstand specified wind pressures, liquid water penetration, and water vapor pressures, without failure due to defective manufacture of products.
- B. High-Performance Installations:
 - 1. For installation with one of the following building envelope performance or structural characteristics:
 - a. Exceeding 65 mph equivalent structural load.
 - b. Exceeding 15 mph equivalent wind-driven rainwater infiltration.
 - c. Buildings with 60 feet or more total height above grade plane, as defined in the International Building Code.
 - d. Construction with gypsum or cement-based exterior sheathing.

- e. Non-wood based primary structure such as: steel, light gage steel, masonry, or concrete.

2.3 WEATHER BARRIER

- A. Commercial Building Wrap: ASTM E 2357 passed, ABAA (Air Barrier Association of America) evaluated air barrier assembly, and assembly water resistance per ASTM E 331; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested in accordance with ASTM E 84; UV stabilized for nine-month exposure; and acceptable to authorities having jurisdiction.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont Safety & Construction: E. I. du Pont de Nemours and Company; Tyvek CommercialWrap and Tyvek CommercialWrap D or a comparable product as approved by Architect prior to bidding.
 - a. Other approved manufacturers:
 - 1) Tytar, DrainableWrap Commercial.
 - 2. System Description, Single-Layer Drainable: Single-layer weather barrier with integral drainage, including flashing and sealing of penetrations and seams.
 - 3. Drainability: 98 percent or greater when tested in accordance with ASTM E 2273.
 - 4. Air Permeance, Product: Not more than 0.001 cfm/sq. ft. at 1.57 lbf/sq. ft. when tested in accordance with ASTM E 2178.
 - 5. Air Permeance, Assembly: Not more than 0.04 cfm/sq. ft. at 1.57 lbf/sq. ft. when tested in accordance with ASTM E 2357 and evaluated by ABAA.
 - 6. Water Penetration Resistance, Product: Hydrostatic head resistance greater than 7.7 feet in accordance with AATTC 127.
 - 7. Water Penetration Resistance, Assembly: Assembly wall specimen described in ASTM E 2357 to water resistance in accordance with ASTM E 331 to 10.4 lbf/sq. ft.
 - 8. Water-Vapor Permeance: Not less than 23 perms) per ASTM E 96/E 96M, Desiccant Method (Procedure A) or not less than 28 perms per ASTM E 96/E 96M, Water Method (Procedure B).
 - 9. Water-Vapor Permeance: Not less than 30 perms per ASTM E 96/E 96M, Desiccant Method (Procedure A) or not less than 46 perms per ASTM E 96/E 96M, Water Method (Procedure B).
 - 10. Allowable UV Exposure Time: Not less than nine months when tested in accordance with ASTM G 155 (Accelerated Weathering).
 - 11. Flame Propagation Test: Materials and construction shall be as tested in accordance with NFPA 285.
 - 12. Heat and Visible Smoke Release Rates: Maximum rates in accordance with NFPA 285.
 - a. Peak Heat Release: 13,217 Btu/sq. ft.
 - b. Total Heat Release: 1762 Btu/sq. ft.
 - c. Effective Heat of Combustion: 7744 Btu/lb.
 - 13. Weather barrier system to have a VOC content of 30 g/L or less.

2.4 WEATHER BARRIER FLASHING

- A. Conformable Weather Barrier Flashing: Composite flashing material composed of micro-creped, polyethylene laminate with a 100 percent butyl-based adhesive layer; AAMA 711 Class A (no primer), Level 3 thermal exposure, 176 deg F for 7 days.
1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont Safety & Construction: E. I. du Pont de Nemours and Company; FlexWrap™ NF or comparable product as approved prior to bidding.
 2. Conformability: Able to create a seamless sill pan extending up the jambs without cuts, patches, or fasteners.
 3. Water Penetration: No leakage at 15 psf per ASTM E 331.
 4. Low Temperature Adhesion: Exceeds minimum value of 1.5 lb./in. at 25 degrees F as Class A (without primer use).
 5. Adhesion After Water Immersion: Exceeds minimum value of 1.5 lb./in., after AAMA 800, Sections 2.4.1.3.1/2.4.1.4.3, Test B.
- B. Strip Flashing: Composite flashing material composed of spunbonded polyethylene laminate with 100 percent butyl-based, dual-sided, adhesive layer; AAMA 711, Class A (no primer), Level 3 thermal exposure, 176 deg F for 7 days.
1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont Safety & Construction: E. I. du Pont de Nemours and Company; StraightFlash, StraightFlash VF or comparable product as approved by Architect prior to bidding.
 2. Water Penetration: No leakage at 15 psf, per ASTM E 331.
 3. Low Temperature Adhesion: Exceeds minimum value of 1.5 lb./in. at 25 deg F as Class A without primer use.
 4. Adhesion After Water Immersion: Exceeds minimum value of 1.5 lb./in., after AAMA 800, Sections 2.4.1.3.1/2.4.1.4.3, Test B.

2.5 FLUID-APPLIED FLASHING

- A. Fluid-Applied Flashing: Trowel or brush applied, non-water soluble, single component, silyl terminated polyether technology (STPE), vapor permeable, flashing material.
1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont Safety & Construction: E. I. du Pont de Nemours and Company; Tyvek® Fluid Applied Flashing & Joint Compound+ or comparable product as approved by the Architect prior to bidding.
 2. VOC Content: ASTM C 1250, less than 2 percent by weight and between 25 to 30 g/L.
 3. Water Vapor Transmission: ASTM E 96, Method B, greater than 20 perms at 25 mils thick.
 4. Minimum Tensile Strength: ASTM D 412, 165 lb/sq. ft.
 5. Minimum Elongation at Break: ASTM D 412; 360 percent.

2.6 WEATHER BARRIER ACCESSORIES

- A. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by weather barrier manufacturer for sealing joints and penetrations in commercial building wrap.
 - 1. Basis-of-Design Product: DuPont Safety & Construction: E. I. du Pont de Nemours and Company; Tyvek® Tape.
- B. Closed-Cell Polyurethane Foam Insulation: Low pressure, low expansion, single component polyurethane foam, with maximum flame-spread and smoke-developed indexes of 15 and 25, respectively, per ASTM E 84.
 - 1. Basis-of-Design Product: DuPont Safety & Construction: E. I. du Pont de Nemours and Company; DuPont™ Window & Door Foam.
 - 2. Pressure Build-Up: 0.0247 psi maximum, AAMA 812.
 - 3. Deflection: 0.0050 inch maximum, AAMA 812.
- C. Fasteners with Self-Gasketing Washers: Commercial building wrap manufacturer's recommended pneumatically or hand-applied fasteners with 1-inch- diameter, high-density polyethylene cap washers with UV inhibitors.
 - 1. Basis-of-Design Product: DuPont Safety & Construction: E. I. du Pont de Nemours and Company; Tyvek® Wrap Caps.
- D. Primer for Flashings: Synthetic rubber-based product; spray applied. Strengthen adhesive bond at low temperature applications between weather products such as self-adhered flashing products, commercial building wraps, and common building sheathing materials.
 - 1. Basis-of-Design Product: DuPont Safety & Construction: E. I. du Pont de Nemours and Company, DuPont™ Adhesive Primer.
 - 2. Peel Adhesion Test: Passes in accordance with ASTM D 3330, Test Method F, for the following.
 - a. Peel Angles: 0, 25, 72, and 180 degrees.
 - b. Substrates: Concrete masonry units (CMU), exterior gypsum sheathing, oriented strand board (OSB), aluminum, and vinyl.
 - 3. Chemical Compatibility: Pass; AAMA 713.
 - 4. Flame Spread Index: 5; ASTM E 84.
 - 5. Smoke Development Index: 0; ASTM E 84.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements.
- B. Verify that substrate and surface conditions are in accordance with commercial weather barrier manufacturer recommendations prior to installation.

1. Verify that rough sill framing for doors and windows is sloped downwards towards the exterior and is level across width of the opening.
- C. Verify that surfaces to receive weather barrier flashing are clean, dry, and free of frost.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Direct water onto an acceptable weather barrier drainage plane with an unobstructed path to exterior of wall.
 1. Provide a drainage path for water intrusion through window and door attachment system that collects at window and door sills and directs water to the exterior or weather barrier.

3.3 COMMERCIAL BUILDING WRAP INSTALLATION

- A. General: Comply with weather barrier manufacturer's written instructions and warranty requirements.
- B. Cover exposed exterior surface of sheathing with weather barrier securely fastened to framing immediately after sheathing is installed.
 1. Maintain continuity of air and water barrier assemblies.
 2. Start weather barrier installation at a building corner, leaving 12 inches of weather barrier extended beyond corner to overlap.
 3. Install weather barrier horizontally starting at lower portion of wall surface.
 4. Provide minimum 6 inches overlap at horizontal- and vertical-wrap seams in a shingle manner to maintain continuous downward drainage plane and air and water barrier.
- C. Seams: Seal seams with building wrap tape per manufacturer's recommended installation instructions.
 1. Shiplap horizontal seams in weather barrier to facilitate proper drainage.
- D. Fasteners: Use weather barrier manufacturer's recommended fasteners to secure weather barrier and install fasteners according to weather barrier manufacturer's installation guidelines.
 1. Do not use temporary fasteners to permanently attach weather barrier.
 2. Do not place fasteners with gasketing washers where weather barrier flashing will be installed.
 3. Install fasteners with gasketing washers through flashing where recommended by manufacturer.
- E. Openings: Completely cover openings with weather barrier, then cut weather barrier membrane to openings according to weather barrier manufacturer's installation guidelines.

1. Provide head and jamb flaps and seam overlaps to maintain continuous drainage.
2. Repair damage to weather barrier using method recommended by weather barrier manufacturer.
3. Install flashing according to weather barrier manufacturer's installation guidelines.

3.4 WEATHER BARRIER FLASHING INSTALLATION

- A. Installation: Remove wrinkles and bubbles, reposition weather barrier as necessary to produce a uniform, smooth surface.
1. Ensure that ambient and substrate surface temperatures are acceptable in accordance with manufacturer instructions and recommendations.
 2. Wipe surfaces to remove moisture, dirt, grease, and other debris that could interfere with adhesion.
 3. Apply weather barrier manufacturer's recommended primer over concrete, masonry, and glass-mat gypsum wall sheathing substrates to receive weather barrier flashing.
 4. Lap weather barrier flashing a minimum of 2 inches onto weather barrier.
 5. Apply pressure over entire surface using roller or firm hand pressure.
- B. Rough Openings: Shiplap flashing with weather barrier in a shingle manner to maintain a continuous downward drainage plane and air and water barrier in accordance with manufacturer's written instructions.
1. Apply 9-inch- wide conformable weather barrier flashing at door and windowsills.
 2. Ensure that sill flashing does not slope to the interior.
 3. Install backer rod in joint between frame of opening product and flashed rough opening on the interior.
 4. Apply sealant or closed-cell polyurethane foam insulation around entire opening/fenestration product to create air seal around interior perimeter of window openings in accordance with weather barrier manufacturer's instructions.
 5. Around door and window openings, apply butyl-based flashing to flaps of weather barrier.
 6. Use strip flashing with wrap cap screws to secure head flap of the windows.
- C. Penetrations: Apply weather barrier manufacturer's recommended weather barrier flashing patches behind fastening plates, such as brick-tie base plates, metal-flashing clips, and metal channels.
1. Seal weather barrier around each penetration with weather barrier manufacturer's recommended self-adhered flashing product or sealant. Integrate products with flanges into the weather barrier.
- D. Terminations: Provide minimum 2 inches overlap using strip flashing on adjoining roof and base of wall systems to maintain continuous downward drainage plane.
1. Secure weather barrier with fasteners and weather-barrier flashing.

3.5 FLUID-APPLIED FLASHING INSTALLATION

- A. General: Before installing fluid-applied flashing, do the following:
 - 1. Ensure drainage path is not blocked or disrupted. Do not install on walls that do not feature a continuous path for moisture drainage. Blocked or disrupted paths for drainage can result in excess moisture buildup in wall cavity. Do not install below grade.
 - 2. Remove surface dust, dirt, and loose mortar.
 - 3. Verify that surface is free of grease and other contaminants and that surface is smooth.
 - 4. Fill joints in concrete masonry units, and voids in cast-in-place concrete with trowel-applied fluid-applied flashing to ensure surface is flush and smooth.
 - 5. Allow masonry mortar and cast-in-place concrete a minimum of 24 hours to cure before installing fluid-applied flashing.
- B. Fluid-Applied Flashing Installation: Using a trowel or brush, apply fluid-applied flashing around perimeter of window and door openings to a minimum thickness of 25 mils.
 - 1. Extend flashing a minimum of 2 inches onto exterior face of adjacent surface.
 - 2. Inspect for gaps and pinholes in fluid-applied flashing and apply additional coats until no gaps and pinholes appear.
 - 3. Joint Applications: Using a trowel or a brush, fill cracks and voids up to 1/4 inch in width.
 - a. For joints and cracks between 1/4 and 1/2 inch wide, cover first with mesh tape.
 - b. For joints and cracks between 1/2 and 1 inch wide, cover first with butyl-based strip flashing.
 - c. Apply a bead, then trowel smooth.
 - d. Seam coverage should be a minimum of 2 inches wide and 15 to 20 mils thick.
 - e. Inspect for gaps and pinholes in fluid-applied flashing and apply additional coats until no gaps and pinholes appear.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to train installers and observe subject test-wall areas and installations.
- B. Testing Agency: Engage a qualified third-party testing agency to perform tests and inspections.
- C. Test Area: Perform tests on one bay at least 30 feet, by one story.
- D. Field Quality Control Testing: Perform the following test on mockups.
 - 1. Air Infiltration Whole Building: ASTM E 779 at not more than 0.25 cfm/sf at 1.57 lb/sq. ft.

2. Water Penetration: ASTM E 1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" article, but not less than 10.0 lbf/sq. ft. No water penetration shall occur as defined in ASTM E 1105.

- a. Perform a minimum of two tests in areas as directed by Architect.

- E. Prepare test and inspection reports.

3.7 CLEANING

- A. Immediately remove release paper and scrap from work area and dispose of material in accordance with requirements of Section 017300 "Execution".

3.8 PROTECTION

- A. Protect installed weather barrier from the following:
 1. Damage from cladding, structure, or a component of the structure (e.g., window, door, or wall system).
 2. Contamination from building site chemicals, premature deterioration of building materials, or nonstandard use or application of products.
 3. Foreign objects or agents, including the use of materials incompatible with weather barrier products.
 4. UV exposure in excess of products' stated limits.

END OF SECTION 072500

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SECTION 076200 - SHEET METAL FLASHING AND TRIM

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. Formed Products:

- a. Formed roof drainage sheet metal fabrications.
 - b. Formed low-slope roof sheet metal fabrications.
 - c. Formed wall sheet metal fabrications.
 - d. Formed equipment support flashing.
 - e. Formed overhead-piping safety pans.

- B. Related Sections:

- 1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 079200 "Joint Sealants".

1.3 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated 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. Wind Resistance: Fabricate and install roof edge flashing in accordance with the recommendations in FMG Loss Prevention Data Sheet 1-49 for the specified wind zone. Ensure that substrate construction is also in compliance.
- C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
 - 1. Identification of material, thickness, weight, and finish for each item and location in Project.
 - 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 - 3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 - 4. Details of termination points and assemblies, including fixed points.
 - 5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
 - 6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counter flashings as applicable.
 - 7. Details of special conditions.
 - 8. Details of connections to adjoining work.
 - 9. Detail formed flashing and trim at a scale of not less than 3 inches per 12 inches.
- C. Samples for Initial Selection: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 - 1. Sheet Metal Flashing: 12 inches 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 long and in required profile. Include fasteners and other exposed accessories.
 - 3. Accessories and Miscellaneous Materials: Full-size Sample.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified fabricators.
- B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.
- C. Pre-installation Conference: Conduct conference at project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
 - 2. Review methods and procedures related to sheet metal flashing and trim.
 - 3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 - 4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing.
 - 5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.8 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 other 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 the extent necessary for the period of sheet metal flashing and trim installation.

1.9 WARRANTY

- A. Special Warranty on Finishes: Manufacturer's standard form 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: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A 755/A 755M.
 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
 2. Surface: Smooth, flat and with manufacturer's standard clear acrylic coating on both sides.
 3. Finish: Natural Galvanized or Galvalume Finish

2.2 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, non-perforated.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

- b. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
- 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
- 3. Fasteners for Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, non-staining tape 1/2 inch wide and 1/8 inch thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

2.4 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the 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 without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed 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 on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."
- D. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant.

- E. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- G. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.
- H. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- I. 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.
- J. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.
- K. Do not use graphite pencils to mark metal surfaces.

2.5 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.
 - 1. Gutter Style: SMACNA designation 'H'.
 - 2. Gutter Size: 6-inch x 6-inch, min.
 - 3. Expansion Joints: Butt type with concealed cover plate.
 - 4. Accessories: Wire ball downspout strainer.
 - 5. Gutters with Girth up to 15 Inches: Fabricate from the following materials:
 - a. Galvanized Steel: 0.022 inch thick
- B. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 1. Manufactured Hanger Style: Rear & Side Mounted Pipe-Cleat Style Hanger
 - 2. Downspout Size: 3-inch x 4-inch, min.
 - 3. Fabricate from the following materials:
 - a. Galvanized Steel: 0.022 inch thick

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof-Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch-long, but not exceeding 10-foot-long, sections. Furnish with 6-inch-wide, joint cover plates.
 - 1. Joint Style: Butt, with 12-inch-wide, concealed backup plate and 6-inch- wide, exposed cover plates.
 - 2. Fabricate from the following materials:
 - a. Galvanized Steel: 0.028 inch thick.
 - b. Coated Steel: 0.028 inch thick
- B. Roof and Roof to Wall Transition, Roof to Roof Edge Flashing (Gravel Stop) Transition, and Roof to Roof Edge Flashing (Gravel Stop) and Fascia Cap Transition, and Expansion-Joint Cover: Fabricate from the following materials:
 - a. Galvanized Steel: 0.034 inch thick.
 - b. Coated Steel: 0.034 inch thick
- C. Base Flashing: Fabricate from the following materials:
 - a. Galvanized Steel: 0.028 inch thick.
 - b. Coated Steel: 0.028 inch thick
- D. Counter flashing: Fabricate from the following materials:
 - a. Galvanized Steel: 0.022 inch thick.
 - b. Coated Steel: 0.022 inch thick
- E. Flashing Receivers: Fabricate from the following materials:
 - a. Galvanized Steel: 0.022 inch thick.
 - b. Coated Steel: 0.022 inch thick

2.7 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing (at windows, doors, and metal siding): Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot-long, sections, at shelf angles and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch-high, end dams where flashing is discontinuous. Fabricate from the following materials:
 - 1. Aluminum: 0.032 inch thick.
 - 2. Coated Steel: 0.022 inch thick.

- B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.
2. Coated Steel: 0.022 inch thick.

2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.019 inch thick.
2. Zinc-Tin Alloy-Coated Stainless Steel: 0.018 inch thick.
3. Galvanized Steel: 0.028 inch thick.
4. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

- B. Overhead-Piping Safety Pans: Fabricate from the following materials:

1. Stainless Steel: 0.025 inch thick.
2. Zinc-Tin Alloy-Coated Stainless Steel: 0.024 inch thick.
3. Galvanized Steel: 0.040 inch thick.
4. Aluminum-Zinc Alloy-Coated Steel: 0.040 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions 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.
- B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. General: Install underlayment as indicated on Drawings.
- B. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage 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.

3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, 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 and levels indicated. 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 apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim without oil canning, buckling, and tool marks.
 - 5. Install sealant tape where indicated.
 - 6. Torch cutting of sheet metal flashing and trim is not permitted.
 - 7. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
 - 1. Coat back side of uncoated aluminum sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing 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.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws and metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal joints as required for watertight construction.
 - 1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, 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 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- F. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.

3.4 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets or straps spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
 1. Fasten gutter spacers to front and back of gutter.
 2. Loosely lock straps to front gutter bead and anchor to roof deck.
 3. Anchor and loosely lock back edge of gutter to continuous eave or apron flashing.
 4. Anchor gutter with spikes and ferrules spaced not more than 24 inches apart.
 5. Install gutter with expansion joints at locations not exceeding, 50 feet apart. Install expansion-joint caps.
- C. Downspouts: Join sections with 1-1/2-inch telescoping joints.
 1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c. in between.
 2. Provide elbows at base of downspout to direct water away from building.
 3. Connect downspouts to underground drainage system indicated.

3.5 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
- C. Pipe or Post Counter flashing: Install counter flashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

- D. Counterflashing: Coordinate installation of counter flashing with installation of base flashing. Insert counter flashing in reglets or receivers and fit tightly to base flashing. Extend counter flashing 4 inches over base flashing. Lap counter flashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner by means of interlocking folded seam or blind rivets and sealant or anchor and washer at 36-inch centers.
- E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with sealant recommended by roofing manufacturer and clamp flashing to pipes that penetrate roof.

3.6 WALL FLASHING INSTALLATION

- A. Through-Wall Flashing (at windows, doors, and fiber-cement siding): Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.7 MISCELLANEOUS FLASHING INSTALLATION

- A. Overhead-Piping Safety Pans: Suspend pans independent from structure above as indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.
- B. 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.

3.8 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch 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's "Guide Specification for Residential Metal Roofing."

3.9 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 manufacturers written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a 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 076200

SECTION 077200 - ROOF ACCESSORIES

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. Pipe supports.
- 2. Preformed flashing sleeves.
- 3. Equipment supports.

- B. Related Sections:

- 1. Section 055000 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access.
- 2. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
- 3. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: 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.

1.4 ACTION SUBMITTALS

- A. Submit under provisions of Section 013300 "Submittal Procedures."
- B. All submittals shall be subject to the Owner's review and approval.
- C. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- D. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

- E. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

1.5 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 are specified in this Section.
 - 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. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.7 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 field verified dimensions.

1.8 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form 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: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.
 - 1. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
- A. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123/A 123M.
- B. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, 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 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 non-removable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
- F. Gaskets: Manufacturer's standard 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 polyurethane or 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.

2.3 APPROVED EQUIVALENT

- A. The Contractor must submit any specific product not specified below per the directions laid out in Section 016300 "Substitution Procedures."

2.4 PIPE SUPPORTS

- A. Pipe Supports: Adjustable-height, extruded-aluminum tube, filled with urethane insulation; 2 inches 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.
- 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.
- C. Duct Supports: Extruded-aluminum, urethane-insulated supports, 2 inches in diameter; with manufacturer's recommended hardware for mounting to structure or structural roof deck.

2.5 PREFORMED FLASHING SLEEVES

- A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches high, with removable metal hood and slotted metal collar.
- B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.

2.6 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, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, 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 only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: 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, excessive oil canning, 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 other miscellaneous items as required 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 or 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. Pipe Support Installation: Install pipe supports so top surfaces are in contact with and provide equally distributed support along length of supported item.
- D. Preformed Flashing-Sleeve Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions.
- E. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

- A. Clean exposed surfaces according to manufacturer's written instructions.
- B. Clean off excess sealants.
- C. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 078413 - PENETRATION FIRESTOPPING

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. Penetrations in fire-resistance-rated walls.
- B. Related Sections:
 - 1. Section 078446 "Fire-Resistive Joint Systems" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each penetration fire stopping system. Include location and design designation of qualified testing and inspecting agency.
 - 1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration fire stopping condition, submit illustration, with modifications marked, approved by penetration fire stopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Installer Certificates: From Installer indicating penetration fire stopping has been installed in compliance with requirements and manufacturer's written recommendations.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration fire stopping.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing penetration fire stopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration fire stopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- B. Fire-Test-Response Characteristics: Penetration fire stopping shall comply with the following requirements:
 - 1. Penetration fire stopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Penetration fire stopping is identical to those tested per testing standard referenced in "Penetration Fire stopping" Article. Provide rated systems complying with the following requirements:
 - a. Penetration fire stopping products bear classification marking of qualified testing and inspecting agency.
 - b. Classification markings on penetration fire stopping correspond to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
 - 2) FM Global in its "Building Materials Approval Guide."
- C. Pre-installation Conference: Conduct conference at project site.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration fire stopping when ambient or substrate temperatures are outside limits permitted by penetration fire stopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration fire stopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration fire stopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration fire stopping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. 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. Sika Corporation.
 2. Grace Construction Products.
 3. Hilti, Inc.
 4. Johns Manville.
 5. 3M Fire Protection Products.
 6. Tremco, Inc.; Tremco Fire Protection Systems Group.
 7. USG Corporation.

2.2 PENETRATION FIRESTOPPING

- A. Provide penetration fire stopping that is 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. Penetration fire stopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration fire stopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls and fire partitions. Refer to code plan and/or building plans for location of required fire walls.
 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration fire stopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. Horizontal assemblies include ceiling membranes of roof/ceiling assemblies.
 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
 3. T-Rating: Not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Barriers: Provide penetration fire stopping with ratings determined per UL 1479.
1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.

- E. W-Rating: Provide penetration fire stopping showing no evidence of water leakage when tested according to UL 1479.
- F. Exposed Penetration Fire stopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- G. Accessories: Provide components for each penetration fire stopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration fire stopping manufacturer and approved by qualified testing and inspecting agency for fire stopping indicated.
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-wool-fiber or rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars.
 - 5. 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 metallic sleeve lined with an intumescent strip, a radial extended 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 elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Non-hardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- 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 non-shrinking, 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, non-shrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and non-sag formulation for openings in vertical and sloped surfaces, unless indicated fire stopping limits use of non-sag grade for both opening conditions.

2.4 MIXING

- A. For those products requiring mixing before application, comply with penetration fire stopping 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, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing penetration fire stopping to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration fire stopping.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration fire stopping. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.

- B. Priming: 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 fire stopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire stopping's seal with substrates.

3.3 INSTALLATION

- A. General: Install penetration fire stopping 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 fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire stopping.
- C. Install fill materials for fire stopping by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 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. Identify penetration fire stopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of fire stopping edge so labels will be visible to anyone seeking to remove penetrating items or fire stopping. 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 Fire stopping - 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. Authority having jurisdiction will inspect penetration fire stopping.
- B. Where deficiencies are found or penetration fire stopping is damaged or removed because of testing, repair or replace penetration fire stopping to comply with requirements.
- C. Proceed with enclosing penetration fire stopping with other 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 fire stopping 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 fire stopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration fire stopping and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

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SECTION 078446 - FIRE-RESISTIVE JOINT 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. Section Includes:
 - 1. Joints in or between fire-resistance-rated constructions.
 - 2. Fire-rated expansion joints.
- B. Related Sections:
 - 1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.
 - 1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- B. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:
 - 1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
 - a. Fire-resistive joint system products bear classification marking of qualified testing agency.
 - b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
- C. Pre-installation Conference: Conduct conference at project site.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

- A. Where required, provide fire-resistive joint 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 assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint 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 fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:
 - 1. Joints include those installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies.
 - 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
 - 3. 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. Sika Corporation.
 - b. Grace Construction Products.
 - c. Hilti, Inc.
 - d. Johns Manville.
 - e. 3M Fire Protection Products.
 - f. Tremco, Inc.; Tremco Fire Protection Systems Group.
 - g. USG Corporation.
- C. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- D. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

2.2 FIRE-RATED EXPANSION JOINT

- A. Basis-of-Design Product: Emshield WFR2
 - 1. 2-inch joint system or size as indicated in structural drawings.
 - 2. 2-Hour Fire Rated, Watertight, Sound Dampening, Primary Seal.
 - 3. UL: WW-D-1158
 - a. Reference Architectural plans & details for locations and installation requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems 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 fill materials.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by fire-resistive joint 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.
- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

- A. General: 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 fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing 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 fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply fill materials so they contact and adhere to substrates formed by joints.
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. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels will be visible to anyone seeking to remove or penetrate joint 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 - Fire-Resistive Joint System - 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: Authority having jurisdiction will inspect fire-resistive joint systems.
- B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.
- C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint 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 fire-resistive joint 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.

END OF SECTION 078446

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SECTION 079200 - JOINT SEALANTS

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. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.

B. Related Sections:

1. Section 088000 "Glazing" for glazing sealants.
2. Section 092900 "Gypsum Board" for sealing perimeter joints.
3. Section 095123 "Acoustical Tile Ceilings" for sealing edge moldings at perimeters with acoustical sealant.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
 1. Joint-sealant application, joint location, and designation.
 2. Joint-sealant manufacturer and product name.
 3. Joint-sealant formulation.
 4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

- B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- C. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- E. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- F. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- G. Field-Adhesion Test Reports: For each sealant application tested.
- H. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
 - 2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
- D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.
- E. Pre-installation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Five (5) years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Five (5) years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

- A. Applications:
 1. Interior
 2. Wet-locations within 5 feet of sinks or plumbing fixtures.
 3. On non-porous surfaces such as tile, glass and metal.
- B. Single-Component, Non-sag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
 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; 790
 - b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
 - c. Sika Corporation, Construction Products Division; SikaSil-C990.
 - d. Tremco Incorporated; Spectrem 1, Spectrem 800.

2.3 URETHANE JOINT SEALANTS

- A. Applications:
 1. Exterior
- B. Single-Component, Non-sag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
 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. Sika Corporation, Construction Products Division; Sikaflex - 15LM.
 - b. Tremco Incorporated; Vulkem 921.

2.4 LATEX JOINT SEALANTS

A. Applications:

1. Interior
2. Non-wet-locations further than 5 feet from sinks or plumbing fixtures.
3. Gap-filler at woodwork, trim, baseboard, etc.
4. Where sealant is required to be painted to match adjacent surfaces.

B. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems; Sonolac.
 - b. Bostik, Inc.; Chem-Calk 600.
 - c. Tremco Incorporated; Tremflex 834.

2.5 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material, Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 - 4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
 - 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

- G. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
 2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
 3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
 4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.
- H. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200

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SECTION 081113 - HOLLOW METAL DOOR AND FRAMES

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 hollow-metal work.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for door hardware.
 - 2. Section 088000 "Glazing" for door and frame lites.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 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 such items to Project site in time for installation.

1.5 PREINSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at project site.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.
- B. Shop Drawings: Include the following:

1. Elevations of each door frame type.
 2. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 3. Locations of reinforcement and preparations for hardware.
 4. Details of each different wall opening condition.
 5. Details of anchorages, joints, field splices, and connections.
 6. Details of accessories.
 7. Details of moldings, removable stops, and glazing.
 8. Details of conduit and preparations for power, signal, and control systems.
- C. Schedule: Provide a schedule of hollow-metal work 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.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal frame assembly, for tests performed by a qualified testing agency.
- B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
1. 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 Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked surface to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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. Amweld International, LLC.
 2. Ceco Door Products; an Assa Abloy Group company.
 3. Curries Company; an Assa Abloy Group company.

4. Republic Doors and Frames.
5. Steelcraft; an Ingersoll-Rand company.

- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

- A. 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 and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
1. Smoke- and Draft-Control Assemblies: Provide an assembly 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.
- B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR HOLLOW METAL DOORS AND FRAMES

- A. Construct interior frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

Note: some interior door locations shall be rated to exterior door & frame standards, see plans and schedule for specific locations.

- A. Commercial Doors and Frames: NAAMM-HMMA 861. At locations indicated in the Door and Frame Schedule.
1. Physical Performance: Level A according to SDI A250.4.
 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches
 - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch.
 - d. Edge Construction: Continuously welded with no visible seam.
 - e. Core: Steel stiffened.
 - f. Elevation: See Drawings and Schedules.
- 1) Flush Doors.

3. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.053-inch door openings 48 inches or less, or window frames; minimum thickness of 0.067-inch for door openings greater than 48 inches.
 - b. Construction: Full profile welded.
4. Exposed Finish: Prime & Field Paint as shown on Drawings.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

Note: some interior door locations shall be rated to exterior door & frame standards, see plans and schedule for specific locations.

- B. Commercial Doors and Frames: NAAMM-HMMA 861. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level A according to SDI A250.4.
2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum G60 paint-grade coating.
 - d. Edge Construction: Continuously welded with no visible seam.
 - e. Core: Steel stiffened and insulated.
 - f. Elevation: See Drawings. See Door Schedule.
 - 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.

3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067-inch, with minimum G60 paint-grade coating.
 - b. Construction: Full profile welded, thermally broken.
4. Exposed Finish: Prime & Field Paint as shown on Drawings.

2.5 FRAME ANCHORS

- A. Jamb Anchors:

1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 2. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 3. Post-installed Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z 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.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. 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 hollow-metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- H. 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.
- I. Glazing: Comply with requirements in Section 088000 "Glazing."

2.7 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026-inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
 - 2. Fire Core Doors: As required to provide fire-protection and temperature-rise ratings indicated.
 - 3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches. Provide beveled or square edges at manufacturer's discretion.
 - 4. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
 - 5. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
 - 6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 - 7. 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 beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Sidelight and Transom Bar 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 butt welding.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 - 4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 - 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:

- 1) Four anchors per jamb from 90 to 120 inches high.
 - 2) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Five anchors per jamb from 90 to 96 inches high.
 - 2) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
6. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
7. 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.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 1. Reinforce frames to receive non-templated, mortised, and surface-mounted door hardware.
 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.
 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior frames.
 4. Provide loose stops and moldings on inside of hollow-metal work.
 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.8 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.9 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

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 the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-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.
- B. Drill and tap frames to receive non-templated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that will be filled with grout containing anti-freezing agents.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 5. In-Place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 6. In-Place Metal Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
 7. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
 - c. At Bottom of Door: 5/8 inch or minus 1/32 inch. Coordinate with threshold.
 - d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" 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 o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust 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 otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. 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.
- D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 083113 - ACCESS DOORS AND FRAMES

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. Access doors and frames for walls and ceilings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Detail fabrication and installation of access doors and frames for each type of substrate.
- C. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- 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:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
 - 1. Access Panel Solutions.

2. Acudor Products, Inc.
3. Jensen Industries; Div. of Broan-Nutone, LLC.
4. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
5. Karp Associates, Inc.
6. Larsen's Manufacturing Company.
7. Milcor Inc.

C. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

D. Flush Access Doors with Concealed Flanges

1. Assembly Description: Fabricate door to fit flush to frame. Provide frame with gypsum board beads for concealed flange installation.
2. Locations: Wall and ceiling.
3. Door Size: As indicated on drawing or as required for access to equipment.
4. Uncoated Steel Sheet for Door: Nominal 0.060-inch, 16 gage. Provide metallic-coated finish (galvanized A60) steel sheet in pool room or areas with caustic fumes/materials.
 - a. Finish: Factory finish, White.
5. Frame Material: Same material and thickness as door.
6. Hinges: Continuous.
7. Hardware: Latch and lock. Locking where specified or required.

E. Plastic Flush Access Doors

1. Assembly Description: Fabricate door to fit flush to frame. Fabricate frame from single piece, 3/4 inch wide, with gypsum board bead for concealed installation.
2. Locations: Wall and ceiling.
3. Door Size: Up to 1 square ft. maximum.
4. Door and Frame Materials: 1/8-inch- thick, high-impact plastic with UV stabilizer. White finish with textured exposed surfaces.
5. Hinges: Manufacturer's standard.
6. Hardware: Snap latch.

F. Hardware:

1. Latch: Self-latching bolt operated by screwdriver with interior release (where lock not present) or by lever with interior release (when lock is present).
2. Lock: Cylinder, keyed to building keying system.
 - a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 087100 "Door Hardware."

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

- B. 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.
- C. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A60 metallic coating.
- E. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- F. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- G. Aluminum Sheet: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of Alloy 5005-H15; with minimum sheet thickness according to ANSI H35.2.
- H. Frame Anchors: Same type as door face.
- I. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.3 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
 - 2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
 - 3. Provide mounting holes in frames for attachment of units to metal or wood framing.
 - 4. Provide mounting holes in frame for attachment of masonry anchors.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.

1. For recessed doors with plaster infill, provide self-furring expanded metal lath attached to door panel.
- E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 1. For cylinder locks, furnish two keys per lock and key all locks alike. Coordinate with building keying system.
 2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.
- F. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

2.4 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical 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 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.
- D. Steel and Metallic-Coated-Steel Finishes:
 1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
 2. Factory Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry-film thickness of 1 mil for topcoat.

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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

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SECTION 083613 - SECTIONAL DOORS

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 manually operated electrically operated overhead sectional doors.
- B. Related Sections:
 - 1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Sectional doors shall meet performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.
- B. Structural Performance: Exterior sectional doors 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: As identified in the drawings.
 - a. Basic Wind Speed: 115 mph.
 - b. Occupancy Category: II.
 - c. Exposure Category: B.
 - d. Enclosure Classification: Enclosed (GCpi = +/- 0.18)
 - e. Wind Load Pressures: 26.7 psf, -29.7 psf, see structural.
 - 2. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components. Deflection of door in horizontal position (open) shall not exceed 1/120 of the door width.
- C. Air Infiltration: Maximum rate not more than indicated when tested according to ASTM E 283.
 - 1. Air Infiltration: Maximum rate of 0.08 cfm/sq. ft. at 15 and 25 mph.

- D. Operation Cycles: Provide sectional door components and operators capable of operating for not less than number of cycles indicated for each door. 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.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type and size of sectional door and accessory. Include the following:
 - 1. Construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
 - 2. Rated capacities, operating characteristics, and furnished accessories.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. 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.
- C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
 - 1. Include similar Samples of accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 - 1. Flat Door Sections: 6 inches square.
 - 2. Frame for Paneled Door Sections: 6 inches long of each width of stile and rail required.
 - 3. Panel for Raised-Panel Door Sections: 12 inches square at panel corner, but not smaller than required to show raised-panel profile.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Warranties: Sample of special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sectional doors to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain sectional doors from single source from single manufacturer.
 - 1. Obtain operators and controls from sectional door manufacturer.
- 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.
- D. Standard for Sectional Doors: Fabricate sectional doors to comply with DASMA 102 unless otherwise indicated.
- E. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sectional doors 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 hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
 - d. Delamination of exterior or interior facing materials.
 - 2. Warranty Period: 2 (Two) years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 10 (Ten) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 STEEL DOOR SECTIONS

- A. Exterior Section Faces and Frames: Fabricate from zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated zinc coating and thickness.
 - 1. Fabricate section faces from single sheets to provide sections not more than 24 inches high and of indicated thickness. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weathertight seal, with a reinforcing flange return.
 - 2. For insulated doors, provide sections with continuous thermal-break construction, separating the exterior and interior faces of door.
- B. Section Ends and Intermediate Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.064-inch-nominal coated thickness and welded to door section. Provide intermediate stiles formed from not less than 0.064-inch-thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches apart.
- C. Reinforce bottom section with a continuous channel or angle conforming to bottom-section profile and allowing installation of astragal.
- D. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place. Ensure that reinforcement does not obstruct vision lites.
- E. Provide reinforcement for hardware attachment.
- F. Board Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free polystyrene or polyurethane board insulation, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84; or with glass-fiber-board insulation. Secure insulation to exterior face sheet. Enclose insulation completely within steel sections that incorporate the following interior facing material, with no exposed insulation:
 - 1. Interior Facing Material: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated thickness.
 - 2. Interior Facing Material: Manufacturer's standard prefinished hardboard panel, 1/8 inch thick and complying with ANSI A135.5.
- G. Fabricate sections so finished door assembly are rigid and aligned, with tight hairline joints and free of warp, twist, and deformation.

2.2 TRACKS, SUPPORTS, AND ACCESSORIES

- A. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances shown on Drawings, and complying with ASTM A 653/A 653M for minimum G60 zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track spaced 2 inches apart for door-drop safety device. Slope tracks at proper angle from vertical or design tracks to ensure tight closure at jams when door unit is closed.
- B. Track Reinforcement and Supports: Galvanized-steel track reinforcement and support members, complying with ASTM A 36/A 36M and ASTM A 123/A 123M. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.
 - 1. Vertical Track Assembly: Track with continuous reinforcing angle attached to track and attached to wall with jamb brackets wall jamb brackets attached to track and attached to wall.
 - 2. Horizontal Track Assembly: Track with continuous reinforcing angle attached to track and supported at points from curve in track to end of track by laterally braced attachments to overhead structural members.
- C. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.
- D. Windows: Manufacturer's standard insulated window units of type and size indicated and in arrangement shown. Set glazing in vinyl, rubber, or neoprene glazing channel for metal-framed doors and elastic glazing compound for wood doors, as required. Provide removable stops of the same material as door-section frames.

2.3 HARDWARE

- A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.
- B. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch- nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges where required, for doors over 16 feet wide unless otherwise recommended by door manufacturer.
- C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch- diameter roller tires for 3-inch- wide track and 2-inch- diameter roller tires for 2-inch-wide track.

- D. Push/Pull Handles: For push-up or emergency-operated doors, provide galvanized-steel lifting handles on each side of door.

2.4 LOCKING DEVICES

- A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.
- B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.5 COUNTERBALANCE MECHANISM

- A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A 229/A 229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.
- B. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
- C. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

2.6 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and "operation cycles" requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than the number of cycles per hour indicated for each door.
- C. Door-Operator Type: Unit consisting of electric motor, gears, pulleys, belts, sprockets, chains, and controls needed to operate door and meet required usage classification.
 - 1. Jackshaft, Side Mounted: Jackshaft operator mounted on the inside front wall on right or left side of door and connected to torsion shaft with an adjustable coupling or drive chain.

- D. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 110513 "Common Motor Requirements for Equipment" unless otherwise indicated.
1. Electrical Characteristics:
 - a. Phase: Single phase.
 - b. Volts: 208 V.
 - c. Horsepower: 3/4 hp.
 2. Motor Type and Controller: Reversible motor and controller disconnect switch for motor exposure indicated.
 3. Speed in first subparagraph below is for standard-speed doors. Consult manufacturer and revise for higher-speed operation.
 4. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
 5. Revise first subparagraph below if required; coordinate requirements with electrical engineer. Verify which electrical devices, connections, and wiring, if any, are furnished or installed by other than sectional-door manufacturer. These devices are required to comply with requirements for electrical devices and connections specified elsewhere.
 6. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 7. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
 8. Use adjustable motor-mounting bases for belt-driven operators.
- E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- F. Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
1. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
 - a. Self-Monitoring Type: Four-wire configured device designed to interface with door-operator control circuit to detect damage to or disconnection of sensor edge.
- G. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
1. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

2. Exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.
- H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- K. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.
- L. Radio-Control System: Consisting of the following:
 1. Three-channel universal coaxial receiver to open, close, and stop door; two per operator.
 2. Multifunction remote control.
 3. Remote antenna and mounting kit.

2.7 DOOR ASSEMBLY (OH1)

- A. Galvanized Steel Sectional Door with Vision Lite Panels: Sectional door formed with hinged sections.
 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. Arm-R-Lite.
 - b. C.H.I. Overhead Doors.
 - c. Clopay Building Products; a Griffon company.
 - d. Haas Door; a Nofziger company.
 - e. Overhead Door Corporation.
 - f. Wayne-Dalton Corp.
- B. Operation Cycles: Not less than 10,000.
- C. Installed U-Factor: 0.12 Btu/deg F x h x sq. ft. or less.
- D. R-value: 16.22
- E. Steel Sections: Zinc-coated (galvanized) steel sheet with G60 zinc coating.

1. Section Thickness: 1-7/8"
 2. Exterior-Face, Steel Sheet Thickness: 0.015-inch, galvanized
 3. Surface: Flush
 4. Insulation: Polyurethane Core
- F. Track Configuration: Standard headroom lift track as indicated on the Drawings.
- G. Weatherseals: Fitted to bottom and top and around entire perimeter of door.
- H. Windows: Full-view panel. 1/2-inch, Thermolite Insulated Tempered Glass or approved equal.
- I. Roller-Tire Material: Case-hardened steel
- J. Locking Devices: Equip door with slide bolt for padlock.
1. Locking Device Assembly: Single-jamb side, locking bars, operable from inside with thumbturn.
- K. Counterbalance Type: Torsion spring.
- L. Electric Door Operator:
1. Usage Classification: Medium duty, up to 15 cycles per hour.
 2. Operator Type: Jackshaft, side mounted. Coordinate operator size so to fit between overhead door openings and not interfere with tank fill locations.
 3. Motor Exposure: Interior, clean, and dry.
 4. Emergency Manual Operation: Push-up type. Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
 5. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
 6. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar.
 7. Remote Control Station: Interior.
- M. Door Finish:
1. Baked-Enamel Finish.
 2. Interior & Exterior colors to match closely to adjacent clear anodized door finish. Or as selected by Architect from manufacturers full range of standard & custom colors.

2.8 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "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.

2.9 STEEL AND GALVANIZED-STEEL FINISHES

- A. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
- B. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard 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, with Installer present, 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 only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Tracks:
 - 1. Fasten vertical track assembly to opening jambs and framing, spaced not more than 24 inches apart.
 - 2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
 - 3. Repair galvanized coating on tracks according to ASTM A 780.
- C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust doors and seals to provide weathertight fit around entire perimeter.
- D. Align and adjust motors, pulleys, belts, sprockets, chains, and controls according to manufacturer's written instructions.
- E. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 083613

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SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

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. Exterior storefront framing.
 - 2. Aluminum Sun-Shades (Intent is for future installation. Contractor shall provide delegated design/engineering, frame reinforcement, and other preparatory measures to allow for future installation of Aluminum Sun-Shades).
- B. Related Sections:
 - 1. Section 088000 "Glazing".
 - 2. Section 087100 "Door Hardware".

1.3 DEFINITIONS

- A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 PERFORMANCE REQUIREMENTS

- A. Test Units
 - 1. Air, water, and structural test unit size shall be a minimum of two stories high and three lites wide.
 - 2. Thermal test unit sizes shall be 80" (2032 mm) wide x 80" (2032 mm) high with one intermediate vertical mullion and two lites of glass.
- B. Test Procedures and Performance
 - 1. Air Infiltration Test
 - a. Test unit in accordance with ASTM E 283 at a static air pressure difference of 6.24 psf.
 - b. Air infiltration shall not exceed .06 cfm/SF of unit.

2. Water Resistance Test

- a. Test unit in accordance with ASTM E 331.
- b. There shall be no uncontrolled water leakage at a static test pressure of 12.0 psf.

3. Uniform Load Deflection Test

- a. Test in accordance with ASTM E 330.
- b. Deflection under design load shall not exceed $L/175$ of the clear span.

4. Uniform Load Structural Test

- a. Test in accordance with ASTM E 330 at a pressure 1.5 times the design wind pressure in 1.05.B.3.b.
- b. At conclusion of the test, there shall be no glass breakage, permanent damage to fasteners, storefront parts, or any other damage that would cause the storefront to be defective.

5. Condensation Resistance Test (CRF)

- a. Test unit in accordance with AAMA 1503.1.
- b. Condensation Resistance Factor (CRF) shall not be less than 57 (frame) when glazed with 47 center of glass U-Factor. (See chart at end of section).

6 Thermal Transmittance Test (Conductive U-Factor)

- a. With ventilators closed and locked, test unit in accordance with NFRC 100-2010.
- b. Conductive thermal transmittance (U-Factor) shall not be more than .55 BTU/hr•ft²•°F when glazed with .47 center of glass U-Factor.

- C. Delegated Design: Glazing supplier to design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.
- B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
 - 2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12-inch lengths of full-size components and showing details of the following:
 - 1. Joinery, including concealed welds.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.
- F. Other Action Submittals:
 - 1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- G. For aluminum-framed systems indicated to comply with performance requirements and design criteria, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of aluminum-framed systems.
 - 2. Include design calculations.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer
- B. Preconstruction Test Reports: For sealant.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.
- D. Source quality-control reports.
- E. Quality-Control Program for Structural-Sealant-Glazed System: Include reports.
- F. Field quality-control reports.
- G. Warranties: Sample of special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- C. Provide data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.
- D. Quality-Control Program for Structural-Sealant-Glazed System: Develop quality control program specifically for Project. Document quality-control procedures and verify results for aluminum-framed systems. Comply with ASTM C 1401 recommendations including, but not limited to, system material-qualification procedures, preconstruction sealant-testing program, procedures for system fabrication and installation, and intervals of reviews and checks.
- E. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
 - 1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
- F. Accessible Entrances: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- G. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.
- H. Pre-installation Conference: Conduct conference at project site.

1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems 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 caused by thermal movements.
- c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- d. Adhesive or cohesive sealant failures.
- e. Water leakage through fixed glazing and framing areas.
- f. Failure of operating components.

2. Warranty Period: Ten (10) years from date of Substantial Completion.

- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: Ten (10) years from date of Substantial Completion.

1.11 MAINTENANCE SERVICE

- A. Entrance Door Hardware:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Manko Series 2450FS; 2" x 4.5" Thermally-Broken Storefront Framing, or comparable product by one of the following:

1. EFCO
2. Kawneer North America; an Alcoa company
3. Tubelite

- B. Basis-of-Design Product – Sunshades: Subject to compliance with requirements, provide Manko Sunshade system or comparable product by one of the following:
1. EFCO
 2. Kawneer North America; an Alcoa company
 3. Tubelite
 4. System Properties:
 - a. Extension: 31" Square Outrigger- measured from face of storefront system.
 - b. System Anchor Brackets: 2450cg FS
 - c. Face Cap: Rectangular
 - d. Louvers: Air Foil Blade

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B 209.
 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 3. Extruded Structural Pipe and Tubes: ASTM B 429.
 4. Structural Profiles: ASTM B 308/B 308M.
 5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- B. Steel Reinforcement: Manufacturer's standard 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.
1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

- A. Framing Members: Manufacturer's standard extruded-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: Offset
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard 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.
 3. Use exposed fasteners with countersunk Phillips screw heads, fabricated from stainless steel.
- D. 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.
- E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- F. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

- A. Glazing: As specified in Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.
- D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.
- E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:
1. Structural Sealant: ASTM C 1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.
 2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.
 - a. Color: Matching structural sealant.

2.5 HEAVY DUTY ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's heavy duty glazed entrance doors for manual-swing operation. (Manko 150i Series Doors or similar)

1. Door Construction: 2-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 2. Door Design (as shown on Drawings):
 - a. Jambs: Wide stile; 5-inch, min. nominal width.
 - b. Header: Wide stile; 5-inch, min. nominal width.
 - c. Accessible Doors: Smooth surfaced for width of door in area within 10-inches, min. above floor or ground plane.
 3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide non-removable glazing stops on outside of door.
- B. Entrance Door Hardware: As specified in Section 087100 "Door Hardware."

2.6 ENTRANCE DOOR HARDWARE

- A. General: Prep for hardware identified in schedule & See 087100 "Door Hardware"
- B. Opening-Force Requirements:
 1. Latches and Exit Devices: Not more than 15 lbf required to release latch.
- C. Continuous-Gear Hinges: See 087100 "Door Hardware" Supplied by Door Supplier.
- D. Panic Exit Devices: See 087100 "Door Hardware"
- E. Cylinders: See 087100 "Door Hardware"
- F. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- G. Operating Trim: BHMA A156.6.
- H. Removable Mullions: BHMA A156.3, extruded aluminum.
 1. When used with panic exit devices, provide removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305. Use only mullions that have been tested with exit devices to be used.
- I. Closers: See 087100 "Door Hardware"
- J. Door Stops: See 087100 "Door Hardware"
- K. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
- L. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- M. Silencers: BHMA A156.16, Grade 1.
- N. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

2.7 ACCESSORY MATERIALS

- A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Section 079200 "Joint Sealants."

2.8 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. Framing Members, General: 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. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
 4. Physical and thermal isolation of glazing from framing members.
 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 6. Provisions for field replacement of glazing from interior.
 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Storefront Framing: Fabricate components for assembly using screw-spline system.
- F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 1. At exterior doors, provide compression weather stripping at fixed stops.

2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 2. At exterior doors, provide weather sweeps applied to door bottoms.
- H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

- A. Color Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
 1. Color: Clear Anodized.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
 1. Comply with manufacturer's written instructions.
 2. Do not install damaged components.
 3. Fit joints to produce hairline joints free of burrs and distortion.
 4. Rigidly secure non-movement joints.
 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
 6. Seal joints watertight unless otherwise indicated.

- B. Metal Protection:
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum will 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 the system to exterior.
- D. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weather tight installation.
- E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
- F. Install glazing as specified in Section 088000 "Glazing."
- G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weather tight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.
- H. Install perimeter joint sealants as specified in Section 079200 "Joint Sealants" to produce weather tight installation.

3.3 ERECTION TOLERANCES

- A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
 - 1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet.
 - 2. Alignment:
 - a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
- B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections.
- B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive phases as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
 - 1. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing under "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft., of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft.
 - 2. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure difference of 0.67 times the static-air-pressure difference specified for laboratory testing under "Performance Requirements" Article, but not less than 4.18 lbf/sq. ft., and shall not evidence water penetration.
 - 3. Water Spray Test: Before installation of interior finishes has begun, a minimum area of 75 feet by 1 story of aluminum-framed systems designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
- C. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- E. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
 - 1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

END OF SECTION 084113

SECTION 087100 - DOOR HARDWARE

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 commercial door hardware for the following:

- 1. Swinging doors.

- B. Door hardware includes, but is not necessarily limited to, the following:

- 1. Mechanical door hardware.
 - 2. Electromechanical door hardware.
 - 3. Automatic operators.
 - 4. Cylinders specified for doors in other sections.

- C. Related Sections:

- 1. Division 081113 "Hollow Metal Doors and Frames".
 - 2. Division 081416 "Flush Wood Doors".
 - 3. Division 084113 "Aluminum-Framed Entrances and Storefronts".

- D. Codes and References: Comply with the year version adopted by the Authority Having Jurisdiction.

- 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. State Building Codes, Local Amendments.

- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

- a. Elevation diagram of each unique access-controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
- D. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- E. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- F. Informational Submittals:
 - 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

- A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.
- B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.5 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years' documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years' documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier is recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third-party source will not be accepted.
 - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 - 3. Review sequence of operation narratives for each unique access-controlled opening.
 - 4. Review and finalize construction schedule and verify availability of materials.
 - 5. Review the required inspecting, testing, commissioning, and demonstration procedures.

- I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.7 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.

- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Please note that ASSA ABLOY is transitioning the Yale Commercial brand to ASSA ABLOY ACCENTRA. This affects only the brand name; the products and product numbers will remain unchanged. The brand transition is expected to be complete in or about May of 2024, and products shipping after that time will be branded ASSA ABLOY ACCENTRA.
- D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 BUTT HINGES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
 - 1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 - 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

- a. Widths up to 3'-0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'-1" to 4'-0": 5" standard or heavy weight as specified.
3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
5. Manufacturers:
 - a. McKinney (MK) - TA/T4A Series, 5-knuckle.
 - b. Ives/Allegion (IV).

2.3 CONTINUOUS HINGES

- A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
 1. Manufacturers:
 - a. Pemko (PE).
 - b. Ives/Allegion (IV).

2.4 POWER TRANSFER DEVICES

- A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:
 - a. Pemko (PE) - EL-CEPT Series.
 - b. Securitron (SU) - EL-CEPT Series.
 - c. Von Duprin (VD) - EPT-10 CON Series.

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:
 - a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
 - b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:
 - a. McKinney (MK) - QC-C Series.
 - b. Von Duprin (VD) - Connect.

2.5 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.
 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
 2. Furnish dust proof strikes for bottom bolts.
 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 5. Manufacturers:
 - a. Rockwood (RO).
- B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.
 1. Manufacturers:
 - a. Rockwood (RO).

- C. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 4. Pulls, where applicable, shall be provided with a 10" clearance from the finished floor on the push side to accommodate wheelchair accessibility.
 5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
 6. Manufacturers:
 - a. Rockwood (RO).

2.6 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years' experience designing secured master key systems and have on record a published security keying system policy.
1. Manufacturers:
 - a. Sargent Manufacturing (SA).
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
1. Threaded mortise cylinders with rings and cams to suit hardware application.
 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 4. Tubular deadlocks and other auxiliary locks.
 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 6. Keyway: Match Facility Standard.
- C. Keying System: Each type of lock and cylinders to be factory keyed.
1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.

- D. Key Quantity: Provide the following minimum number of keys:
 - 1. Change Keys per Cylinder: Two (2)
 - 2. Master Keys (per Master Key Level/Group): Five (5).
 - 3. Construction Keys (where required): Ten (10).
- E. Construction Keying: Provide construction master keyed cylinders.
- F. Key Registration List (Bitting List):
 - 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 - 2. Provide transcript list in writing or electronic file as directed by the Owner.

2.7 KEY CONTROL

- A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
 - 1. Manufacturers:
 - a. Lund Equipment (LU).
 - b. MMF Industries (MM).
 - c. Telkee (TK).

2.8 MORTISE LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.
 - 1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ML2000 Series.
 - b. Sargent Manufacturing (SA) - 8200 Series.
 - c. Schlage/Allegion (SC) – L9000 Series.

2.9 CYLINDRICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 1 (Heavy-Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed cylindrical locksets. Listed manufacturers shall meet all functions and features as specified herein.
 - 1. Electromechanical locksets shall have the following functions and features:

- a. Universal Molex plug-in connectors that have standardized color-coded wiring and are field configurable in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
- b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
- c. Options to be available for request-to-exit or enter signaling, latchbolt and deadbolt monitoring.
- d. Two-year limited warranty on electrified functions.

2. Manufacturers:

- a. Sargent Manufacturing (SA) - 10X Line.

2.10 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
 4. Dustproof Strikes: BHMA A156.16.

2.11 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
 1. Exit devices shall have a five-year warranty.
 2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.

4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.
1. Electromechanical exit devices shall have the following functions and features:
 - a. Universal Molex plug-in connectors that have standardized color-coded wiring and are field configurable in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
 - b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
 - c. Options to be available for request-to-exit or enter signaling, latchbolt and touchbar monitoring.
 - d. Field configurable electrified trim to fail-safe or fail-secure that operates from 12-24VDC.
 - e. Five-year limited warranty for electromechanical features.
 2. Manufacturers:
 - a. Sargent Manufacturing (SA) - 80 Series.
 - b. Von Duprin (VD) – 33 / 99 Series.

2.12 SURFACE DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire-rated doors.
 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.
1. Large body cast iron surface mounted door closers shall have a 30-year warranty.
 2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DC8000 Series.
 - b. Norton Rixson (NO) - 9500 Series.
 - c. Sargent Manufacturing (SA) - 281 Series.
 - d. LCN/Allegion (LC) – 4040XP Series.
- C. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.
1. Manufacturers:
 - a. LCN Closers (LC) - 1450 Series.
 - b. Sargent Manufacturing (SA) - 1431 Series.

2.13 ELECTROHYDRAULIC DOOR OPERATORS

- A. Electrohydraulic Door Operators (High Traffic): Provide ANSI/BHMA A156.19 Certified Products Directory (CPD) listed low energy operators that meet ANSI/BHMA A156.4 requirements and are UL listed for use on fire rated doors and UL10C certified that comply with requirements for the Americans with Disabilities Act (ADA). Operators shall be verified by GreenCircle to offer energy savings of 19% when compared to similar products to accommodate openings up 250 pounds and 48" wide.
1. Provide operators with features as follows:
 - a. Non-handed with push and pull side mounting.
 - b. Operates as mechanical surface closer during close cycles, when door is opened manually or if power is off.
 - c. Activation by push button, hands-free or radio frequency devices.
 - d. On board electronics to collect usage and cycle count data to facilitate preventative maintenance/diagnostics.
 - e. Two-year limited warranty.
 - f. Wi-Fi interface where the operator is a secure, password protected WiFi hot spot with no connection to building's IT required.
 - 1) Simple setup with no app required.
 - 2) View status and make adjustments without removing the cover.
 - 3) Built-in logic to support single use restroom applications with no external relay boards, logic modules, position switches required.
 - g. Mounting backplate to simplify and speed up installation.
 2. Operators shall have the following functionality:
 - a. Adjustable Hold Open: Amount of time a door will stay in the full open position after an activation.
 - b. Blow Open for Smoke Ventilation: Door opens when signal is received from alarm system allowing air or smoke to flow through opening. Door will stay open until signal from alarm system is stopped.
 - c. Infinite Hold Open: Door will hold open at set position until power is turned off.
 - d. Obstruction Detection: Door closes if it hits an obstruction while opening; door will reverse to open position if it hits an obstruction while closing. Door will stop once it hits an obstruction and will rest against the obstruction until removed.
 - e. Open Delay: Delays operator opening for locking hardware.
 - f. Overload Safety Shut-Off: After two minutes of receiving a door activation signal, inverter times out and door closes to prevent motor/inverter damage.
 - g. Presence Detector Input: Input for external sensor to detect presence at door open or close position only.
 - h. Push & Go: As the door is manually opened, the operator "senses" movement and opens door to the full-open position.

- i. Selector Mode Switch: Off disables the signal inputs unless Blow Open is activated, on activates the signal inputs, hold open activates the unit (unless Blow Closed is activated) to the hold open position.
 - j. Vestibule Delay: When the wall switch is pressed, first door in vestibule will open. Second door will open once vestibule door delay has expired. Delay is adjustable.
3. Manufacturers:
- a. LCN (LC) - 4630/4640 Series.
 - b. Norton Rixson (NO) - 6000 Series.

2.14 ARCHITECTURAL TRIM

A. Door Protective Trim

- 1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
- 2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
- 3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
- 4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, 050-inch thick.
- 5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
- 6. Manufacturers:
 - a. Rockwood (RO).
 - b. Trimco (TC).
 - c. Ives/Allegion (IV).

2.15 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:
 - a. Rockwood (RO).
 - b. Trimco (TC).
 - c. Ives/Allegion (IV).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 1. Manufacturers:
 - a. Norton Rixson (RF).
 - b. Sargent Manufacturing (SA).
 - c. Glynn-Johnson/Allegion (GJ).

2.16 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 1. Pemko (PE).
 2. Reese Enterprises, Inc. (RE).
 3. Zero Products/Allegion (ZE).

2.17 ELECTRONIC ACCESSORIES

- A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.
 - 1. Manufacturers:
 - a. Securitron (SU) - DPS Series.
- B. Switching Power Supplies: Provide power supplies with either single or dual voltage configurations at 12 or 24VDC. Power supplies shall have battery backup function with an integrated battery charging circuit and shall provide capability for power distribution, direct lock control and Fire Alarm Interface (FAI) through add on modules. Power supplies shall be expandable up to 16 individually protected outputs. Output modules shall provide individually protected, continuous outputs and/or individually protected, relay controlled outputs.
 - 1. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
 - 2. Manufacturers:
 - a. Securitron (SU) - AQD Series.
 - b. Altronix (AS) - Maximal 3.

2.18 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.19 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify Architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
1. Quantities listed are for each pair of doors, or for each single door.
 2. The supplier is responsible for handing and sizing all products.
 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
 4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.
- B. Manufacturer's Abbreviations:
1. MK - McKinney
 2. NO - Norton
 3. OT - Other
 4. PE - Pemko
 5. RF - Rixson
 6. RO - Rockwood
 7. SA - Sargent
 8. SU - Securitron

HARDWARE SETS

Set: 1.0

Doors: 104A

1 Continuous Hinge	CFM83HD1-M PT x Height Required	C	PE
1 Electric Power Transfer	EL-CEPT	630	SU
1 Fail Secure Exit Device	55 8876 ETL	US32D	SA
1 Surf Overhead Stop	9-x36	630	RF
1 Door Closer	281 PD10	EN	SA
1 Drop Plate	281D	EN	SA
1 Gasketing	Provided by Alum. Door Supplier		OT
1 Blade Stop Spacer	581-2	EN	SA
1 Sweep	3452CNB TKSP8		PE
1 Threshold	253x3AFG		PE
1 ElectroLynx Harness	QC-C1500P (Frame - EPT to Power/Controller)		MK
1 ElectroLynx Harness	QC-CxxxP (Door - EPT to Elec. Exit Device)		MK
1 Position Switch	DPS-M / W		SU
1 Card Reader	Provided by Security Contractor		OT
1 Power Supply	AQD1		SU

Notes: Door normally closed, latched, and secured.
Entry by valid card read or key override.
Free egress at all times.

Set: 2.0 (NOT USED)

Set: 3.0

Doors: 112.1, 112.2

1 Continuous Hinge	CFM83HD1-M PT x Height Required	C	PE
1 Electric Power Transfer	EL-CEPT	630	SU
1 Fail Secure Exit Device	55 8876 ETL	US32D	SA
1 Door Closer w/ Hold Open	281 CPSH	EN	SA
1 Kick Plate (Doors 105, 112C)	K1050 10" x 1" LDW CSK BEV	US32D	RO
1 Armor Plate (Doors 100, 100J)	K1050 32" x 1" LDW CSK BEV	US32D	RO
1 Gasketing	2891APK TKSP8		PE
1 Sweep	3452CNB TKSP8		PE
1 Threshold	253x3AFG		PE
1 ElectroLynx Harness	QC-C1500P (Frame - EPT to Power/Controller)		MK
1 ElectroLynx Harness	QC-CxxxP (Door - EPT to Elec. Exit Device)		MK
1 Position Switch	DPS-M / W		SU
1 Card Reader	Provided by Security Contractor		OT
1 Power Supply	AQD1		SU

Notes: Door normally closed, latched, and secured.
Entry by valid card read or key override.
Free egress at all times.

Install gasketing prior to surface mounted hardware. Do not notch gasketing for surface mounted hardware.

Set: 4.0

Doors: 113

3 Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Electric Power Transfer	EL-CEPT	630	SU
1 Fail Secure Mortise Lock	RX 56-8204 LE2 FEL	US26D	SA
1 Surface Closer	1431 P10	EN	SA
1 Armor Plate	K1050 32" x 1" LDW CSK BEV	US32D	RO
1 Wall Stop	400 / 403	US26D	RO
1 Gasketing	2891APK TKSP8		PE
1 Sweep	3452CNB TKSP8		PE
1 ElectroLynx Harness	QC-C1500P (Frame - EPT to Power/Controller)		MK
1 ElectroLynx Harness	QC-CxxxP (Door - EPT to Elec. Lock)		MK
1 Position Switch	DPS-M / W		SU
1 Card Reader	Provided by Security Contractor		OT
1 Power Supply	AQD1		SU

Notes: Door normally closed, latched, and secured.
Entry by valid card read or key override.
Free egress at all times.

Install gasketing prior to surface mounted hardware. Do not notch gasketing for surface mounted hardware.

Door keyed to EMS master- coordinate w/ Owner.

Set: 5.0

Doors: 103

3 Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Mortise Lock	8237 LE2 L	US26D	SA
1 Surface Closer w/ Hold Open	1431 CPSH	EN	SA
1 Kick Plate	K1050 10" x 1" LDW CSK BEV	US32D	RO
1 Wall Stop	400 / 403	US26D	RO
1 Gasketing	2891APK TKSP8		PE
1 Sweep	3452CNB TKSP8		PE

Install gasketing prior to surface mounted hardware. Do not notch gasketing for surface mounted hardware.

Set: 6.0

Doors: 107B

3 Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Passage Mortise Lock	8215 LE2 L	US26D	SA
1 Surface Closer	1431 P10	EN	SA
1 Kick Plate	K1050 10" x 1" LDW CSK BEV	US32D	RO
1 Surf Overhead Stop	9-x36	630	RF
1 Gasketing	2891APK TKSP8		PE
1 Sweep	3452CNB TKSP8		PE

Install gasketing prior to surface mounted hardware. Do not notch gasketing for surface mounted hardware.

Set: 7.0

Doors: 110, 111

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Privacy Set w/ Indicator	V21 EMB 8265 LNL	US26D	SA
1 Surf Overhead Stop	9-x36	630	RF
1 Surface Closer	1431 P10	EN	SA
1 Kick Plate	K1050 10" x 1" LDW CSK BEV	US32D	RO
3 Silencer	608-RKW		RO

Set: 8.0

Doors: 108

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Privacy Set w/ Indicator	V21 EMB 8265 LNL	US26D	SA
1 Surface Closer	1431 P10	EN	SA
1 Kick Plate	K1050 10" x 1" LDW CSK BEV	US32D	RO
1 Wall Stop	400 / 403	US26D	RO
3 Silencer	608-RKW		RO

Set: 9.0

Doors: 105.1, 105.2

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Passage Set	10XU15 LL	US26D	SA
1 Wall Stop	400 / 403	US26D	RO
3 Silencer	608-RKW		RO

Set: 10.0

Doors: 104, 106.1, 107.1, 107.2

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Passage Set	10XU15 LL	US26D	SA
1 Conc Overhead Stop	1-x36	630	RF
3 Silencer	608-RKW		RO

Set: 11.0

Doors: 102

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Entry/Office Lock	10XG05 LL	US26D	SA
1 Wall Stop	400 / 403	US26D	RO
3 Silencer	608-RKW		RO

Set: 12.0

Doors: 100, 114

6 Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
2 Exit Hardware	12-8715-F-LL	US26D	SA
2 Surface Closer	1431 P10	EN	SA
2 Conc Overhead Stop	1-x36	630	RF
2 Kick Plate	K1050 10" x 1" LDW CSK BEV	US32D	RO
6 Silencer	608-RKW		RO
1 Astragal (2-Piece Set)	354	C	PE
2 Sweep	3452CNB TKSP8		PE
1 Coordinator (Full Width)	352	US26D	SA

Set: 13.0

Doors: 112.3

6 Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
2 Exit Hardware	12-8715-F-LL	US26D	SA
2 Surface Closer	1431 P10	EN	SA
2 Conc Overhead Stop	1-x36	630	RF
2 Kick Plate	K1050 10" x 1" LDW CSK BEV	US32D	RO
1 Gasketing	2891APK TKSP8		PE
1 Astragal (2-Piece Set)	354	C	PE
2 Sweep	3452CNB TKSP8		PE
1 Threshold	253x3AFG		PE
1 Coordinator (Full Width)	352	US26D	SA

Set: 14.0

Doors: 112.1, 112.2, 112.3, 112.4, 112.5, 112.6, 112.7, 112.8, 112.9, 112.10

1 Position Switch	MSS-1G	SU

Notes: Balance of hardware provided by overhead door supplier.

END OF SECTION 087100

SECTION 088000 - GLAZING

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 glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Windows.
 - 2. Doors.
 - 3. Glazed entrances.
- B. Related Sections:
 - 1. Section 081113 "Hollow Metal Doors and Frames".
 - 2. Section 084113 "Aluminum-Framed Entrances and Storefronts".

1.3 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 C 1036.
- C. Interspace: Space between lites of an insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

- A. General: 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: Design glass, including comprehensive engineering analysis according to ASTM E 1300 & ICC's International Building Code, current edition by a qualified professional engineer, using the following design criteria:

1. Design Wind Pressures: As indicated on Drawings.
 2. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
 3. 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, whichever is less.
 4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 4. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.6 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
1. Clear float glass.
 2. Insulated glass.
 3. Insulated spandrel glass.
 4. Transom glass.
 5. Insulated metal panels.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

- D. 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.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installers & manufacturers of insulating-glass units with low-e coatings.
- B. Product Certificates: For glass and glazing products, from manufacturer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for coated glass, insulating glass, glazing sealants, and glazing gaskets.
 - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Preconstruction adhesion and compatibility test report.
- E. Warranties: Sample of special warranties.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- E. Source Limitations for Glass: Obtain coated float glass, laminated glass, and insulating glass from single source from single manufacturer for each glass type.
- F. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- H. Safety Glazing Labeling: Where safety glazing labeling 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.
- I. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- J. Pre-installation Conference: Conduct conference at project 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.

1.9 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.
- B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 PROJECT 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.
1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.11 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass 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: Ten (10) years from date of Substantial Completion.
- B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees 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: Ten (10) years from date of Substantial Completion.
- C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass 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: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
1. Minimum Glass Thickness for Exterior Lites: Not less than 3/16 inch.
- B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is required, provide Kind FT heat-treated float glass.
- C. 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.
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.

2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 2. For uncoated glass, comply with requirements for Condition A.
 3. For coated vision glass, comply with requirements for Condition C (other coated glass).
- C. Silicone-Coated Spandrel Glass: ASTM C 1048, Condition C, Type I, Quality-Q3, and complying with other requirements specified.
 1. Glass: Clear float.
 2. Silicone Coating Color: Black.

2.3 INSULATING GLASS

- 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. Manko
 2. Cardinal IG Company
 3. Glass Fabricators Inc.
 4. Guardian Glass
 5. PPG Architectural Glass
 6. Pilkington North America
- B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.

2. Spacer: Manufacturer's standard spacer material and construction.
 3. Desiccant: Molecular sieve or silica gel, or blend of both.
- C. Glass: Comply with applicable requirements in "Glass Products" Article.

2.4 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
1. Neoprene complying with ASTM C 864.
 2. EPDM complying with ASTM C 864.
 3. Silicone complying with ASTM C 1115.
 4. Thermoplastic polyolefin rubber complying with ASTM C 1115.
- A. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone, or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.
- B. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.5 GLAZING SEALANTS

- A. General:
1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will 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.
 2. 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.
 3. Sealants used inside the weatherproofing system 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."
 4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
 - 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; 790.
 - b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
 - c. Sika Corporation, Construction Products Division; SikaSil-C990.
 - d. Tremco Incorporated; Spectrem 1.

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 C 1281 and AAMA 800 for products indicated below:
 - 1. AAMA 804.3 tape, where indicated.
 - 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 3. 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. General: Provide products of material, size, and shape complying with referenced glazing standard, 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: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- G. Self-Adhered, Opaque Film:
 - 1. Basis-of-Design: 3M Crystal Glass Finish, 7725SE-324, Frosted Crystal.

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.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

2.9 INSULATING-GLASS UNIT (TYPE 'A')

- A. Low-e coated, clear insulating glass.
 - 1. Overall Unit Thickness: 1 inch.
 - 2. Thickness of Each Glass Lite: Min. 3/16".
 - 3. Outdoor Lite: Clear float glass, (Provide tempered wherever required by code).
 - 4. Inter space Content: Argon.
 - 5. Indoor Lite: Clear float glass (Provide tempered wherever required by code).
 - 6. Low-E Coating: Pyrolytic or sputtered on second or third surface.
 - 7. Visible Light Transmittance: 80% percent minimum.
 - 8. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.25 Btu/sq.ft x h x deg F
 - 9. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.23.
 - 10. Provide safety glazing labeling wherever required by code.

2.10 MONOLITHIC-GLASS (TYPE 'B')

- A. Heat-Strengthened Float Glass.
 - 1. Thickness: 1/4-inch.
 - 2. Clear float glass (Provide tempered wherever required by code).
 - 3. See interior elevations for locations to receive self-adhered, opaque film.

2.11 1/2" INSULATING-GLASS UNIT (TYPE 'C')

- A. Reference Section 083613 Sectional Doors.

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 only after unsatisfactory conditions have been corrected.

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 will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- 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. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

- E. 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.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 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 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.
- H. 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.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

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 and then to jambs. Cover horizontal framing joints by applying tapes to jambs and 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.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

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 weather tight 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 weather tight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. 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; remove as recommended in writing by glass manufacturer.

- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project 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 088000

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SECTION 092216 - NON-STRUCTURAL METAL FRAMING

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. Non-load-bearing steel framing systems for interior gypsum board assemblies.
 - 2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.
 - 3. Sound attenuation batts for interior partitions.
- B. Related Requirements:
 - 1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs, and roof joists.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATION SUBMITTALS

- A. Evaluation Reports: For dimpled steel studs and runners, from ICC-ES.

PART 2 - PRODUCTS

2.1 DESCRIPTION

- A. 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.

2.2 FRAMING SYSTEMS

- 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, G40 (interior applications) and ASTM A 653/A 653M, G90 (exterior applications), hot-dip galvanized, unless otherwise indicated.
- B. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.
1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 0.027 inch.
 - b. Depth: See Drawings.
 2. Dimpled Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 0.025 inch.
 - b. Depth: See Drawings.
- C. Slip-Type Head Joints: At the top of all interior walls, provide one of the following:
1. 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. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
 - 2) MBA Building Supplies; FlatSteel Deflection Track
 - 3) Steel Network Inc. (The); VertiTrack VTD Series.
 - 4) Superior Metal Trim; Superior Flex Track System (SFT).
 - 5) Telling Industries; Vertical Slip Track
- D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thickness: As indicated on Drawings
- E. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.
1. Depth: As indicated on Drawings
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base-Metal Thickness: 0.033 inch
 2. Depth: 7/8". As indicated on Drawings

- G. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.
 - 1. Configuration: Asymmetrical or hat shaped.

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
 - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.
- C. Resilient Sound Isolation Clip: Unibody molded rubber and steel isolator couple with 7/8" metal furring channels.
 - 1. GenieClip RST by Pliteq Inc. or approved equal.

2.4 GLASS-FIBER SOUND ATTENUATION BATT (SAB) INSULATION

- 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. CertainTeed Corporation.
 - 2. Guardian Building Products, Inc.
 - 3. Johns Manville.
 - 4. Knauf Insulation.
 - 5. Owens Corning.
- B. Unfaced, Glass-Fiber Sound Attenuation Batt Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.
 - 1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
 - 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
 - 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
 - 4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install studs so flanges within framing system point in same direction.

1. Space studs as follows:
 - a. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
 - b. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
 - C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 1. 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.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 - D. Direct Furring:
 1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 - E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.
- 3.5 INSTALLING SUSPENSION SYSTEMS
- A. Install suspension system components in sizes and spacing indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
 - 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. 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.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacing 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.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 3. 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.
 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 5. Do not attach hangers to steel roof deck.
 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. 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.
- E. 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.
- F. Glass-Fiber Batt 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 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, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

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. Interior gypsum board.
- B. Related Requirements:
 - 1. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

1.4 QUALITY ASSURANCE

- A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Install mockups for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations.
 - b. Each texture finish indicated.
 - 2. Apply or install final decoration indicated, including painting on exposed surfaces for review of mockups.
 - 3. Simulate finished lighting conditions for review of mockups.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- 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.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

- 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 Gypsum.
 - 2. CertainTeed Corp.
 - 3. Georgia-Pacific Gypsum LLC.
 - 4. Lafarge North America Inc.
 - 5. National Gypsum Company.
 - 6. USG Corporation.
- B. Gypsum Wallboard: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch, Type X, unless otherwise indicated on Drawings
 - 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

- C. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
 - 1. Core: 5/8 inch, Type X.
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- D. Abuse/Impact-Resistant Gypsum Board: ASTM C 1629.
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
 - 4. Performance Category: Heavy Duty.

2.3 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, or paper-faced galvanized steel sheet.
 - 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.

2.4 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.

- a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Fit gypsum panels around ducts, pipes, and conduits.
 - 2. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated.
 - 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

- B. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 INSTALLING TRIM ACCESSORIES

- 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. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners unless otherwise indicated.
 - 2. LC-Bead: Use at exposed panel edges.
 - 3. L-Bead: Use where indicated.
- D. Aluminum Trim: Install in locations indicated on Drawings.

3.5 FINISHING GYPSUM BOARD

- A. General: 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.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 5: Typical at all exposed finished gypsum board wall and ceiling areas.
 - a. Primer and its application to surfaces are specified in other Section 099123 "Interior Painting."

3.6 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and 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.

END OF SECTION 092900

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SECTION 095123 - ACOUSTICAL TILE CEILINGS

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. Acoustical tiles for ceilings.
 - 2. Metal Suspension Systems.
 - 3. Metal Edge Moldings and Trim.
- B. Related Requirements:
 - 1. None.
- C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, 6-inches- in size.
- C. Samples for Initial Selection: For components with factory-applied color finishes.

1.4 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. 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.

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.
5. Minimum Drawing Scale: 1/4 inch = 1 foot.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL 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. Acoustical Ceiling Units: Full-size tiles equal to Two (2) percent of quantity installed.
 2. Suspension-System Components: Quantity of each concealed grid and exposed component equal to (2) percent of quantity installed.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to the National Voluntary Laboratory Accreditation Program (NVLAP) for testing indicated.
- B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Build mockup of typical ceiling area as shown on Drawings.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical tiles, suspension-system components, and accessories to Project site in original, unopened packages and store them 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 tiles, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, 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 tile ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 (Comply with ASTM E 1264 for Class A materials).
 - 2. Smoke-Developed Index: 50

2.2 ACOUSTICAL TILES, GENERAL

- A. Source Limitations: Obtain each type of acoustical ceiling tile and supporting suspension system from single source from single manufacturer.
- B. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.
- C. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.
 - 1. Where appearance characteristics of acoustical tiles are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL CEILING TILE AND GRID: (ACT1)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide “Optima 3254 Acoustical Panels” Panels by Armstrong Ceilings or comparable product by one of the following:
 - 1. USG Ceilings.
 - 2. Certainteed, Saint-Gobain.
- B. Color: Flat White.
- C. NRC: 0.90 NRC
- D. Edge/Joint Detail:
 - 1. Profile: Square Tegular
 - 2. Where tiles are field cut, provide edge/joint detail along all cut edges, match factory finished edges.
- E. Thickness: 3/4-inch.
- F. Modular Size: 24 x 24 inches and 24 x 48 inches. See Drawings for exact sizes/layout.
- G. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard 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 and evaluated according to ASTM D 3274 or ASTM G 21.
- H. Ceiling Grid: Provide “Prelude XL” by Armstrong.

2.4 ACOUSTICAL CEILING TILE AND GRID: (ACT2)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide “Cermaguard 605, Unperforated” Acoustical Panels by Armstrong Ceilings or comparable product by one of the following:
 - 1. USG Ceilings.
 - 2. Certainteed, Saint-Gobain.
- B. Color: White.
- C. CAC: 40
- D. Edge/Joint Detail:
 - 1. Profile: Square
 - 2. Where tiles are field cut, provide edge/joint detail along all cut edges, match factory finished edges.
- E. Thickness: 5/8-inch.

- F. Modular Size: 24 by 24 inches. See Drawings for exact sizes/layout.
- G. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard 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 and evaluated according to ASTM D 3274 or ASTM G 21.
- H. Ceiling Grid: Provide "Prelude XL" by Armstrong.

2.5 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension-System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
- B. 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 (5) times that imposed by ceiling construction, as determined by testing according to ASTM E 488 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 to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 - c. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchors.
 - 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 Ten (10) times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so 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.

- D. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.

2.6 METAL SUSPENSION SYSTEM TYPICAL

- A. Basis-of-Design Product: Subject to compliance with requirements, provide “Prelude XL” Grid by Armstrong Ceilings or comparable product by one of the following:
 - 1. USG Ceilings.
 - 2. Certainteed, Saint Gobain.
- B. Color: Flat White.
- C. Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, pre-painted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 coating designation.
 - 1. Structural Classification: Intermediate-duty system.
 - 2. Access: Upward, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.
 - a. Initial Access Opening: In each module, 24 by 24 inches (610 by 610 mm). See Drawings for exact sizes/layout.

2.7 METAL EDGE MOLDINGS AND TRIM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide typical wall edge mouldings (where ceilings terminate into walls) and Compasso trim (at transitions between stepped ceilings) by Armstrong Ceilings or comparable product by one of the following:
 - 1. USG Ceilings.
 - 2. Certainteed, Saint Gobain.
- B. Height: As shown on Drawings.
- C. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
 - 1. Provide manufacturer's standard edge moldings that fit acoustical tile edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.

2. 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 and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Testing Substrates: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.
- B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions
- B. Suspend ceiling hangers from building's structural members and as follows:
 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. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 3. 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.
 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures 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.
5. 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.
 6. 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.
 7. 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.
 8. Do not attach hangers to steel deck tabs.
 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical tiles.
1. Apply 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 o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Arrange directionally patterned acoustical tiles as follows:
1. As indicated on reflected ceiling plans.
- G. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.
1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.

2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches o.c.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections of completed installations of acoustical tile 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 tiles have been installed. Do not proceed with installations of acoustical tile ceiling hangers for the next area until test results for previously completed installations of acoustical tile 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 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 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 tile ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 CLEANING

- A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095123

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SECTION 096513 - RESILIENT BASE AND ACCESSORIES

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. Resilient base.
 - 2. Resilient transition.
- B. Related Sections:
 - 1. Section 096813 "Tile Carpeting" for carpet floor covering.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product indicated.
- C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.
- D. Product Schedule: For resilient products use same designations indicated on Drawings.

1.4 MAINTENANCE MATERIAL 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. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: 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. Mockups: Provide resilient products with mockups specified in other Sections.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.7 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 85 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE (VN-WB)

- A. Resilient Base:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Traditional Wall Base by Johnsonite or comparable product by one of the following:
 - a. Armstrong
 - b. Roppe.
- B. Resilient Base Standard: ASTM F 1861.
 - 1. Material Requirement: Type TV (vinyl, vulcanized thermoplastic)
 - 2. Manufacturing Method: Group I (solid, homogeneous)

- C. Style: Match profile of existing adjacent vinyl base.
- D. Minimum Thickness: 0.125-inch.
- E. Height: 4 inch.
- F. Lengths: Coils in manufacturer's standard length.
- G. Outside Corners: Job formed or preformed.
- H. Inside Corners: Job formed or preformed.
- I. Color: #29 "Moon Rock"

2.2 RESILIENT TRANSITION STRIP (VN-XX)

- A. Resilient Transition Strip:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Carpet Transition Strips by Mannington or comparable product by one of the following:
 - a. Armstrong
 - b. Roppe
- B. Resilient Standard: ASTM F 1861
- C. Material Requirement: Type TV (vinyl, vulcanized thermoplastic).
- D. Manufacturing Method: Group 1 (solid, homogeneous).
- E. Style: Fusion Transition Strip (VN-TR); carpet-to-carpet transition.
 - 1. Color: #527 "Clay"
- F. Style: Imperial Reducer (VN-RD); Reducer strip carpet to concrete.
 - 1. Color: #29 "Moon Rock"

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 manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
- C. Plastic Edge/Transition Strips: Fusion Rubber Transition Strip by Mannington, Black, Typ.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are same temperature as the space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. 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.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
 1. Remove adhesive and other blemishes from exposed surfaces.
 2. Sweep and vacuum surfaces thoroughly.
 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products until Substantial Completion.

END OF SECTION 096513

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SECTION 096813 – TILE CARPETING

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 modular, tufted carpet tile.
- B. Related Requirements:
 - 1. Section 096513 "Resilient Base and Accessories" and Section 096519 "Resilient Tile Flooring" for resilient wall base and accessories installed with carpet tile.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include installation recommendations for each type of substrate.
- B. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, 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. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. 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-long Samples.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

E. Sustainability: Provide the Statement of the Achievement Level the carpet has attained for Gold, 52 to 70 points, based on specific Sustainable Attribute Performance for all product stages according to ANSI/NSF 140.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance 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.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- 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.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.
- B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

1.10 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels 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.

1.11 WARRANTY

- A. Special Warranty for Carpet Tiles: 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, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
 - 3. Warranty Period: Lifetime. 10 year on static, 10 year on Color.

PART 2 - PRODUCTS

2.1 CARPET – TYPE 1 TILE (CPT1)

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. “Nutopia 2.0, Urban Fringe II” as manufactured by Mohawk.
- A. Color: 867 “Uptown”.
- B. Pattern: Multi-colored staggered installation, see Finish Plans.
- C. Size: 12 by 36 inches.

2.2 CARPET – TYPE 1 TILE (CPT2)

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. “Nutopia 2.0, Urban Passage II” as manufactured by Mohawk.
- B. Color: 867 “Uptown”.
- C. Pattern: Multi-colored staggered installation, see Finish Plans.
- D. Size: 12 by 36 inches.

2.3 CARPET – TYPE 1 TILE (CPT3)

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. “Nutopia 2.0, Urban Field II” as manufactured by Mohawk.
- B. Color: 889 “Museum”.
- C. Pattern: Multi-colored staggered installation, see Finish Plans.
- D. Size: 12 by 36 inches.

2.4 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, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
 - 2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
 - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. For painted subfloors, verify the following:
 - 1. Perform bond test recommended in writing by adhesive manufacturer.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. 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 wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. 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 carpet tile manufacturer.
- D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: 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. 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.
- E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders.
- H. Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive, seam sealer, 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 104, Section 16, "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 096813

SECTION 099123 - PAINTING

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. In general, this section includes new finishes on all exposed surfaces within the building, or added to the exterior of the building unless specifically excluded on the drawings or room finish schedule.
- B. Section includes surface preparation and the application of paint systems on the following new and existing substrates:
 - 1. Concrete.
 - 2. Concrete masonry units (CMU).
 - 3. Steel.
 - 4. Galvanized metal.
 - 5. Wood.
 - 6. Gypsum board.
- C. Section includes surface preparation and application of semi-transparent finishes on new and existing doors, trim, woodwork and casework. Scope indicated on drawings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- 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. Paint: Five (5) percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

- A. 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 specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - 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. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 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. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 85 deg F
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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. Diamond Vogel Paints.
 2. PPG Architectural Finishes, Inc.
 3. Benjamin Moore & Co.
 4. ICI Paints.
 5. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

- A. Material Compatibility:
1. Provide materials for use within each paint system that are 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, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. Colors: As selected by Architect from manufacturer's full range. See drawings for colors.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
1. Owner may 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 coatings 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. Prior to start of painting review acceptability of all surfaces with the General contractor and applicable Subcontractor(s).
- B. Start of paint application indicates acceptance of sub-surface finish by Painting Contractor. Any additional repair work then required to be performed by Painter.
- C. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMU): 12 percent.
 - 3. Wood: 15 percent.
 - 4. Gypsum Board: 12 percent.
- D. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- F. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- G. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION OF SURFACES

- A. New and existing surfaces:
 - 1. Before proceeding with painting or finishing, remove from surfaces all dust, dirt, grease or other foreign particles which would affect either satisfactory execution or permanency of work. Do such cleaning after general cleaning.
 - 2. Thoroughly clean bare metal of all foreign matter, rust, scale, dirt, etc. before paint is applied. Clean shop painted metal and retouch shop paint where marred before succeeding coats are applied. Remove oil or grease with a suitable solvent. Thoroughly sandpaper all paint finishing on metalwork, doors, frames, etc. to feather out chips or mars in shop finish and work out any dents or imperfections.
 - 3. Woodwork to be painted or given a transparent type finish shall be free of foreign matter before being coated. Surface shall be clean, smooth and dry. Remove all scratches, dirt, stains, raised grain or other surface defects before painting or other finishing is started.
 - 4. Painting or other finishing shall not be done under conditions, weather or temperature unsuitable for execution of a quality job. Air shall be free from dust

and dirt to prevent lodgment of foreign matter in fresh paint or varnish. Floors must be broom clean before painting is started.

5. Woodwork to be painted shall have all knots, pitch streaks and bad sap spots shellacked, two coats, before priming coat is applied.
- B. Existing walls and ceiling surfaces:
1. Remove loose paint, sand out or fill voids in existing finish to produce a smooth homogeneous finish.
 2. Sand off ridges in existing finishes to produce a smooth surface.
 3. Contractor to test compatibility of new paint material specified with existing materials. Where necessary, apply a test patch to check adhesion. Notify Architect of any incompatibilities.
- C. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- D. Remove hardware, covers, plates, and similar items already 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.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- E. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- F. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- G. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- H. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- I. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- J. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

- K. Existing Walls & Ceilings: Remove loose paint or plaster, patch & blend with existing adjacent textures. Sand out voids or ridges in existing finish to produce a smooth, uniform surface.
- L. Aluminum Substrates: Remove loose surface oxidation.
- M. New and Existing Wood Substrates for semi-transparent finish: Patch all hardware mounting screw holes that will not be reused or covered by new hardware with matching wood filler. Fill large holes with wood blocking or Dutchmen. Scuff-sand all surfaces to ensure good bond with new finish. Use tinted polyurethane finish where required to obtain matching finish to surrounding wood finish.
- N. New and Existing Wood Substrates for paint:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 WORKMANSHIP – MINIMUM REQUIREMENTS

- A. Evenly spread and thoroughly brush out, spray finish hollow metal. Flow on varnish and enamel evenly and smoothly. Execute all work in accordance with best practices recognized for class of work and grade, type and kinds of materials specified.
- B. Use varnish as it comes from manufacturer's container without thinning or adulterating.
- C. Thoroughly and uniformly sand each coat, except final coat, on wood or metal finishes with 180-grit or finer sandpaper or other equal abrasive, removing all surface defects and providing a smooth, even surface for subsequent coats.
- D. Cover surfaces specified to be stained with a uniform application of stain, equalizing where necessary, and wipe off if required.
- E. Putty-stop nail holes, imperfections and defacement in wood finish. Bring putty-stopping flush with finished surface in a neat and clean manner. Close and smooth open joints, surfaces containing unused holes, screws, bolts, etc., producing a finished piece of work.
- F. Where ferrous metal panels, boxes, access doors, registers, louvers or grilles occur in finished doors, walls or ceilings, paint in with surrounding surfaces unless otherwise directed.
- G. When covered and uncovered pipes and ducts pass through a finished room or space, paint with type of undercoat material consistent with material to be painted, then finish with same type of finish coat as used on immediately adjacent wall or ceiling surfaces, whichever surface is most appropriate to be matched. This requirement is not intended to apply to color-code painting in equipment rooms which, if required, is specified in another section of the Specifications.

H. Application Methods:

1. Use brush, roller or spray application for work, depending on which method is most appropriate for surface to be covered, unless scheduled otherwise.
2. Each coat shall be applied and worked out evenly to leave no brush marks or "holidays". Each coat shall be flowed on smoothly and free from sags and runs.
3. The following items to require use of HVLP cup sprayer finish:
 - a. Interior/exterior HM doors and frames.
 - b. Handrails/Guardrails
 - c. Metal Fabrications

I. Rate of application shall not exceed average rate of coverage recommended by paint manufacturer for type of surface involved, less 10 percent allowance for losses, unless manufacturer's printed specifications state that recommended rate included normal expected losses.

J. Whenever over-thinning or similar Contractor errors cause lack of proper coverage, Contractor shall apply additional coats of paint or finish as required to cover surfaces completely to provide uniform color and appearance.

K. Whenever necessary to obtain required results, a whole wall shall be refinished rather than spot finishing where a portion of finish has been damaged or is unsatisfactory.

L. First application of stain shall provide desired result. Second-coating will not be permitted.

M. Minimum drying time shall comply with that recommended by paint manufacturer. Each coat shall be thoroughly dry before application of succeeding coats.

N. All parts of moldings and ornaments shall be left clean and true to details and without undue amount of paint in corners and depressions.

O. Make edges of paint adjoining other materials or colors sharp and clean and without overlapping.

3.4 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. 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.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- 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. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 1. Paint the following work where exposed to view:
 - a. Uninsulated & Insulated metal piping.
 - b. Uninsulated & Insulated plastic piping.
 - c. Pipe hangers and supports.
 - d. Metal or Plastic conduit.
 - e. Fire suppression/sprinkler piping
 - f. Fire suppression/sprinkler heads.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering, paint-grade galvanization or other paintable jacket material.
 - i. Other items as directed by Architect.
 - j. Portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are exposed to view.
 2. DO NOT Paint the following work where exposed to view:
 - a. Telecommunications cables, raceway and other devices:
 - 1) DO NOT PAINT CABLE - If a cable is inadvertently painted, it shall be hereby defined as damaged. The cable shall be replaced, in its entirety, by the Contractor at their expense.
 - 2) DO NOT PAINT SURFACE MOUNT RACEWAY OR DEVICE BOXES - The Panduit LDPH10 surface mount raceway and the data termination boxes shall not be painted.
 - 3) CLEANING NOT ACCEPTABLE - Cleaning of painted cable is not acceptable.
 - 4) NOTIFICATION - It shall be the responsibility of the Contractor to notify the Architect if any cable is painted. Such notification shall be made within one working day of the occurrence, so that representative of the owner can make assessment of the damage.

3.5 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.

3.6 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. 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.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.7 PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 - 1. Latex System:
 - a. Prime Coat: Diamond Vogel's (DV) OmniPrep Universal Interior Primer.
 - b. Intermediate Coat: DV SureFlo Acrylic Latex Semi-Gloss Enamel.
 - c. Topcoat: DV SureFlo Acrylic Latex Semi-Gloss Enamel.
- B. CMU Substrates:
 - 1. Latex System:
 - a. Block Filler: DV UniFill Acrylic Blockfiller.
 - b. Intermediate Coat: DV Assure Interior Latex Semi-Gloss Enamel .
 - c. Topcoat: DV Assure Interior Latex Semi-Gloss Enamel.

C. Steel Substrates:

1. Alkyd System:

- a. Prime Coat: DV Finium DTM-AT Acrylic Primer.
- b. Intermediate Coat: DV Finium DTM-AT Acrylic Semi-Gloss.
- c. Topcoat: DV Finium DTM-AT Acrylic Semi-Gloss.

D. Galvanized-Metal Substrates:

1. Latex over Waterborne Primer System:

- a. Prime Coat: DV Finium DTM-AT Acrylic Primer.
- b. Intermediate Coat: DV Finium DTM-AT Acrylic Semi-Gloss.
- c. Topcoat: DV Finium DTM-AT Acrylic Semi-Gloss.

E. New and existing Painted Wood Substrates:

1. Latex System:

- a. Prime Coat: DV Mill Max Latex Enamel Undercoat.
- b. Intermediate Coat: DV SureFlo Acrylic Latex Semi-Gloss Enamel.
- c. Topcoat: DV SureFlo Acrylic Latex Semi-Gloss Enamel.

F. New and existing Gypsum Board Substrates:

1. Latex System (typical walls and ceilings):

- a. Prime Coat: DV PosiPrime Interior Primer.
- b. Intermediate Coat: DV SureFlo Acrylic Latex Semi-Gloss Enamel.
- c. Topcoat: DV SureFlo Acrylic Latex Semi-Gloss Enamel.

2. Epoxy System (typical at wet-locations where indicated on room finish schedule):

- a. Prime Coat: DV PosiPrime Interior Primer.
- b. Intermediate Coat: DV Vers-E-Poxy 131 Waterborne Acrylic Semi-Gloss Epoxy.
- c. Topcoat: DV Vers-E-Poxy 131 Waterborne Acrylic Semi-Gloss Epoxy.

3.8 CLEAN UP:

- A. At completion of work painting subcontractor is responsible to clean and/or remove over spray or paint from surfaces not shown to receive coatings.

END OF SECTION 099123

SECTION 099600 - HIGH-PERFORMANCE COATINGS

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 surface preparation and application of high-performance coating systems on the following substrates:
 - 1. Exterior:
 - a. Exterior and Interior Hollow Metal Frames.
 - b. Exposed Exterior Steel.
 - c. Exterior Louvers and Grilles.
- B. Related Requirements:
 - 1. Section 081113 "Hollow Metal Door Frames" for shop priming of metal substrates with primers specified in this Section.
 - 2. Section 099123 "Painting" for painting of hollow metal doors.

1.3 DEFINITIONS

- A. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- B. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product indicated.
- C. Samples for Verification: For each type of coating system and in each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.

4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- 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. Coatings: Five (5) percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each coating system indicated 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 coating system specified in Part 3.
 - a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft..
 - 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.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than the temperature range recommended by the manufacturer.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures and humidity levels are within the ranges recommended by the manufacturer.
- B. Do not apply coatings to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide the following manufacturer:
 - 1. Tnemec Company, Inc.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

- A. Material Compatibility:
 - 1. Provide materials for use within each coating system that are 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 coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
 - 3. Provide products of same manufacturer for each coat in a coating system.
- B. Colors: As selected by Architect from manufacturer's full range.

2.3 High-Performance System:

- A. Zinc-Rich Urethane/ Polyamidoamine Epoxy/ Polyurethane, as manufactured by the Tnemec Company, Inc
 - 1. Surface Preparation: SSPC-SP6/NACE 3
 - 2. Series 90-97 Tneme-Zinc, DFT 2.5 to 3.5 mils
 - 3. Intermediate Coat: Series N69 Hi-Build Epoxoline II, DFT 4.0 to 6.0 mils
 - 4. Finish (2 Coats): Series 1095 Endura-Shield, DFT 2.0 to 3.0 mils
 - 5. Total DFT: 8.5 to 12.5 mils

2.4 SOURCE QUALITY CONTROL

- A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating 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 coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Remove hardware, covers, plates, and similar items already 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.
 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- B. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

- C. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:
 - 1. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- D. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner will engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
 - 1. Contractor shall touch up and restore coated surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Steel Substrates:
 - 1. Polyamidoamine Epoxy over Zinc-Rich Epoxy Primer System:
 - a. Prime Coat: Primer, zinc-rich, epoxy. (2.5 mils, minimum).
 - b. Intermediate Coat: Polyamidoamine Epoxy (4-5 mils).
 - c. Topcoat: Polyamidoamine Epoxy (4-5 mils).

END OF SECTION 099600

SECTION 101416 – SIGNAGE

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 signage plaques.
- B. Related Requirements:
 - 1. Section 220553 "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
 - 2. Section 230553 "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
 - 3. Section 260553 "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.

1.3 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.4 ACTION SUBMITTALS

- A. Signage Plaque Schedule: Use same designations specified or indicated on Drawings or in a plaque or sign schedule. Working with the Architect and owner, prepare and submit a schedule indicating the following:
 - 1. Room Name and Room Number to be shown on each signage plaque.
 - 2. Location of each signage plaque, by room number, as shown on the Drawings. Exact mounting locations by each door (taking into account the 30 by 48 inch clear floor area required by ADA and ANSI A117.1).
 - 3. Mounting heights as shown on the Drawings.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signage plaques to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 SIGNAGE, GENERAL

- A. Plastic engraved room name and number signage to be provided and installed by contractor.
- B. Contractor shall assume approximately one name/number sign per room door.
- C. New signage shall match existing signage in size, color, font and pictorial description.

2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

2.3 ACCESSORIES

- A. Two-Face Tape: Manufacturer's standard high-bond, foam-core, vinyl tape, 0.045 inch thick, with adhesive on both sides provided by Contractor.
- B. Where signs are required to be installed on glass, provide blank sign of same size and install on opposite side of glass from sign to conceal two-face tape visible from back of sign.

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 plaque work.
- B. Verify that plaque-support surfaces are within tolerances to accommodate signage without gaps or irregularities between backs of signage and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signage plaques using mounting methods indicated and according to manufacturer's written instructions.

1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that plaque surfaces are clean and free of materials or debris that would impair installation.
4. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of plaque and of suitable quantity to support weight of plaque without slippage. Keep strips away from edges to prevent visibility at plaque edges. Place plaque in position, and push to engage tape adhesive.
5. Where signs are required to be installed on glass, provide blank sign of same size and install on opposite side of glass from sign to conceal two-face tape visible from back of sign.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed plaques and plaques that do not comply with specified requirements. Replace plaques 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 signage plaques are installed.
- C. On completion of installation, clean exposed surfaces of plaques according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain plaques in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101416

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SECTION 102800 - TOILET ACCESSORIES

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. Restroom Accessories:
 - a. Grab Bars
 - b. Paper Towel Dispensers
 - c. Toilet Tissue Dispensers
 - d. Liquid Soap Dispensers
 - e. Feminine Hygiene Disposals.
 - f. Wall Hooks.
 - g. Shower Rods and Curtains.
 - h. Mirror Units
 - i. Changing Bench.
 - j. Locker Room Bench.
 - 2. Under lavatory guards.
 - 3. Custodial accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.
 - 1. Approved full-size Samples will be returned and may be used in the Work.

- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify products using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.
- B. 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 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.

1.8 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Fifteen (15) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, 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 B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 RESTROOM ACCESSORIES

- 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 Specialties, Inc.
 - 2. Bobrick Washroom Equipment, Inc.
 - 3. Bradley Corporation.
- A. Grab Bars:
 - 1. Basis-of-Design Product: Bradley 812, 1-1/2" Dia. Concealed Mounting
 - 2. Peened Grip Surface
 - 3. Sizes as indicated on Drawings.
- B. Combination Paper Towel Dispenser & Waste Receptacle:
 - 1. Basis-of-Design Product: Bradley 235.
 - 2. Mounting: Recessed.

- C. Toilet Tissue Dispensers:
 - 1. Basis-of-Design Product: Bradley 5402.
 - 2. Mounting: Surface mounted.
- D. Surface Mounted Sanitary Napkin Disposal
 - 1. Basis-of-Design Product: Bradley 4A10-11.
 - 2. Mounting: Surface mount using No. 10 self-tapping screws
 - 3. Material: Stainless Steel
 - a. Finish: Smooth, No. 4 finish (satin)
- E. Surface Mounted Hat, Coat and Wardrobe Hooks
 - 1. Basis-of-Design Product: Bradley 9134-00.
 - 2. Provide 2 per restroom / bathroom.
- F. Liquid-Soap Dispensers:
 - 1. Basis-of-Design Product: Bradley 6543.
 - 2. Mounting: Surface mounted.
- G. Mirror Units:
 - 1. Basis-of-Design Product: Bradley 781-024360 (RR 108) and 7815-024360 (RRs 110 & 111).
 - 2. Frame: Stainless-steel channel frame with shelf.
 - a. Corners: Welded and ground smooth.
 - 3. Finish: Stainless Steel
 - 4. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
 - b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
 - 5. Size: As indicated on Drawings
- H. Changing Bench
 - 1. Basis-of-Design Product: Salsbury Wood ADA Bench.
 - 2. Size: 42-inch x 20-inch (with back) and 42-inch x 20-inch (no back), see plans.
 - 3. Mounting: Floor mounted
 - 4. Finish: Stainless Steel Frame w/ Light Wood Top.

I. Locker Room Bench

1. Basis-of-Design Product: Salsbury Wood Locker Bench.
2. Size: 72-inch x 9.5-inch, see plans.
3. Mounting: Floor mounted
4. Finish: Stainless Steel Frame w/ Light Wood Top.

J. Shower Curtain Rod:

1. Basis-of-Design Product: Bradely 9530-600000, Curved Shower Curtain Rod.
2. Typical 1 at each shower.

K. Shower Curtain:

1. Basis-of-Design Product: Bradley 9537 Antimicrobial Shower Curtain, 60" x 72".
2. Typical 1 at each shower.

L. Shower Curtain Hooks:

1. Basis-of-Design Product: Bradley 9540 Shower Curtain Hooks with Rollers.
2. Quantities required for hanging shower curtains, all locations.

2.3 UNDERLAVATORY GUARDS

A. Provide one at each individual lavatory.

B. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Truebro Lav Shield by IPS Corporation.
2. Plumberex Specialty Products, Inc.

D. Color: China White

E. Accessories: Color to match shield.

2.4 CUSTODIAL ROOM ACCESSORIES

A. Utility Shelves- Provide (1) at mop sink.

1. Basis-of-Design Product: Bradley 9984, 3 Hooks / 4 Holders.
2. Length: 36 inches.
3. Mop/Broom Holders: (4) spring-loaded, rubber hat, cam type.
4. Material and Finish: Stainless steel, No. 4 finish (satin).

2.5 FABRICATION

- A. General: 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 (6) keys to Owner's representative.

PART 3 - EXECUTION

3.1 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, (or current IBC building code minimum) when tested according to ASTM F 446.

3.2 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 recommendations.

END OF SECTION 102800

SECTION 104413 - FIRE EXTINGUISHER CABINETS

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. Fire protection cabinets for the following:
 - a. Portable fire extinguishers.
- B. Related Sections:
 - 1. Section 104416 "Fire Extinguishers."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.
 - 1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
 - 2. Show location of knockouts for hose valves.
- B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

- B. 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.

1.6 COORDINATION

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate size of fire protection cabinets to ensure that type and capacity of fire hoses, hose valves, and hose racks indicated are accommodated.
- C. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
 - 1. Sheet: ASTM B 209.
 - 2. Extruded Shapes: ASTM B 221.
- C. Stainless-Steel Sheet: ASTM A 666, Type 304.
- D. Copper-Alloy Brass Sheet: ASTM B 36/B 36M, alloy UNS No. C26000 (cartridge brass, 70 percent copper).
- E. Copper-Alloy Bronze Sheet: ASTM B 36/B 36M, alloy UNS No. C28000 (muntz metal, 60 percent copper).
- F. Clear Float Glass: ASTM C 1036, Type I, Class 1, Quality q3, [3] [6] mm thick.
- G. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).
- H. Break Glass: Clear annealed float glass, ASTM C 1036, Type I, Class 1, Quality q3, 1.5 mm thick, single strength.
- I. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.
- J. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 3 mm thick, with Finish 1 (smooth or polished).

2.2 FIRE PROTECTION CABINET

- A. Cabinet Type: Ambassador Steel Fire Extinguisher Cabinet by JL Industries, Suitable for specified fire extinguisher.
 - 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. J. L. Industries, Inc., a division of Activar Construction Products Group;
 - b. Kidde Residential and Commercial Division, Subsidiary of Kidde plc;
 - c. Larsen's Manufacturing Company;
- B. Cabinet Material: Steel with Powder Coat Finish
 - 1. Shelf: Same metal and finish as cabinet.
- C. Semi-recessed Cabinet: Model #1816F10 cabinet box partially recessed in walls of sufficient depth (1.5" square trim) to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semi-recessed cabinet installation. Provide fire-rated cabinet for locations being installed in fire-rated assemblies.
- D. Cabinet Trim Material: Steel with Powder Coat Finish
- E. Door Material: Steel with Powder Coat Finish
- F. Door Style: Full Glazing
- G. Door Glazing: Clear Acrylic
- H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide manufacturer's standard.
 - 2. Provide continuous hinge permitting door to open 180 degrees.
- I. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard 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: White Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.

2.3 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. Provide factory-drilled mounting holes.
 3. Prepare doors and frames to receive locks.
 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. Fabricate door frames of one-piece construction with edges flanged.
 3. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "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 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 walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semi-recessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire protection cabinets in locations and at mounting heights indicated and, at heights acceptable to authorities having jurisdiction.
- B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semi-recessed fire protection cabinets.
 - 2. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturers 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.

END OF SECTION 104413

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SECTION 104416 - FIRE EXTINGUISHERS

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 portable fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Sections:
 - 1. Section 104413 "Fire Extinguisher Cabinets."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

- B. 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 FMG.

1.7 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail 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.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six (6) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Larsen MP Series or comparable product by one of the following:
 - a. Ansul Incorporated; Tyco International Ltd.
 - b. Badger Fire Protection; a Kidde company.
 - c. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - 2. Valves: Manufacturer's standard.
 - 3. Handles and Levers: Manufacturer's standard.
 - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

- B. Multipurpose Dry-Chemical Type: 2-A minimum rating, UL-listed, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

2.2 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel (galvanized steel at wet-locations), designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with black baked-enamel finish.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Larsen's Manufacturing Company.
 - b. Ansul Incorporated; Tyco International Ltd.
 - c. Badger Fire Protection; a Kidde company.
 - d. J. L. Industries, Inc.; a division of Activar Construction Products Group.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in letter decals applied to mounting surface.
 - a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

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SECTION 107300 – ALUMINUM CANOPIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building supported, pre-engineered metal canopies including fascia channels, decking, tension rods, and attachment hardware.

B. Related Sections:

1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

A. Aluminum Association (AA) DAF 45 - Designation System for Aluminum Finishes.

B. American Architectural Manufacturers Association (AAMA)

1. 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Architectural Extrusions and Panels.

C. American Society of Civil Engineers (ASCE) 7 - Minimum Design Loads for Buildings and Other Structures.

D. ASTM International (ASTM)

1. B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
2. B429 - Standard Specification for Aluminum-Alloy Extruded Pipe and Tube.
3. A36 Standard Mild Steel Specification
4. A50/A53 Standards for Structural steel

1.3 SYSTEM DESCRIPTION

A. Design Requirements: Design canopy system to withstand:

1. Standards for wind pressure, snow load, and drifting snow load in accordance with current adopted form of the Uniform Construction code or accepted requirements of local municipality.

1.4 SUBMITTALS

A. Submittals for Review:

1. Shop Drawings: Indicate system components, dimensions, attachments, and accessories.
2. Samples:
 - a. 3 x 3-inch coating samples in specified color.
 - b. 6-inch-long fascia profile sample showing profile and standard finish.
 - c. 6-inch decking samples showing profile and standard finish.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 5 years' experience in installation of self-supporting canopy systems.

1. Mockup: Provide mockup of canopy system including all framing members, supports, decking, hanger rods, and attachments at location selected by architect.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design: Super Lumideck by Mapes Architectural Canopies

1. Extrudeck Series by MASA Architectural Canopies
2. Or approved equal

2.2 MATERIALS

A. Aluminum Extrusions:

1. ASTM B221& ASTM B429 6063-T5 alloy and temper.

B. Hardware:

1. All fasteners shall be (stainless steel) or (zinc coated) for corrosion resistance.

2.3 COMPONENTS

A. Framing:

1. Type: Extruded aluminum "J" channel fascia.
2. Size: 8" x .125"

B. Canopy Supports: Extruded aluminum canopy support "I" beam.

- C. Decking: 3" x 6" x .078" Interlocking Extruded aluminum flat soffit decking.
- D. Attachment: standard steel hanger rod configuration, finished to match canopy. Metal building wall mount style attachment.
- E. Custom Fascia Profiles: 8" Heavy Industrial.
- F. Other Components: compressive sleeves, through-bolt anchors, gusset plates, clevis, angles, hangers, and other components as indicated or as required for system attachment and performance.

2.4 ACCESSORIES

- A. Deflector-style scupper. Clear Anodized Aluminum Finish.
- B. Wall flashing and sealant.

2.5 FABRICATION

- A. Fabricate canopy system in accordance with approved Shop Drawings.
- B. Kit canopies to be mechanically assembled with shear stress strength as per engineering. Pre-assembled canopies are shop welded by manufacturer's approved personnel.
- C. Drainage system to be concealed type. Covered surfaces direct water to field drilled drain, to be coordinated at site.

2.6 FINISHES

- A. Aluminum:
 - 1. Pre- Treatment: Pre-treat to ASTM D1730 type B, Method 5 using a multistage chromate process or an approved chrome- free pretreatment process approved by powder coat manufacturer for optimized weather resistance.
 - a. Finish: Clear Anodized Aluminum.

PART 3 - EXECUTION

3.1 FIELD DIMENSIONS

- A. Field verify dimensions of supporting structure at site of installation prior to fabrication.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Install components plumb and level, in proper plane, free from warp and twist.

- C. Anchor system to building components; provide adequate clearance for movement caused by thermal expansion and contraction and wind loads.

3.3 ADJUSTING

- A. Touch up minor scratches and abrasions on finished surfaces to match original finish.
- B. Clean with mild, non-abrasive solution and a cotton cloth under low pressure.

END OF SECTION 107300

SECTION 122413 - ROLLER WINDOW SHADES

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. Manually operated roller shades with single rollers.
- B. Related Requirements:
 - 1. Section 061053 "Misc. Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
 - 2. Section 079200 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

1.3 REFERENCES

- A. National Fire Protection Association (NFPA) 701 (2004) - Standard Methods of Fire Tests for Flame Propagation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
- C. Samples: For each exposed product and for each color and texture specified, 10 inches long.
- D. Samples for Initial Selection: For each type and color of shadeband material.
 - 1. Include Samples of accessories involving color selection.

- E. Samples for Verification: For each type of roller shade.
 - 1. Shadeband Material: Not less than 10 inches square. Mark inside face of material if applicable.
- F. Roller-Shade Schedule: Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of shadeband material, signed by product manufacturer.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roller shades to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL 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. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 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. Manufacturer Qualifications:

1. Assign responsibility for design, engineering, installation, and performance of window shade system to manufacturer and their qualified dealers and installers.
2. Furnish shading system for complete installation.
3. Qualified to supply specified products and to honor claims against products presented in accordance with warranty.

D. Installer Qualifications: Qualified to install and commission specified products by prior factory training, minimum 3 years shades installation experience, demonstrated performance, and acceptance of any requirement of the manufacturer, subsidiary of the manufacturer, or licensed agent.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.11 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use. Do not install products under environmental conditions outside the manufacturer's absolute limits.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.12 COORDINATION

- A. Fabricate shades after obtaining field dimensions for each opening.
- B. Coordinate construction of surrounding conditions to allow for timely field dimension verification.

1.13 MAINTENANCE

- A. Make ordering of new equipment for expansions, replacements, and spare parts available to qualified dealer or installer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design: Subject to compliance with requirements, provide Draper, Inc. or comparable product by one of the following:
1. Hunter Douglas Contract.
 2. MechoShade Systems, Inc.
 3. Lutron Electronics Co., Inc.
- B. Source Limitations: Obtain manual roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Chain-and-Clutch-Operated Flex Shade by Draper with 24# Bracket, Ceiling-Wall Mount Head Box, Regular Roll Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
1. Bead Chains: Stainless steel.
 - a. Loop Length: 6" shorter than shade height.
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: P-clip.
 2. Clutch mechanism: Fabricated from high carbon steel and molded fiberglass reinforced polyester or injected molded nylon. Finish: Clear Anodized.
 - a. Spring-assist bead chain clutch mechanism: Adjustment-free system includes spring-assist components to reduce lifting forces required to raise the shade. Manufacturer shall provide estimated torque for shade unit. Spring-assist is recommended on estimated non-spring-assist torque above 6 lb.-in; required on shades with an estimated torque higher than 15 lb.-in.
 3. Idler Assembly: Provide roller idler assembly of molded nylon with adjustable or spring-loaded length idler pin to facilitate easy installation, and removal of shade for service.
 4. Single Roller Configuration:
 - a. Mounting:
 - 1) Universal Mounting brackets, 2-1/4" Heavy-Duty Clutch.
 - b. Brackets: Plated stamped steel. Provide size compatible with roller size.

- 1) Mounted to jamb.
- 2) Finish: Clear Anodized.
- c. Endcaps: Stamped steel with universal design suitable for mounting to jamb. Provide size compatible with roller size.
 - 1) Idler endcap to have optional levelling adjustment.
 - 2) Endcap covers: To match bracket.
- d. Headbox Ceiling/Wall style: “L” shaped extruded aluminum back and top cover piece with removable extruded aluminum closure and stamped steel endcaps:
 - 1) Finish: Selected from Manufacturers standard range.
- e. Roller Tube: Fabricated from extruded aluminum. Diameter, wall thickness, and material selected by manufacturer to accommodate shade type and size. Minimum roller diameter 1.5 inches. Tube diameters less than 1.5 inches shall not be acceptable unless manufacturer provides deflection analysis showing deflection limited to $\leq \text{width(inches)}/700$ at 1.5 X design load.
- f. Fabric to tube attachments: LSE (low surface energy) double sided adhesive specifically developed to attach coated textiles to metal. Adhesive attachment to eliminate horizontal impressions in fabric.
- g. Shade slat:
 - 1) Closed pocket elliptical slat: 1 inch aluminum elliptical slat inside of a 1-5/8 -inch pocket with heat sealed ends.

2.3 FABRIC:

A. Light-Filtering Fabric, Woven, and Stain Resistant.

1. Where applicable, seal shade fabric or treat PVC-coated fabric edges to prevent fraying.
2. Minimum 5 mm “No Growth Contact Area”, tested to ASTM G22 for ATCC6538 (*Staphylococcus aureus*) and ATCC13388 (*Pseudomonas aeruginosa*).
3. No growth, tested to ASTM G21 for ATCC9642, ATCC9348, and ATCC9645.
 - a. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - b. Source: Roller-shade manufacturer.
4. PVC Coated Fiberglass

a. Twill Weave:

- 1) T Screen 030030 (charcoal/charcoal), 3% by Mermet®: PVC coated fiberglass woven mesh. Dark on one side, light on the other. Fire rating: NFPA 701-10 TM#1, California U.S. Title 19, CAN/ULC-S109-03 Small & Large Flame Test. Environmental Benefits: Certified to UL GREENGUARD® and GREENGUARD Gold® standards for low chemical emissions into indoor air during product usage. RoHS compliant – lead free. Bacterial and fungal resistance: ASTM E2180, ASTM G21. Average 3 percent open, .025 inches thick, 11.6 oz/square yard.

2.4 ROLLER-SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:
 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
 - 1. Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain manual-operated roller shades.

END OF SECTION 122413

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SECTION 133400 ENGINEERED LADDER FRAME STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Engineered wood-framed structures consisting of the following components:
 - a. Factory-engineered wall construction.
 - b. Factory-engineered roof truss.
 - c. Factory-engineered metal roof and wall panels.
 - d. Factory-engineered building system accessories including doors and windows.
 - e. Prefinished metal trim items.
 - f. Prefinished ridge vents and soffits.

1.2 REFERENCES

A. Reference Standards:

1. Preservative Treated Lumber:
 - a. American Wood Preservers Association (AWPA).
2. Lumber grading rules and wood species:
 - a. National Design Specifications for Wood Construction, current edition.
 - b. Northeastern Lumber Manufacturer's Association, Inc. (NELMA).
 - c. Southern Pine Inspection Bureau (SPIB): Southern Pine.
 - d. West Coast Lumber Inspection Bureau (WCLIB): Douglas Fir.
 - e. Western Wood Products Association (WWPA): Douglas Fir and Ponderosa Pine.
3. MSR Lumber Producers Council (MSR) for machine stress rated lumber.
4. National Design Specifications for Wood Construction.
5. National Design Standard for Metal Plate Connected Wood Truss Construction (TPI).

1.3 ACTION SUBMITTALS

- A. Product Data:** For each type of process and factory-engineered product. Indicate component materials, dimensions, profiles, and construction and installation details.
1. Include information for specialty accessory products specified for this Project.
 2. 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.

3. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to truss fabricator.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 1. Sizes, stress grades, and species of lumber.
 2. Anchor-bolt layout.
 3. Structural Framing Drawings: Show complete fabrication of primary and secondary framing. Include provisions for openings and the following information:
 - a. Roof Slope: Per Drawings
 - b. Bearing Height: Per Drawings
 - c. Design loading to include:
 - 1) 30 LB/SF Top chord live load.
 - 2) 10 LB Top chord dead load.
 - 3) 10 LB Bottom chord dead load.
 - 4) Concentrated loads and their points as indicated in the plans.
 - d. Adjustments to lumber and plate design values for conditions of use.
 - e. Plate type, thickness of gauge, and size.
 - f. Lumber size, species and grade for each member.
 4. Metal Roof and Wall Panel Layout Drawings: Show layouts of metal panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and special details. Indicate the following components:
 - a. Roof mounted items.
 - b. Wall mounted items.
 5. Submit Shop Drawings and calculations that have been engineered and certified by professional engineer licensed in the State in which Project is located. Include seal and signature of professional engineer on Shop Drawings.
- C. Design Data: Roof and wall gravity and lateral engineering calculations for loading and stresses, bearing seal and signature of professional engineer licensed in the State in which Project is located. Include the following calculations:
 1. Minimum design shall meet design standards of latest edition of International Building Code unless other, more stringent requirements are in force in Project location.
 2. Bending moments and axial forces for each member.
 3. Basic plate design values.
 4. Design analysis for each joint indicating that proper plates have been used.
 5. Provide design calculations for roofs, exterior walls, canopies, soffit systems, and lateral bracing walls. Design loads are indicated on structural Drawings.

6. Submit design calculations that have been engineered and certified by professional engineer licensed in the State in which Project is located. Include seal and signature of professional engineer on calculations
- D. Samples for Initial Selection: For units with factory-applied color finish, color chart of manufacturer's full range of available colors.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 1. Wood-preservative-treated wood.
 2. Engineered wood products.
- B. Quality Control Submittals:
 1. Test Reports: Certified test reports showing compliance with specified performance characteristics.
 2. Certification: Manufacturer's certification that Products furnished meet specified design and performance criteria.
- C. Submit written proof of third-party inspection program in force for truss manufacturer used on Project.
- D. Certifications: Certify that specified roof and wind load requirements are met.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with minimum 5 years documented experience that participates in recognized quality-assurance program that complies with quality-control procedures and that involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.
 1. Manufacturers' responsibilities include providing professional engineering services needed to assume engineering responsibility.
 2. Manufacturer shall have engineering department.
 3. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by qualified professional engineer.
- B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- C. Source Limitations: Obtain engineered post frame building components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store materials per manufacturer's requirements.
- B. Handle and store trusses to comply with recommendations in TPI BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

1. Store trusses flat, off ground surface, and adequately supported to prevent lateral bending.
 2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
 3. Provide air circulation around stacks and under coverings.
 4. Store trusses to avoid contact with other materials that could create staining or discoloration.
- C. Inspect trusses upon deliver to Project site and notify manufacturer immediately if members have damage from handling or show discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

1.7 WARRANTY

- A. Manufacturer's Special Warranty – Treated Material: Manufacturer agrees to repair, restore, or replace columns that fail in materials within specified warranty period.
1. Warranty Period: 50 years from date of Substantial Completion.
 2. Manufacturer shall repair treated structural columns that fail because of insect damage or because of decay that occurs under normal conditions and proper use. If manufacturer is not able to repair structural posts to satisfaction of Architect and Owner, manufacturer shall replace damaged treated structural columns.
- B. Special Warranty on Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
1. Exposed Panel Finish: Deterioration includes the following:
 - a. Color fading more than 5 Hunter units when tested per ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested per ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Finish Warranty Period: From date of Substantial Completion, 40 years on chalk; 30 years on color change:
 3. To conform to UL2218 hail impact rating Class 4
 4. Warranty Exclusions: Manufacturer will not warrant metal panel finishes damaged due to exposure to atmospheric pollutants including animal waste or other corrosive conditions. Manufacturer will not warrant labor by others.
 5. Manufacturer shall repair painted steel roofing or siding panels if the paint peels, cracks, checks, flakes or blisters to an extent that is apparent by ordinary outdoor visual observation when exposed to normal weather and atmospheric conditions. If manufacturer is not able to repair steel panels to satisfaction of Architect and Owner, manufacturer shall replace damaged steel panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products from the following manufacturer or approved equal:

Energy Panel Structures, Inc.
102 East Industrial Park
Graettinger, IA 51342
Toll Free: 800.967.2130
Email: sales@epsbuildings.com
Website: www.epsbuildings.com

2.2 PERFORMANCE CRITERIA

- A. Design Requirements:
1. Design wood members per formulas published in National Design Specifications (NDS) for Wood Construction.
 2. Design light metal-toothed connector plates and joint design in compliance with Truss Plate Institute's (TPI) National Design Standard for Metal Plate Connected Wood Truss Construction.
 3. Include unbalanced roof loads required by ASCE-7, edition noted on drawings.

2.3 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPAC U1; 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.
 2. For exposed items indicated to receive stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Maximum moisture content of 19 percent or per appropriate grading rules. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of inspection agency approved by ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
1. Laminated columns.
 2. Baseboards.
 3. Hold down blocks.

2.4 MATERIALS - WOOD

A. Wood Framed Walls:

1. Double 2x Studs at 4'-0" o.c., or sizes, spacing, and species by design engineer. Fastened together on site.
2. Treated 2x Sill Plate
3. Double 2x Top Plate
4. "Ladder" 2x Girts at 24" o.c., or sizes, spacing, and species by design engineer.

B. Wood Trusses: Factory-fabricated of surfaced lumber.

1. 4' OC spacing, or as required by design engineer. Notify architect and engineer of changes to this specification.
2. Lumber:
 - a. Top and Bottoms Chords: No. 1 or better Southern yellow pine or comparable Spruce-pine-fir, or as required by design engineer. Notify architect and engineer of changes to this specification.
 - b. Webs: No. 2 or better Southern yellow pine or SPF, or as required by design engineer. Notify architect and engineer of changes to this specification.
3. Metal Connector Plates: Fabricated from ASTM A653; Structural Steel, high-strength low-alloy steel Type A (HSLAS Type A); G60 hot-dip galvanizing coating designation.
 - a. Plate Thicknesses: 0.036-inch and 0.0556-inch thick, or as required by design engineer.

C. Purlins and Truss Ties: 2-inch by 4-inch laid on edge, SPF #2 or better, or as required by design engineer. Notify architect and engineer of changes to this specification.

1. Purlins to be installed over top chord of truss, laid on flat, SPF #2 or better, or as required by design engineer. Notify architect and engineer of changes to this specification.
2. Fascia boards: 2-inch by 8-inch SPF #2 or as required by design.

D. Overhang Framing: Fabricated rafter frames.

1. Provide factory beveled fascia boards, 2-inch by 8-inch SPF #2.

E. Wind Bracing:

1. 2 inch by 6 inch, No. 2 or better Spruce-pine-fir from end wall column to first truss back, or as required by design engineer. Notify architect and engineer of changes to this specification.
2. 2 inch by 4 inch diagonal in roofline bracing as required by design. Notify architect and engineer of changes to this specification.

F. Framing Around Openings:

1. Provide 2x framing around door, window, and overhead sectional door openings. Size and connections by design engineer. Notify architect and engineer of changes to this specification.

G. Headers: Provide built-up No. 1 or better Southern yellow pine headers as required to meet loading designs, or as required by design engineer. Notify architect and engineer of changes to this specification.

H. Incidental Framing: No.2 or better 2-inch by 4-inch, or as required by design engineer. Notify architect and engineer of changes to this specification.

2.5 MATERIALS – PREFINISHED MATERIALS

A. General: Factory-formed metal panels, roll-formed in manufacturer's facility, designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Including accessories and sealants required for weathertight installation.

A. Metal Panels 2A (Field): Multi-V Panel by McElroy Metal (or approved equal).

1. Exposed-fastener metal wall panels, formed with raised ribs and recesses.
2. Material: Zinc-coated (galvanized) steel sheet, 0.024 inch, 24 ga. nominal thickness.
 - a. Exterior Finish: Siliconized polyester.
 - b. Wall Color: Ash Gray (McElroy Metal) or approved equal.
3. Rib Spacing: Major longitudinal ribs 1-3/16" deep, spaced at 12" o.c. with minor longitudinal 'V'-ribs centered between major ribs, spaced 6" o.c.
4. Panel Coverage: 35-3/4 inches.
5. Panel Height: 1-3/16" inch.
6. To conform to UL2218 hail impact rating Class 4.

B. Metal Panels 2B (Accent): Multi-V Panel by McElroy Metal (or approved equal).

1. Exposed-fastener metal wall panels, formed with raised ribs and recesses.
2. Material: Zinc-coated (galvanized) steel sheet, 0.024 inch, 24 ga. nominal thickness.
 - a. Exterior Finish: Siliconized polyester.
 - b. Wall Color: Brite Red (McElroy Metal) or approved equal.
3. Rib Spacing: Major longitudinal ribs 1-3/16" deep, spaced at 12" o.c. with minor longitudinal 'V'-ribs centered between major ribs, spaced 6" o.c.
4. Panel Coverage: 35-3/4 inches.
5. Panel Height: 1-3/16" inch.
6. To conform to UL2218 hail impact rating Class 4.

- C. Metal Panels 2C (Roof): Multi-Rib PB Panel by McElroy Metal (or approved equal.)
 - 1. Exposed-fastener metal roof panel, formed with raised ribs and recesses.
 - 2. Material: Zinc-coated (galvanized) steel sheet, 0.024 inch, 24 ga. nominal thickness.
 - a. Exterior Finish: Siliconized polyester.
 - b. Wall Color: Ash Gray (McElroy Metal) or approved equal.
 - 3. Rib Spacing: Major longitudinal ribs 1-3/16" deep, spaced at 12" o.c. with minor longitudinal ribs centered between major ribs, spaced 6" o.c.
 - 4. Note: roof slope is planned as 1:12 – provide continuous bead of butyl at panel lap joints.
 - 5. Panel Coverage: 36 inches.
 - 6. Panel Height: 1-3/16" inch.
 - 7. To conform to UL2218 hail impact rating Class 4.
- D. Metal Liner Panels (MLP): Mini-Rib Panels by McElroy Metal (or approved equal.)
 - 1. Exposed-fastener metal wall panels, formed with raised ribs and recesses.
 - 2. Material: Zinc-coated (galvanized) steel sheet, 0.0135 inch, 29 ga. nominal thickness.
 - a. Exterior Finish: Siliconized polyester.
 - b. Color: Bone White (McElroy Metal) or approved equal.
 - 3. Rib Spacing: Major longitudinal ribs 3/8" deep, spaced at 3" o.c. with minor longitudinal ribs centered between major ribs.
 - 4. Panel Coverage: 36 inches.
 - 5. Panel Height: 3/4" inch.
- E. Metal Trim: Match material and color of metal panels, unless noted otherwise. Provide trim for corners, ridge lines, rakes, eaves, and panel bases.
 - 1. Verify colors and locations with Architect. Various colors will be required.
 - 2. Lengths: Minimum 10 feet.
 - 3. Trim, overhang facias, track covers, and slide door jambs available in building panel covers.
 - 4. Overhead Sectional Door and Slide Door Jamb Trim: Fabricated from 1 piece up to 10 feet in length.
- F. Soffit Vent: Cor-a-Vent S-400 continuous soffit strip vent system or approved equal.
 - 1. Black finish.
- G. Ridge Vent: Manufacturer's standard pre-engineered ridge cap, flashings, and eave and gable trim. Field-fabricate minor flashings as indicated on approved Shop Drawings.
 - 1. Provide manufacturer's standard Continuous Vented Ridge, 12 square inches per lineal foot.

2.6 RELATED MATERIALS

- A. Anti-Condensation Felt: Manufacturer's shop-applied, proprietary, self-adhered felt designed to trap condensation moisture and release moisture as humidity.
 - 1. Acceptable Product: DripStop by Filc, a company of Freudenberg.
- B. Closure Strips: Closed cell, 2 psf density polyethylene foam, pre-molded to match configuration of panels.
- C. Plywood Sheathing: See Section 061600 Provide and install where indicated on drawings.
- D. Thermal Insulation: See Section 072100 Provide and install where indicated on drawings.
- E. Weather Barrier: See Section 072500 Provide and install where indicated on drawings.
 - 1. Note: building supplier shall provide 'Perfection Roll' or approved equivalent cushioning spacer to eliminate telegraphing of weather-barrier fasteners (button caps) through the exterior metal panel finish.
- F. Walk Doors: Where indicated on Drawings, provide the following type of doors:
 - 1. Galvannealed steel or extruded aluminum frame and sash with electrostatically coated enamel paint finish and window manufacturer's standard single pane glass or insulated glass unit, and locking options based on Project requirements.
 - a. Acceptable Product:
 - 1) PLYCO: 20 Series, Polar White finish, Commercial Post Frame Entry / Walk Doors. (interior doors)
 - a) Lite Kits: 1LG-2 22x30, 1LD-2 4x24, or no lite kits.
Note: Lite kit size varies per location- see door & frame elevations.
 - 2) PLYCO: 92 Series, Ash Gray finish, Full Thermal Break Door, no embossing. (exterior doors)
 - a) Lite Kit: 1LT-2 7x36
 - 3) Provide and install door hardware per Section 087100.
- G. Overhead Doors: See Section 083613 Provide and install where indicated on drawings.

2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153.
 2. Exposed Fastener Heads: Match color of steel panel.
 3. Where steel panels or trim is attached to preservative-treated lumber, provide fasteners of unpainted Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F1667.
1. Framing Lumber: 10d, 16d and 60d ring shank nails.
 2. Machine Bolts: Minimum grade 1, A307.
 3. Metal Panels: Minimum 1-1/2-inch No. 10 screw fasteners with EPDM sealing washers bearing on weather side of metal panels.
 - a. Match color of metal panels.

2.8 FABRICATION

- A. Shop-fabricate wood trusses in TPI inspected plant.
- B. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- C. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
- D. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
- E. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
 1. Engage land surveyor to perform surveying.
- C. Verify that mechanical and electrical utilities are in correct position.
- D. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent framing, connections, and bracing are in place unless indicated otherwise.

3.3 ERECTION OF FRAMING

- A. General: Do not use materials that are unsound, warped, improperly finished, or with defective surfaces, sizes, or patterns.
 - 1. Comply with frame manufacturer's approved Shop Drawings for details and building erection.
 - 2. Comply with NFBA document "Accepted Practices for Post-frame Construction Framing Tolerances."
- B. Wall Girts: Install at centers indicated on Building Designer Drawings.
 - 1. If required, install overhang framing at top of wall girts.
- C. Trusses:
 - 1. Set trusses in place in center of column using lifting methods as approved by manufacturer.
 - 2. When trusses are properly positioned, install 1/2 inch by 5-1/2-inch machine bolt and manufacturer recommended 20d ring shank nails through 2 of column laminates and truss heel, or as directed by Building Designer Drawings.
 - 3. Brace trusses per WTCA guidelines and BCSI Manual, or as directed by Building Designer Drawings.
- D. Purlins: Install purlins with fasteners and at spacings per approved Shop Drawings.
- E. Truss Ties: Install truss ties at locations recommended by structure manufacture and per approved Shop Drawings.
 - 1. Run truss ties from end wall to end wall.
- F. Incidental Framing: Install 2-inch by 4-inch or 2-inch by 6-inch blocking as required per structure manufacturers recommendations.

3.4 METAL PANEL INSTALLATION – GENERAL

- A. Install metal panels per manufacturer's established construction procedures.
- B. Install metal panels and components plumb, square, straight, and true to lines, and to assure freedom from rattles.
- C. Take care when cutting prefinished materials to ensure cuttings do not remain on finished surface.
- D. Properly install fasteners taking care to not under- or overdrive.

3.5 METAL PANEL INSTALLATION

- A. Roofing Panels: Install panels perpendicular to supports aligned straight with end fascias and fasten to purlins. Anchor with fasteners at spacings recommended by manufacturer and design loads.
- B. Wall Panels: Install metal panels perpendicular to wall girt and purlin supports, aligned level and plumb. Anchor with fasteners at spacings recommended by manufacturer and design loads.
- C. Vented Ridges: Fasten vented ridges to structure as indicated on Drawings, maintaining manufacturer's minimum clear throat opening.
- D. Soffits: Install soffits to interlock with trim items at top of steel siding and at fascias.
 - 1. Vented soffit shall be used at end overhang.
 - 2. Perforated soffits shall be provided for balanced ventilation at side overhangs.
- E. Trim Items: Install trim items at base, wainscot transitions, corners, top of steel siding, fascia, gables, and ridges using no less than 1 inch screw fasteners.
 - 1. Trim items shall be installed at the base, at any wainscot transition, corners, top of steel siding, fascias, gables and ridge using appropriate 1" screw fasteners.
- F. Closure Strips: Provide closure strips at top and bottom of roofing panels.

END OF SECTION 133400

**SECTION 21 0050
BASIC FIRE SUPPRESSION REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Basic Fire Suppression Requirements specifically applicable to Mechanical Division Specification Sections.
- B. Division 21 Specification requirements also include, by reference, all Division 00 and 01 specification sections. This contractor is responsible to review these specification sections. Requirements of these specification sections are included as a part of this contract.

1.02 OWNER OCCUPANCY

- A. The owner will occupy the premises during the construction period.
- B. Limit use of site and premises to allow owner occupancy.
- C. Cooperate with the owner to minimize conflict and to facilitate owner's operations.
- D. Schedule the work to accommodate this requirement.

1.03 REGULATORY REQUIREMENTS

- A. This contractor shall give proper authorities all requisite notices relating to work in their charge, obtain official permits, licenses for temporary construction and pay proper fees for it.
- B. This contractor is to be solely answerable for and shall promptly make good all damage, injury or delay to other contractors, to neighboring premises or to persons or property of the public by the contractor, by the contractor's employees or through any operation under the contractor's charge, whether in the contract or as extra work.
- C. No attempt has been made to reproduce in these specifications any of the rules or regulations contained in city, state or federal ordinances and codes pertaining to the work covered by these specifications that the contractor be thoroughly familiar with all such ordinances and codes.
- D. The fact that said various rules, regulations and ordinances are not repeated in this specification does not relieve this contractor of the responsibility of making the entire installation in accordance with the requirement of those authorities having jurisdiction.
- E. All work shall comply with the applicable recommendations of:
 - 1. The National Board of Fire Underwriters
 - 2. The American Gas Association
 - 3. The National Fire Protection Association (NFPA)
 - 4. The Occupations Safety and Health Act (OSHA)
 - 5. Current IBC Building Code
 - 6. Current applicable city building codes
 - 7. Fire Protection: Conform to UFC and NFPA
 - 8. The Joint Commission
 - 9. Iowa Administrative Code, Chapter 61
- F. Mechanical: Conform to current mechanical code.
- G. Plumbing: Conform to current plumbing code.
- H. Obtain permits and request inspections from authority having jurisdiction.

1.04 QUALIFICATIONS

- A. The fire suppression installer must be a company specializing in applying the work of this division with a minimum of five years experience.

RENOVATION & ADDITION**1.05 SYSTEM DESCRIPTION**

- A. Design and install the system to NFPA 13.
- B. New system: A new dry sprinkler system shall be installed in the new and existing buildings.

1.06 PROJECT/SITE CONDITIONS

- A. Install work in locations shown on the drawings unless prevented by project conditions.
- B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other sections. Obtain permission of owner and architect/engineer prior to proceeding.
- C. This contractor, before submitting their bid, shall visit the site of the project to become familiar with locations and conditions affecting their work.
- D. It is the intent of this specification that this contractor furnish all labor and material required to complete the installation as outlined in the drawings and specifications. No additions to the contract price shall be allowed due to the failure of this contractor to properly evaluate the effect of existing conditions on the work to be done under this contract.
- E. Whenever renovation or remodeling or relocation of existing equipment is included in the contract, it is imperative that all locations of existing piping, ductwork, equipment, services and grades be noted on the job site prior to bid being submitted and that all elevations and grades be verified before roughing in new work.
- F. This contractor shall provide holes as necessary for the installation of their work and in accordance with other specification sections in materials other than the structure.

1.07 SEQUENCING AND SCHEDULING

- A. This contractor shall arrange their work in order that it progresses along with the general construction of the building.
- B. This contractor shall be kept informed as to the work of other trades engaged in the project and shall execute their work in such a manner so as not to delay or interfere with progress of other contractors.
- C. Where space for mechanical and electrical lines and piping is limited, it is imperative that all such trades coordinate their work so as to ensure concealment in space provided. Where conflict exists, the engineer shall decide priority of space. If work is not properly coordinated, the engineer may require removal and relocation of work without additional compensation.

1.08 GUARANTEE

- A. This contractor shall guarantee all of the apparatus, materials, equipment furnished, and labor installed under this contract for a period of one year after date of final acceptance, unless a longer period is specified.
- B. Neither final certificate of payment nor any provisions in the contract documents nor partial or complete occupancy of premises by owner shall constitute an acceptance for work not done in accordance with contract documents or relieve the contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship.
- C. Should any defects arise as the result of defective workmanship or material within the guarantee period set forth, this contractor shall make the necessary correction at their own expense.

1.09 ENGINEER APPROVED EQUAL PRODUCTS

- A. When the engineer, at the request of the interested parties, including the contractor, supplier and manufacturer approved "engineer approved equal" products for this

project, such products are approved on the assumption that they will equal or exceed the performance of the products specified.

- B. If such products do not do so after being installed on this project, this contractor shall replace or modify the particular product as necessary to equal the performance of the products specified at no expense to the owner, architect or engineer.
- C. Request for "engineer approved equal" products shall be received by the architect/engineer prior to the last addendum being issued. Requests for substitutions received after this date will not be considered. Substitution requests shall clearly state which products are being considered for substitution. Substitution requests shall include all pertinent product information needed to evaluate the substitution as an "equal".
- D. Similar products shall be all of the same manufacturers and style. There is no exception to this unless prior approval has been granted from engineer.

1.10 OWNER'S RIGHT OF SALVAGE

- A. Before beginning construction, this contractor shall check and verify with the owner each item of existing equipment that must be removed.
- B. The owner will designate which items of material or equipment not reused that they may wish to keep. This contractor shall then remove these items with care and store in a location designated by the owner for the owner's disposal.
- C. All other items of equipment to be removed and not specified for reuse in new construction or reserved by the owner for their own use shall become the property of the contractor and shall be removed from site.

1.11 PROTECTION AND MAINTENANCE

- A. The work covered by these drawings and specifications involves all work in the new and [existing buildings.
- B. Any work to be done in existing structures shall be coordinated with the owner and arrangements made so that traffic flow may be maintained and areas finished where possible before other areas are begun.
- C. This contractor shall protect existing equipment in all finished areas from dirt, dust and damage as a result of their work.
- D. Coordinate protection requirements with department heads before beginning construction.
- E. Protect any building openings from unauthorized entry. Coordinate with owner where building entry must be controlled.

1.12 CUTTING AND PATCHING

- A. This contractor shall do all cutting and patching necessary for the installation of their work in all existing and new buildings unless otherwise noted.
- B. In areas where the integrity of new or existing fire separation assembly/wall is compromised by the work, contractor shall be responsible to patch and/or seal openings as necessary to maintain/return fire separation to rating as required by applicable codes.
- C. This contractor shall do all cutting and patching required for their work beyond the remodeled areas unless otherwise noted. All finish work shall include patching to match existing adjacent surfaces. Painting shall be by others.
- D. This contractor shall arrange for openings in the building as required for the installation of equipment furnished under this contract. Where piping must be extended or changed, patching with concrete will be done in the building. Patching shall be at both the top and bottom of sleeves where above grade.

1.13 CLEANING AND RUBBISH

- A. This contractor shall upon completion of their work, remove all rubbish and debris resulting from this contractor's operation and shall remove it from site at their own expense.
- B. In so far as this contractor's work is concerned, all equipment shall be cleaned and the premises left in first class condition.
- C. This contractor shall maintain the work area each day to prevent hazardous accumulation of waste from their work.

1.14 SEALING AND PENETRATION

- A. Clearance around the piping passing through fire or smoke rated construction shall be sealed to maintain the rated integrity of the construction (1 hr. 2 hrs. etc.). One and two-hour rated assemblies are to be patched on both sides of the assembly.
- B. This contractor shall verify with the architect drawings the rating and location of all such construction and seal all penetrations.
- C. Manufacturer offering products to comply with the requirements include the following:
 - 1. Dow Corning "Silicone RTV Foam"
 - 2. 3-M Corporation "Fire Barrier Caulk and Putty"
 - 3. Thomas & Betts "Flame Safe Fire Stop System"
- D. Installation of these products to be in strict accordance with manufacturer's recommendations and architectural specification sections or equivalent fire stopping general specification section.
- E. The contractor shall submit shop drawings showing approved sealing assemblies to be utilized on this project.

1.15 HAZARDOUS MATERIALS

- A. If the contractor stores any hazardous solvents or other materials on the site, the contractor shall obtain copies of the safety data sheets for the materials and post them on the site. The contractor shall inform the owner and all employed of any potential exposure to this material.
- B. At no time shall any product containing asbestos be incorporated into the work.
 - 1. If asbestos materials are encountered, report to the owner. The owner will be responsible for asbestos removal.

1.16 AS-BUILT DRAWINGS

- A. This contractor shall provide, at the conclusion of the project, one clean, non-torn, neat, and legible "as-built" set of drawings to the owner. These drawings shall show the routing of pipes and equipment drawn in at scaled locations. All dimensions indicated shall be referenced to a column line. A set of construction drawings will be furnished for this work.
- B. All sprinkler systems installed shall be shown on the "as-built" drawings.
- C. Refer to respective general specification section for additional information.
- D. This contractor shall update these drawings during the project at least every week.

1.17 REVIEW OF MATERIALS

- A. This contractor shall submit to the engineer for review one (1) electronic copy of a brochure giving a complete list of materials and equipment they propose to furnish. The brochure shall contain complete information as to the make of equipment, type, size, capacities, dimensions and illustration. One of these returned copies shall be kept on the job at all times.
- B. Checking of submittal drawings by the engineer does not relieve the contractor of the responsibility for the accuracy of such drawings and for their conformity to drawings

and specifications unless the contractor notifies engineer in writing of such deviation at time such drawings are furnished.

- C. All submittals shall have the date marked on them when the contractor receives them from the supplier. Submittals shall be submitted through the contractor and shall not come direct from the supplier to the architect or engineer.
- D. This contractor shall mark the date and sign each set signifying that the contractor has checked each of them in their entirety before submitting to the engineer. Submittals that are not dated and signed by the contractor will not be accepted, or checked and will be marked "resubmit" and sent back to the contractor.

1.18 TEST OF SYSTEMS

- A. This contractor, before concealed, shall test all systems installed under this contract as called for in these specifications and as required by local codes. Tests shall be made in the presence of the engineer, local authorities or their duly authorized representative. Any defects discovered in testing shall be corrected and the tests repeated until all defects are eliminated.
- B. This contractor shall be held responsible for all damage resulting from defects in the system.
- C. At the conclusion of construction (before any covering up, painting or finishing) each element of the system shall be thoroughly tested against leakage with appropriate pressure tests as outlined herein and in appropriate sections of the specifications. All testing shall be hydrostatic unless permission is granted otherwise.
 - 1. Underground Fire Lines: 200 psi. Maintain in accordance with NFPA 13.
- D. Fluid lines other than the above shall be tested in accordance with NFPA 13.
- E. After completion of installation, the systems shall be given tests under full operating conditions and pressures and all adjustments shall be made to make the system operative as required. All safety devices shall be tested for correct operation.

1.19 SCOPE OF WORK

- A. All work shall be performed by well-qualified and licensed mechanics with a thorough knowledge of the various systems involved in this building. It shall be this contractor's responsibility to see that their mechanics are familiar with all the various codes and tests applicable to this work.
- B. All equipment shall be new and of the type as specified by the engineer unless otherwise noted in these specifications or on the drawings to remain and or be reused.
- C. The intent of the drawings and specifications is for complete installation of the systems outlined in the drawings and specifications so that at the conclusion of construction the system will be turned over to the owner complete and ready for safe and efficient operation.
- D. This contractor shall be required to furnish and install all such items normally included on systems of this type, which, while not mentioned directly herein or on the drawings are obviously essential to the installation and operation of the system and which are normally furnished on quality installation of this type. The drawings and specifications cannot deal individually with the many minute items that may be required by the nature of the systems.
- E. If there is a discrepancy between the drawings and the specifications or within either document, the more stringent requirement shall be estimated unless brought to the engineer's attention and an addendum is issued for clarification.
- F. The Fire Suppression Contractor shall establish system elevations prior to fabrication and installation. The Fire Suppression Contractor shall coordinate elevations with other trades. All elevations shall be coordinated with all trades in the field prior to installation.

When a conflict between trades arises, the design team shall be notified immediately prior to further installation however priority shall be as follows:

1. Lighting Fixtures
2. Gravity flow piping, including steam and condensate.
3. Electrical bus duct.
4. Sheet metal.
5. Cable trays, including access space.
6. Other piping.
7. Conduits and wireway.

1.20 VERIFICATION OF ELEVATION OF EXISTING LINES

- A. This contractor, before starting any new work, shall verify the elevations of all existing piping to which they must connect under this contract. The contractor shall report any discrepancies between drawing elevations and actual elevations to the engineer before proceeding with the work. Failure of the contractor to do so shall make the contractor liable for the cost of extra work involved.

1.21 WELDING PERMIT

- A. Form titled "Permit For Cutting and Welding With Portable, Gas or Arch Equipment" must be completed and returned to the hospitals designated representative prior to work commencing. The owner upon request will supply this form.

1.22 DAILY HOUSEKEEPING

- A. At the end of each working day, this contractor shall remove all of their debris, rubbish, tools and surplus materials from the project work area. The work area shall be broom clean and left in a neat and orderly condition. This contractor, for the removal of debris from the project, shall not use the owner's waste disposal facility.
- B. At end of construction, all equipment shall be cleaned and the premises left in first class condition as far as this contractor's work is concerned.

1.23 CLEANING OF MECHANICAL SYSTEMS

- A. This contractor shall clean all piping systems by flushing with water until free from all sand, grit, gravel, oil, etc.
- B. Where connections are made to existing piping systems, this contractor shall provide isolation valves, threaded tees, etc., as required to facilitate the cleaning and testing of all new piping.
- C. This contractor shall thoroughly clean all rust, grease, plaster, cement, etc., from all equipment and piping furnished and installed by them as required to leave surfaces suitable for finish painting.
- D. This contractor shall keep all pipes, plugged, drained or otherwise protected during construction. All items of mechanical equipment shall be suitably protected and upon completion of project shall be equal to new condition.

1.24 TRENCHING AND BACKFILLING

- A. Each contractor is responsible for their own individual trenching and backfilling unless otherwise noted in the drawings or addendum.
- B. All underground utilities, piping, etc shall be located exactly before digging. This contractor shall be held responsible for all damages caused by failure to do so.
- C. Any backfill shall be tamped and compacted to prevent future settling. The backfill shall be installed to a smooth and level grade and installed in accordance with local codes.
- D. All excess dirt shall be cleared from the area and disposed of as directed by the owner.
- E. Refer to architectural specification sections for additional requirements.

1.25 ALTERNATES

- A. Refer to General Specification Sections for alternate bid description.

1.26 ALLOWANCE

- A. Include a \$5,000.00 allowance in the bid amount for owner or engineer directed changes during the construction period. Changes shall be priced prior to proceeding with the work. Any amount left over at the conclusion of the project shall be deducted from the contractor's last payment application.

1.27 DIGITAL MEDIA AGREEMENT

- A. Computer Aided Drafting (CAD) documents may be available to the contractor for some uses. Contact the engineer prior to bidding to determine what information is available to be transmitted to the contractor in digital form.
- B. When documents are determined to be available, and as requested by the contractor, they will be transmitted upon the completion and execution of the MODUS digital media agreement. A service fee for each document transmitted will be assessed to the contractor. Documents will be transmitted upon payment receipt. Current service fee is \$100.00 per CAD sheet.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

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SECTION 21 0529

HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe hangers and supports
- B. Accessories
- C. Sleeves

1.02 REFERENCES

- A. ASME B31.1 - Power Piping
- B. ASME B31.9 - Building Services Piping
- C. ASTM F708 - Design and Installation of Rigid Pipe Hangers
- D. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer
- E. MSS SP69 - Pipe Hangers and Supports - Selection and Application
- F. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices
- G. NFPA 13 - Installation of Sprinkler Systems
- H. UL 203 - Pipe Hanger Equipment for Fire Protection Service

1.03 SUBMITTALS

- A. Product Data: Provide manufacturers catalog data including load capacity.
- B. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- C. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

1.04 REGULATORY REQUIREMENTS

- A. Conform to applicable code for support of piping.
- B. Supports for Sprinkler Piping: In conformance with NFPA 13.

PART 2 PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. Grinnell
 - 2. Tolco
 - 3. Engineer approved equal.
- B. Fire Protection Piping:
 - 1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inch: Carbon steel, adjustable swivel, split ring.
 - 2. Hangers for Pipe Sizes Two Inch (2") and Over: Carbon steel, adjustable, clevis.
 - 3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - 4. Wall Support for Pipe Sizes to Three Inches: Cast iron hook.
 - 5. Wall Support for Pipe Sizes Four Inch (4") and Over: Welded steel bracket and wrought steel clamp.
 - 6. Vertical Support: Steel riser clamp.
 - 7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - 8. Provide zinc coated hangers and supports for all non air conditioned areas.

2.02 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, threaded one end or continuous threaded.
- B. Install in accordance with manufacturer's instructions.

2.03 SLEEVES

- A. Sleeves for pipes through wall below grade shall be Schedule 40, two pipe diameters larger than pipe. Seal with Linkseal.
- B. Sleeves for pipes through non-fire rated floors shall be 18 gauge galvanized steel.
- C. Sleeves for pipes through non-fire rated beams, walls, footings, and potentially wet floors shall be Schedule 40 steel pipe or 18 gauge galvanized steel.
- D. Sleeves for pipes through fire rated and fire resistive floors and walls, and fire proofing to be a fire rated sleeve assembly including seals, UL listed.
- E. Stuffing and Firestopping Insulation: Fiberglass type, non-combustible per UL tested assembly type.
- F. Sealant Manufacturers:
 - 1. Dow Corning Silicone RTV Foam.
 - 2. 3-M Fire Barrier Caulk and Putty.
 - 3. Thomas & Betts Flame Safe Fire Stop System.
 - 4. Engineer approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.02 PIPE HANGERS AND SUPPORTS

- A. Provide hanger rod size and spacing in accordance to NFPA requirements.
- B. Support piping in accordance to NFPA requirements.
- C. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- D. Place hangers within 12 inch of each horizontal elbow.
- E. Use hangers with 1-1/2 inch minimum vertical adjustment.
- F. Support vertical piping at every floor.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Design hangers for pipe movement without disengagement of supported pipe.
- J. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.03 SLEEVES

- A. Set sleeves in position in formwork. Provide reinforcing around sleeves.
- B. Size sleeves large enough to allow for movement due to expansion and contraction.
- C. Extend sleeves through floor one inch (1") above finished floor level. Caulk sleeves.
- D. Provide sleeves where piping penetrates floor, ceiling or wall fire rated assemblies. Close off space between pipe or duct and adjacent work with fire stopping insulation and caulk.

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- E. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
 Install chrome plated steel escutcheons at finished surfaces and within cabinets.

3.04 SCHEDULES

HANGER ROD PIPE SIZE	MAX. HANGER SPACING FEET	DIAMETER INCHES
1/2 to 1-1/4	6.5	3/8
1-1/2 to 2	10.0	3/8
2-1/2 to 3	10.0	1/2
4 to 6	10.0	5/8
8 to 12	14.0	7/8
14 and Over	20.0	1

END OF SECTION

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**SECTION 21 1200
FIRE SUPPRESSION PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sprinkler piping
- B. Ball valves
- C. Butterfly valves

1.02 RELATED SECTIONS

- A. Specification Section 21 1300 - Fire Suppression Sprinkler Systems

1.03 REFERENCES

- A. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings, Class 150 and 300
- B. ANSI/ASME B16.4 - Cast Iron Threaded Fittings, Class 125 and 250
- C. ANSI/ASME B16.9 - Factory-Made Wrought Steel Butt Welding Fittings
- D. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
- E. ANSI/ASME Sec 9 - Welding and Brazing Qualifications
- F. ANSI/ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
- G. ANSI/ASTM A135 - Electric Resistance Welded Steel Pipe
- H. ASTM A795 - Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
- I. AWS A5.8 - Specifications for Filler Metal for Brazing and Braze Welding
- J. NFPA 13 - Installation of Sprinkler Systems

1.04 SUBMITTALS

- A. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor, and wall penetration seals.
- B. Product Data: Provide manufacturers catalog information. Indicate valve data and ratings.

1.05 OPERATION AND MAINTENANCE

- A. Maintenance Instructions: Include installation instructions, spare parts list, procedures and treatment programs.

1.06 QUALITY ASSURANCE

- A. Welding Materials and Procedures: Perform to ASME Code.
- B. Valves: Bear UL and FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- C. Maintain one copy of each document on site.

1.07 DELIVERY, STORAGE AND PROTECTION

- A. Deliver, store, protect and handle products to site.
- B. Deliver and store valves in shipping containers with labeling in place.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 PRODUCTS

2.01 SPRINKLER PIPING (ABOVE GROUND)

- A. Galvanized Steel Pipe

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1. 1" - 2": ASTM A53/A795 Schedule 40, Hot Dipped Galvanized Steel, Threaded.
 2. 2 1/2"-6": ASTM A53/A795, Schedule 10, Hot Dipped Galvanized Steel, Roll Grooved.
 3. 8" and Larger: ASTM A153/A53, Black Mill Steel. Roll Grooved.
- B. Fittings:
1. 1"-2" ASTM A 126 Class A Gray Iron.
 2. 2-1/2"-6": ASTM A536 ductile iron housing clamps, ASTM a 153 hot dipped galvanized, pre-lubricated grade "e" EPDM, type "a" gasket, steel bolts, nuts and washers. Mechanical grooved couplings. UL listed and FM approved.
- C. Coupling and fittings shall be made by the same manufacturer.

2.02 BALL VALVES

- A. Manufacturers:
1. NIBCO
 2. Apollo
 3. Engineer approved equal.
- B. Up To and Including 2 Inches: Bronze two piece body, chrome plated brass ball, Teflon seats and stuffing box ring, lever handle, threaded ends, full port on 1" and smaller, standard port above 1".
- C. UL listed and FM approved for fire protection service.

2.03 BUTTERFLY VALVES

- A. Manufacturers:
1. Victaulic
 2. Tyco
 3. NIBCO
 4. Milwaukee
 5. Engineer approved equal.
- B. Two Inch (2") and Smaller: Bronze one piece body, full port, stainless steel disc, EPDM seat, threaded ends, hand wheel and gear drive with integral indicating device, and built-in tamper proof switch rated 10 amp at 115 volt AC.
- C. Over 2 Inches: Ductile iron body, nickel plated ductile iron disc, resilient replaceable EPDM seat, groove ends, extended neck, hand wheel and gear drive and integral indicating device, and built-in tamper proof switch rated 10 amp at 115 volt AC.
- D. UL listed and FM approved for fire protection service.

PART 3 EXECUTION**3.01 PREPARATION**

- A. Ream pipe and tube ends, remove burrs, bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

- A. See plumbing specifications for underground piping requirements.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- C. Install piping to conserve building space and to not interfere with use of space and other work.
- D. Group piping whenever practical at common elevations.
- E. Sleeve pipes passing through partitions, walls, and floors.

- F. Install piping to allow for expansion and contraction without stressing pipe, joints or connected equipment.
- G. Prepare pipe, fittings, supports and accessories for finish painting. Where pipe support members are welded to structural building frame, scrape, brush clean and apply one coat of zinc rich primer to welding.
- H. Do not penetrate building structural members unless indicated.
- I. Provide sleeves when penetrating footings, floors and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- J. Die cut screw joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.
- K. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.
- L. Provide butterfly valves for shut-off or isolating service.
- M. Provide drain valves at main shut-off valves, low points of piping and apparatus.
- N. Run drain piping to suitable drainage point, interior to the building. Coordinate all locations with architect.
- O. Route piping concealed above ceiling. Where piping has to be exposed, coordinate all pipe routing with the architect.

END OF SECTION

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**SECTION 21 1300
FIRE SUPPRESSION SPRINKLER SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sprinkler heads
- B. Flexible sprinkler head connection assembly
- C. Piping specialties
- D. Air compressor
- E. Dual check backflow preventer

1.02 RELATED SECTIONS

- A. Specification Section 21 1200 - Fire Suppression Piping

1.03 REFERENCES

- A. ASTM F2503 - Standard Practice for Marking Medical Devices and Other Items for Safety in the Magnetic Resonance Environment
- B. NFPA 13 - Installation of Sprinkler Systems
- C. NFPA 15 - Water Spray Fixed Systems for Fire Protection
- D. NFPA 231 - Standard for General Storage
- E. NFPA 231C - Standard for Rack Storage of Materials
- F. FM - Factory Mutual Approval Guide
- G. NFPA 70 - National Electrical Code
- H. UL - Fire Resistance Directory
- I. UL 199 - Automatic Sprinklers
- J. Warnock Hersey - Certification Listings

1.04 SYSTEM DESCRIPTION

- A. Provide system as specified in Section 21 0050.
- B. Flow test data included in the contract documents is for bidding purposes only. The contractor shall complete a flow test to determine the available volume and associated pressure of the incoming water supply to the building's sprinkler system. The contractor shall utilize their test data to complete all design calculations as required per these specifications. The contractor's flow test data shall be submitted to the Architect/Engineer for informational purposes prior to submitting any other Division 21 submittals.
- C. Interface system with building fire and smoke alarm system.
- D. Provide fire department connections where required.

1.05 SUBMITTALS

- A. Product Data: Provide manufacturers catalog data including load capacity.
- B. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- C. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

1.06 PROJECT RECORD DOCUMENTS

- A. Preliminary Shop Drawings: Prior to detailed submission, submit preliminary layout of finished ceiling areas indicating only head locations coordinated with ceiling installation.

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- B. Shop Drawings: Indicate hydraulic calculations, detailed pipe lay out, hangers and supports, components and accessories. Indicate system controls.
- C. Product Data: Provide data on sprinklers, valves, and specialties including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- D. Submit shop drawings, product data and hydraulic calculations to the local fire marshal and owner's insurance underwriter for approval. Submit proof of approval to architect and engineer.
- E. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds code requirements.

1.07 AS BUILT DRAWINGS

- A. Record actual locations of sprinkler heads and deviations of piping from the drawings. Indicate drain and test locations.

1.08 OPERATION AND MAINTENANCE DATA

- A. Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers, availability and location of service depot.

1.09 QUALITY ASSURANCE

- A. Perform work in accordance with the System Description in Section 21 0050 where applicable and pre-approved by State Fire Marshal.
- B. Equipment and components shall bear UL and FM label or markings.
- C. Maintain one copy of document on site.

1.10 QUALIFICATIONS

- A. Installer: Company specializing in performing work of this section with a minimum of three years experience.

1.11 REGULATORY REQUIREMENTS

- A. Hydraulic Calculations, Product Data and Shop Drawings:
 - 1. Bear stamp of approval of authority having jurisdiction.
 - 2. Submit to the State of Iowa and to the owner's insurance underwriter.

1.12 DELIVERY, STORAGE AND PROTECTION

- A. Deliver, store, and protect products to site.
- B. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.13 EXTRA MATERIALS

- A. Provide extra sprinkler heads under provisions of NFPA 13.
- B. Provide suitable wrenches for each head type.
- C. Provide metal storage cabinet in location designated.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Viking
- B. Reliable
- C. Tyco
- D. Engineer approved equal.

2.02 SPRINKLER HEADS

- A. All heads shall be quick response style with glass bulb or fusible link elements unless noted otherwise. Temperature ratings shall follow the specific area hazard ratings.
- B. Concealed Ceiling Type:
 - 1. Concealed drop-down type with matching removable ceiling cover plate. [Cover plate shall be rated for clean room application.]
 - 2. Head finish: Brass.
 - a. Ceiling Cover Plate Finish: Factory finish, white.
- C. Exposed Area Type:
 - 1. Type: Standard upright type with guard.
 - 2. Finish: Brass
 - 3. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- D. Side Wall Type:
 - 1. Type: Recessed horizontal sidewall type with matching screw on escutcheon plate.
 - 2. Head Finish: Enamel, color white.
 - 3. Escutcheon Plate Finish: Enamel, color white.
 - 4. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- E. Guards: Finish to match sprinkler head, install where heads are subject to damage.

2.03 FLEXIBLE SPRINKLER HEAD CONNECTION ASSEMBLY

- A. Corrugated stainless steel hose with threaded end fittings and adjustable mounting bracket.
- B. UL listed and FM approved for fire protection service.
- C. Flame spread index of 25 or less and smoke developed index of 50 or less per ASTM E84.
- D. Ambient temperature rating: 300°F. Pressure rating: 175 psi.

2.04 PIPING SPECIALTIES

- A. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate electrically operated alarms with pressure retard chamber and variable pressure trim.
- B. Exterior Horn/Strobe: Mount directly above fire department connection. Coordinate electrical requirements with the electrical contractor.
- C. Water Flow Switch: Vane type switch for mounting horizontal or vertical with two contacts rated 10 amp at 115 volt AC. Switch shall have adjustable time delay feature. Include wiring of flow switch to fire alarm panel.
- D. Fire Department Connections (Verify with local fire department):
 - 1. Type: Flush mounted wall type with brass finish.
 - 2. Outlet: One way with thread size to suite fire department hardware, threaded dust cap and chain of matching material and finish. Verify with local fire department threads required.
 - 3. Drain: 3/4 inch automatic drip, connected to drain.
 - 4. Label: "Sprinkler - Fire Department Connection".
 - 5. Provide storz device as required.
- E. Provide tamper switches on all valves.
- F. Air Compressor: Sized, furnished and installed by sprinkler contractor. Coordinate electrical requirements with the electrical contractor.

2.05 AIR COMPRESSOR

- A. Manufacturers:

1. C-Aire
 2. Engineer approved equal.
- B. Compressor: Single unit, electric motor driven, motor, motor starter, safety valves, check valves, air maintenance device incorporating electric pressure switch and un-loader valve.
- C. Sprinkler contractor shall coordinate the electrical requirements for the dry type sprinkler system air compressor and include any necessary changes to the electrical contract documents.

2.06 DUAL CHECK VALVE BACK FLOW PREVENTER

- A. Manufacturers:
1. Watts #757
 2. Conbraco
 3. Febco
 4. Hersey-Beeco
 5. Ames
 6. Engineer approved equal.
- B. ANSI/ASSE 1015; stainless steel body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.
- C. Conform to USC standards.
- D. Assembly shall include two isolation valves USC approved.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install equipment in accordance with manufacturer's instructions.
- B. Install buried shut-off valves in valve box. Provide post indicator with tamper switch. Coordinate location with local fire department
- C. Provide approved double check valve assembly at sprinkler system water source connection. Verify with local fire marshal prior to bid.
- D. Locate fire department connection with sufficient clearance from walls, obstructions or adjacent Siamese connectors to allow full swing of fire department wrench handle.
- E. Locate exterior horn/strobe alarm directly above fire department connection.
- F. Place pipe runs to minimize obstruction to other work.
- G. Place piping in concealed spaces above finished ceilings.
- H. Center heads in two directions in ceiling tile and provide piping offsets as required.
- I. Apply masking tape or paper cover to protect concealed sprinkler heads. Neither cover plates nor sprinkler heads receive field paint finish.
- J. Flush entire piping system of foreign matter.
- K. Hydrostatically test entire system including piping from the post indicator valve to the building. All piping associated with the automatic fire sprinkler system shall be tested by the Division 21 contractor.
- L. Require test be witnessed by authority having jurisdiction.
- M. Adjust concealed head sprinkler plate snug to ceilings.
- N. Install white painted sprinkler heads in all areas except as noted below:
1. Install brass exposed heads in all areas that do not have ceiling systems.
 2. Install concealed sprinkler heads in all areas where noted on the drawings.

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- O. Install all zone flow switches as called for on the drawings or as required. Extend fire department test connections to above floor drain or building exterior as approved by the local inspector.
- P. Coordinate all head locations with mechanical/electrical systems as well as architectural drawings.
- Q. Coordinate all exposed pipe routing and drain valve locations with architect prior to installation.
- R. Mechanical contractor shall furnish and install post indicator valve and tamper switch. Fire alarm and electrical contractors shall furnish and install wiring and conduit to the tamper switch.
- S. Flexible sprinkler head connection hose length shall be selected as appropriate for distance from branch line to sprinkler head. Maintain manufacturer's requirements for minimum radius and maximum quantity of bends. Sprinkler hose and sprinkler head shall be properly clamped and secured. Installation shall satisfy manufacturer installation requirements, UL and FM requirements. Where the requirements differ, the more stringent requirement applies.

3.02 INTERFACE WITH OTHER PRODUCTS

- A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION

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**SECTION 22 0050
BASIC PLUMBING REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Basic Plumbing Requirements specifically applicable to Mechanical Division Specification Sections.
- B. Division 22 Specification requirements also include, by reference, all Division 00 and 01 specification sections. This contractor is responsible to review these specification sections. Requirements of these specification sections are included as a part of this contract.

1.02 WORK BY OWNER

- A. The Following Work or Sub Contracts Will Be Supplied and Furnished By The Owner:
 - 1. Plymovent System
- B. The Following Products Will Be Furnished By The Owner:
 - 1. Washer/Dryer
 - 2. Relocated Shop Equipment
- C. Owner's Responsibility:
 - 1. Arrange for and deliver owner reviewed shop drawings, product data and samples to contractor.
 - 2. Arrange and pay for product delivery to site.
 - 3. On delivery, inspect products jointly with contractor.
 - 4. Submit claims for transportation damage and replace damaged, defective or deficient items.
 - 5. Contractor's Responsibility:
 - a. Review owner reviewed shop drawings, product data and samples.
 - b. Review and unload owner purchased materials at site, inspect for completeness and/or damage jointly with the owner.
 - c. Handle, store, install and finish products. Install electrical wiring and devices.
 - d. Repair and/or replace items damaged after receipt.

1.03 OWNER OCCUPANCY

- A. The owner will occupy the premises during the construction period.
- B. Limit use of site and premises to allow owner occupancy.
- C. Cooperate with the owner to minimize conflict and to facilitate owner's operations.
- D. Schedule the work to accommodate this requirement.

1.04 REGULATORY REQUIREMENTS

- A. This contractor shall give proper authorities all requisite notices relating to work in their charge, obtain official permits, licenses for temporary construction and pay proper fees for it.
- B. This contractor is to be solely answerable for and shall promptly make good all damage, injury or delay to other contractors, to neighboring premises or to persons or property of the public by themselves, by their employees or through any operation under their charge, whether in the contract or extra work.
- C. No attempt has been made to reproduce in these specifications any of the rules or regulations contained in city, state or federal ordinances and codes pertaining to the work covered by these specifications that the contractor be thoroughly familiar with all such ordinances and codes.

- D. The fact that said various rules, regulations and ordinances are not repeated in this specification does not relieve the contractor of the responsibility of making the entire installation in accordance with the requirement of those authorities having jurisdiction.
- E. All work shall comply with the applicable recommendations of:
 - 1. The National Board of Fire Underwriters
 - 2. The American Gas Association
 - 3. The National Fire Protection Association (NFPA)
 - 4. The Occupations Safety and Health Act (OSHA)
 - 5. Current IBC Building Code
 - 6. Current applicable city building codes
- F. Mechanical: Conform to current mechanical code.
- G. Plumbing: Conform to current plumbing code.
- H. Obtain permits and request inspections from authority having jurisdiction.
- I. Safe Drinking Water Act and Senate Bill S.3874: All products must meet the lead-free requirements of the SDWA and NSF/ANSI 372 certification.

1.05 PROJECT/SITE CONDITIONS

- A. Install work in locations shown on the drawings unless prevented by project conditions.
- B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other sections. Obtain permission of owner and architect/engineer before proceeding.
- C. This contractor, before submitting their bid, shall visit the site of the project to familiarize themselves with locations and conditions affecting their work.
- D. It is the intent of this specification that the contractor furnishes all labor and material required completing the installation as outlined in the drawings and specifications. No additions to the contract price shall be allowed due to the failure of this contractor to properly evaluate the effect of existing conditions on the work to be done under this contract.
- E. Whenever renovation or remodeling or relocation of existing equipment is included in the contract, it is imperative that all locations of existing piping, ductwork, equipment, services and grades be noted on the job site before bid is submitted and that all elevations and grades be verified before roughing in new work.
- F. This contractor shall provide holes as necessary for the installation of their work and in accordance with other specification sections in materials other than the structure.

1.06 SEQUENCING AND SCHEDULING

- A. This contractor shall arrange their work in order that it progresses along with the general construction of the building.
- B. This contractor shall be kept informed as to the work of other trades engaged in the project and shall execute their work in such a manner so as not to delay or interfere with progress of other contractors.
- C. Where space for mechanical and electrical lines and piping is limited, it is imperative that all such trades coordinate their work so as to ensure concealment in space provided. Where conflict exists, the engineer shall decide priority of space. If work is not properly coordinated, the engineer may require removal and relocation of work without additional compensation.

1.07 GUARANTEE

- A. This contractor shall guarantee all of the apparatus, materials, equipment furnished and labor installed under this contract for a period of one year after date of final acceptance, unless a longer period is specified.

- B. Neither final certificate of payment nor any provisions in the contract documents nor partial or complete occupancy of premises by owner shall constitute an acceptance for work not done in accordance with contract documents or relieve the contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship.
- C. Should any defects arise as the result of defective workmanship or material within the guarantee period set forth, this contractor shall make the necessary correction at their own expense.

1.08 ENGINEER APPROVED EQUAL PRODUCTS

- A. When the engineer, at the request of the interested parties, including the contractor, supplier and manufacturer approved "engineer approved equal" products for this project, such products are approved on the assumption that they will equal or exceed the performance of the products specified.
- B. If such products do not do so after being installed on this project, this contractor shall replace or modify the particular product as necessary to equal the performance of the products specified at no expense to the owner, architect or engineer.
- C. Request for "engineer approved equal" products shall be received by the architect/engineer prior to the last addendum being issued. Requests for substitutions received after this date will not be considered. Substitution requests shall clearly state which products are being considered for substitution. Substitution requests shall include all pertinent product information needed to evaluate the substitution as an "equal".
- D. Similar products shall be all of the same manufacturers and style. There is no exception to this unless prior approval has been granted from engineer.

1.09 OWNER'S RIGHT OF SALVAGE

- A. Before beginning construction, this contractor shall check and verify with the owner each item of existing equipment that must be removed.
- B. The owner will designate which items of material or equipment not reused that they may wish to keep. This contractor shall then remove these items with care and store in a location designated by the owner for the owner's disposal.
- C. All other items of equipment to be removed and not specified for reuse in new construction or reserved by the owner for their use shall become the property of the contractor and shall be removed from site.

1.10 PROTECTION AND MAINTENANCE

- A. Where necessary to connect to any existing utility service, this contractor shall contact the owner and shall coordinate any building service connection with the owner so that normal operation to the building is disrupted as little as possible.
- B. Any work to be done in existing structures shall be coordinated with the owner and arrangements made so that traffic flow may be maintained and areas finished where possible before other areas are begun.
- C. This contractor shall protect existing equipment in finished areas from dirt, dust and damage as a result of their work.
- D. Coordinate protection requirements with department heads before beginning construction.
- E. Protect any building openings from unauthorized entry. Coordinate with owner where building entry must be controlled.

1.11 DEMOLITION

- A. This contractor shall be responsible for the demolition and removal of all existing mechanical elements within the project area except as follows:

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1. Elements shown on the drawings as "existing to remain and/or to be relocated".
 2. Elements serving adjacent areas.
 3. Elements required for the support of the newly remodeled areas.
 4. All elements to be removed are subject to the Owner's Right of Salvage.
- B. Preserve services to the existing facility. Extend/reroute/reconnect existing systems as required providing for the continued function of these systems.

1.12 CUTTING AND PATCHING

- A. This contractor shall do all cutting and patching necessary for the installation of their work in all existing and new buildings unless otherwise noted.
- B. This contractor shall arrange for openings in the building as required for the installation of equipment furnished under this contract.
- C. Where sewers must be extended or changed, patching with concrete will be done in the building. Patching shall be at both the top and bottom of sleeves where above grade.
- D. In areas where the integrity of new or existing fire separation assembly/wall is compromised by the work, contractor shall be responsible to patch and/or seal openings as necessary to maintain/return fire separation to rating as required by applicable codes.
- E. This contractor shall do all cutting and patching required for their work beyond the remodeled areas unless otherwise noted. All finish work shall include patching to match existing adjacent surfaces. Painting shall be by others.

1.13 CLEANING AND RUBBISH

- A. This contractor shall upon completion of his work, remove all rubbish and debris resulting from their operation and shall remove it from site at their own expense.
- B. In so far as their work is concerned, all equipment shall be cleaned and the premises left in first class condition.
- C. This contractor shall maintain the work area each day to prevent hazardous accumulation of waste from their work.

1.14 SEALING AND PENETRATION

- A. Clearance around the piping passing through fire or smoke rated construction shall be sealed to maintain the rated integrity of the construction (1 hr. 2 hrs. etc.). One and two-hour rated assemblies are to be patched on both sides of the assembly.
- B. This contractor shall verify rating and location of all such construction with the architectural drawings and seal all penetrations.
- C. Manufacturer offering products to comply with the requirements include the following:
1. Dow Corning "Silicone RTV Foam"
 2. 3-M Corporation "Fire Barrier Caulk and Putty"
 3. Thomas & Betts "Flame Safe Fire Stop System"
- D. Installation of these products to be in strict accordance with manufacturer's recommendations and architectural specification sections or equivalent fire stopping architectural specification section.
- E. This contractor shall submit shop drawings showing approved sealing assemblies to be utilized on this project.

1.15 ELECTRICAL CONNECTIONS

- A. This contractor shall turn over all magnetic starters, thermal protective switches and speed changing switches furnished under this contract for all motor driven equipment to the electrical contractor who will install such starters and switches and wire them to their respective motors as a part of the electrical contract.

1.16 UTILITY COMPANY

- A. Any fees by the utility company are to be billed directly to the owner.
- B. The contractor is required to assist the owner in the preparation of all utility company rebate forms that deal with equipment furnished and/or installed as a part of this contractor.

1.17 HAZARDOUS MATERIALS

- A. If the contractor stores any hazardous solvents or other materials on the site, they shall obtain copies of the safety data sheets for the materials and post them on the site. The contractor shall inform the owner and all employed of any potential exposure to this material.
- B. At no time shall any product containing asbestos be incorporated into the work.
 - 1. If asbestos materials are encountered, report to the owner. The owner will be responsible for asbestos removal.

1.18 RECORD DRAWINGS

- A. This contractor shall provide, at the conclusion of the project, one clean, non-torn, neat, and legible "as-built" set of drawings to the owner. These drawings shall show the routing of pipes, ductwork and equipment drawn in at scaled locations. All dimensions indicated shall be referenced to a column line. A set of construction blue prints will be furnished for this work.
- B. All mechanical systems installed shall be shown on the "as-built" drawings.
- C. Refer to respective architectural specification section for additional information.
- D. This contractor shall update these drawings during the project at least every week.

1.19 REVIEW OF MATERIALS

- A. This contractor shall submit to the engineer for review one (1) electronic copy of a brochure giving a complete list of materials and equipment they propose to furnish. The brochure shall contain complete information as to the make of equipment, type, size, capacities, dimensions and illustration. One of the returned copies shall be kept on the job at all times.
- B. Checking of submittal drawings by the engineer does not relieve the contractor of the responsibility for the accuracy of such drawings and for their conformity to drawings and specifications unless the contractor notifies engineer in writing of such deviation at time such drawings are furnished.
- C. All submittals shall have the date marked on them when the contractor receives them from the supplier. Submittals shall be submitted through the contractor and shall not come direct from the supplier to the architect or engineer.
- D. This contractor shall mark the date and sign each set that they have checked each of them in their entirety before submitting to the engineer. Submittals that are not dated and signed by the contractor will not be accepted, or checked and will be marked "resubmit" and sent back to the contractor.

1.20 SCOPE OF WORK

- A. All work shall be performed by well-qualified and licensed mechanics with a thorough knowledge of the various systems involved in this building. It shall be this contractor's responsibility to see that their mechanics are familiar with all the various codes and tests applicable to this work.
- B. All equipment shall be new and of the type as specified by the engineer unless otherwise noted in these specifications or on the drawings to remain and or be reused.
- C. The intent of the drawings and specifications is for complete installation of the systems outlined in the drawings and specifications so that at the conclusion of construction the

system will be turned over to the owner complete and ready for safe and efficient operation.

- D. This contractor shall be required to furnish and install all such items normally included on systems of this type, which, while not mentioned directly herein or on the drawings are obviously essential to the installation and operation of the system and which are normally furnished on quality installation of this type. The drawings and specifications cannot deal individually with the many minute items that may be required by the nature of the systems.
- E. If there is a discrepancy between the drawings and the specifications or within either document, the more stringent requirement shall be estimated unless brought to the engineer's attention and an addendum is issued for clarification.
- F. The Plumbing Contractor shall establish system elevations prior to fabrication and installation. The Plumbing Contractor shall coordinate elevations with other trades. All elevations shall be coordinated with all trades in the field prior to installation. When a conflict between trades arises, the design team shall be notified immediately prior to further installation however priority shall be as follows:
 - 1. Lighting Fixtures
 - 2. Gravity flow piping, including steam and condensate.
 - 3. Electrical bus duct.
 - 4. Sheet metal.
 - 5. Cable trays, including access space.
 - 6. Other piping.
 - 7. Conduits and wireway.

1.21 VERIFICATION OF ELEVATION OF EXISTING LINES

- A. This contractor, before starting any new work, shall verify the elevations of all existing piping to which they must connect under this contract. The contractor shall report any discrepancies between drawing elevations and actual elevations to the engineer before proceeding with the work. Failure of the contractor to do so shall make them liable for the cost of extra work involved.

1.22 WELDING PERMIT

- A. Form titled "Permit For Cutting and Welding With Portable, Gas or Arch Equipment" must be completed and returned to the hospitals designated representative prior to work commencing. The owner upon request will supply this form.

1.23 DAILY HOUSEKEEPING

- A. At the end of each working day, this contractor shall remove all of their debris, rubbish, tools and surplus materials from the project work area. The work area shall be broom clean and left in a neat and orderly condition. The contractor for the removal of debris from the project shall not use the owner's waste disposal facility.
- B. At end of construction, all equipment shall be cleaned and the premises left in first class condition as far as this contractor's work is concerned.

1.24 CLEANING OF MECHANICAL SYSTEMS

- A. The mechanical contractor shall clean and passivate all plumbing systems. Flush systems with water until free from all sand, grit, gravel, oil, etc. Provide Babcock/Wilcox Millipore and biological testing on the flush water. The flush will be considered a success when the water exiting the system contains less than 100 ppb of total suspended solids and less than 100 RLUs.
- B. Where connections are made to existing piping systems, this contractor shall provide isolation valves, threaded tees, etc., as required to facilitate the cleaning and testing of all new piping.

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- C. This contractor shall thoroughly clean all rust, grease, plaster, cement, etc., from all equipment and piping furnished and installed by them as required to leave surfaces suitable for finish painting.
- D. This contractor shall keep all pipes, traps, waste lines, ducts, etc., plugged, drained or otherwise protected during construction. All items of mechanical equipment shall be suitably protected and upon completion of project shall be equal to new condition.

1.25 TRENCHING AND BACKFILLING

- A. Each contractor is responsible for their own individual trenching and backfilling unless otherwise noted in the drawings or addendum.
- B. All underground utilities, piping, etc shall be located exactly before digging. This contractor shall be held responsible for all damages caused by failure to do so.
- C. Any backfill shall be tamped and compacted to prevent future settling. The backfill shall be installed to a smooth and level grade and installed in accordance with local codes.
- D. All excess dirt shall be cleared from the area and disposed of as directed by the owner.
- E. Refer to architectural specification sections for additional requirements.

1.26 ALTERNATES

- A. Refer to General Specification Sections for alternate bid description.

1.27 DIGITAL MEDIA AGREEMENT

- A. Computer Aided Drafting (CAD) documents may be available to the contractor for some uses. Contact the engineer prior to bidding to determine what information is available to be transmitted to the contractor in digital form.
- B. When documents are determined to be available, and as requested by the contractor, they will be transmitted upon the completion and execution of the MODUS digital media agreement.

PART 2 PRODUCTS**2.01 NOT USED****PART 3 EXECUTION****3.01 NOT USED****END OF SECTION**

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**SECTION 22 0090
MINOR PLUMBING DEMOLITION FOR REMODELING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. The requirements of the Contract Forms, the Conditions of the Contract, Division 1 - General Requirements and Specification Section 22 0050 - Basic Mechanical Requirements "General Provisions" apply to this section.

1.02 SCOPE

- A. This contractor shall be responsible for the demolition and removal of all existing mechanical elements within the project area except as follows:
 - 1. Elements shown on the drawings as "existing to remain and/or to be relocated".
 - 2. Elements serving adjacent areas.
 - 3. Elements required for the support of the newly remodeled areas.
- B. Preserve services to the existing facility. Extend, reroute, and reconnect existing systems as required providing for the continued function of these systems.
- C. This contractor shall be responsible for the cutting and capping of all existing gas, water, sewer, and any other utility service.
- D. Demolition shall be accomplished by the proper tools and equipment for the work to be removed. Personnel shall be experienced and qualified in the type of work to be performed.
- E. This contractor shall remove all abandon equipment, piping, ductwork, supports, equipment curbs, and bases associated with the remodeled areas unless noted otherwise.
- F. This contractor is responsible to provide temporary plumbing protection during this project.

1.03 MATERIALS

- A. All elements to be removed are subject to the Owner's Right of Salvage.
- B. All materials removed shall be the property of the removing contractor and shall be removed from the site by them, unless otherwise specified.
- C. The owner may designate and have salvage rights to any material herein demolished by this contractor. The contractor shall coordinate with the owner prior to start of demolition.

1.04 WORK BY OTHERS

- A. Unless specifically noted under other contracts, this mechanical contractor shall assume they will perform all required work. In general, the following will be performed by others:
 - 1. The electrical contractor will disconnect all electrical service and remove conduit back to behind finished surfaces, close and cap ends of conduits.

1.05 EXISTING CONDITIONS

- A. If any piping serving existing fixtures or equipment (that are to remain) are disturbed by operations under this contract, this contractor shall provide pipe and insulation required to re-establish continuity of such piping systems.
- B. This contractor shall arrange for the general contractor to repair and patch all construction with material necessary to match surrounding due to the removal of equipment, piping, and ductwork.
- C. This contractor shall furnish all required labor and material, where required, to extend new work to connect to similar work for extension of existing systems.

- D. Demolition drawings are based on casual field observation and existing record documents. Report discrepancies to the owner before disturbing existing installation. Beginning of demolition means installer accepts existing conditions.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

END OF SECTION

**SECTION 22 0516
EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flexible pipe connectors
- B. Copper piping
- C. Expansion joints
- D. Accessories

1.02 RELATED SECTIONS

- A. Specification Section 22 1116 - Domestic Plumbing Piping

1.03 REFERENCES

- A. MIL-E-17814E - Expansion Joints, Pipe, Slip-Type, Packed
- B. NSF/ANSI 61 - Drinking Water System Components - Health Effects
- C. NSF/ANSI 372 - Drinking Water System Components - Lead Content

1.04 PERFORMANCE REQUIREMENTS

- A. Provide structural work and equipment required controlling the expansion and contraction of piping. Verify that the anchors, guides, and expansion joints provided, adequately protect the system.
- B. Expansion Calculations:
 - 1. Installation Temperature: 50 deg F.
 - 2. Hot Water Heating: 210 deg F.
 - 3. Domestic Hot Water: 140 deg F.
 - 4. Safety Factor: 30 percent

1.05 SUBMITTALS

- A. Product Data:
 - 1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure and total number of wires in braid.
 - 2. Expansion Joints: Indicate temperature and pressure rating, and maximum expansion compensation.
 - 3. Design Data: Indicate selection calculations.
- B. Manufacturer's Installation Instructions: Indicate special procedures, and external controls.

1.06 PROJECT RECORD DOCUMENTS

- A. Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

1.07 OPERATION AND MAINTENANCE DATA

- A. Maintenance Data: Include adjustment instructions.

1.08 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to the site.

- B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.
- C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.10 WARRANTY

- A. Provide a one-year warranty under provisions of Architectural Specification Sections.
- B. Warranty: Include coverage for leak free performance of packed expansion joints.

1.11 REGULATORY REQUIREMENTS

- A. Wetted surfaces of brass and bronze components shall contain <0.25% weighted average lead content (lead free) as defined by NSF/ANSI Standards 61 and 372.

PART 2 PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS

- A. Steel Piping:
 - 1. Manufacturers:
 - a. Metra Flex
 - b. Mason Industries
 - c. Minnesota Flexible
 - d. Engineer approved equal.
- B. Inner Hose: Stainless steel.
- C. Exterior Sleeve: Single braided stainless steel.
- D. Pressure Rating: 125 psig WSP and 450 deg F.
- E. Joint: As specified for pipe joints.
- F. Size: Use pipe sized units.
- G. Maximum Offset: 3/4 inch on each side of installed centerline.
- H. Copper Piping:
 - 1. Manufacturers:
 - a. Mason Industries
 - b. Metra Flex
 - c. Minnesota Flexible
 - d. Engineer approved equal.
 - 2. Inner Hose: Bronze
 - 3. Exterior Sleeve: Braided bronze.
 - 4. Pressure Rating: 125 psig WSP and 450 deg F.
 - 5. Joint: As specified for pipe joints.
 - 6. Size: Use pipe-sized units.
 - 7. Maximum Offset: 3/4 inch on each side of installed centerline.

2.02 EXPANSION JOINTS

- A. Stainless Steel Bellows Internally Guided Type:
 - 1. Manufacturers:
 - a. Hyspan
 - b. Metra Flex
 - c. Engineer approved equal.
 - 2. Bellows Pressure Rating: 150 psig WSP and 850 deg F.
 - 3. Maximum Compression: Six inches.
 - 4. Maximum Extension: Two inches.
 - 5. Joint: Flanged 3500 series with gasket.
 - 6. Size: Use pipe-sized units.

7. Application: Steel piping two inch (2") and over.
8. Use single fixed flanged type #3501 or fixed flanged dual with an anchor base type #3505 as noted on the drawings.

2.03 ACCESSORIES

- A. Pipe Alignment Guides:
 1. Manufacturers:
 - a. Hyspan
 - b. Metra Flex
 - c. Engineer approved equal.
 2. Two piece welded steel with enamel paint, bolted with spider to fit standard pipe, frame with four mounting holes, clearance for minimum two inch (2") thick insulation, minimum three inch (3") travel.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Construct spool pieces to exact size of flexible connection for future insertion.
- C. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Provide line size flexible connectors. Base mounted equipment including pumps use double sphere flex.
- D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.
- E. Rigidly anchor pipe to building structure where necessary. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.
- F. Provide support and equipment required controlling expansion and contraction of piping. Provide loops, pipe offsets and swing joints or expansion joints where required or indicated.
- G. Provide Victaulic piping with minimum one joint per inch pipe diameter instead of flexible connector supported by vibration isolation. Victaulic piping need not be anchored.
- H. Provide expansion loops or expansion joints as indicated on the drawings.
- I. Use external ring expansion joints with pipe guides on steam and condensate piping in the basement and tunnels.

3.02 MANUFACTURER'S FIELD SERVICES

- A. Provide inspection services by flexible pipe manufacturer's representative for final installing and certify installation is in accordance with manufacturer's recommendations and connectors are performing satisfactorily.

END OF SECTION

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**SECTION 22 0519
METERS AND GAUGES FOR PLUMBING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pressure gauges
- B. Pressure gauge tapings
- C. Stem type thermometers
- D. Dial thermometers
- E. Thermometer supports
- F. Test plugs

1.02 REFERENCES

- A. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element
- B. ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle and Venturi
- C. ASTM E1 - Standard Specification for ASTM Thermometers
- D. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers
- E. AWWA C706 - Direct-Reading Remote-Registration Systems for Cold-Water Meters
- F. AWWA C710 - Cold-Water Meters - Displacement Type, Plastic Main Case
- G. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance
- H. UL 393 - Indicating Pressure Gauges for Fire-Protection Service
- I. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service
- J. NSF/ANSI 61 - Drinking Water System Components - Health Effects
- K. NSF/ANSI 372 - Drinking Water System Components - Lead Content

1.03 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents
 - 4. Have options clearly indicated as applicable to each submittal
- B. Construction submittal
 - 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data, indicating use, operating range, total range, accuracy, and location for manufactured components.
- C. Closeout submittal
 - 1. After project substantial completion, provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Operation and Maintenance Information, including calibration instructions
- D. Project Record Documents
 - 1. Final installed locations of all components on a PDF floor plan

1.04 ENVIRONMENTAL REQUIREMENTS

- A. Do not install instruments when areas are under construction, except for required rough in, taps, support, and test plugs.

1.05 REGULATORY REQUIREMENTS

- A. Wetted surfaces of brass and bronze components shall contain <0.25% weighted average lead content (lead free) as defined by NSF/ANSI Standards 61 and 372.

PART 2 PRODUCTS**2.01 PRESSURE GAUGES**

- A. Manufacturers:
 - 1. Ametek/US Gauge Series
 - 2. Terice
 - 3. Miljoco - Weiss
 - 4. Weiss Instruments
 - 5. Dwyer
 - 6. Winters Instruments
 - 7. Engineer approved equal.
- B. Gauge: Install where indicated on the drawings, 4.5 inch dial size pressure gauge, phenolic solid front pressure relieving case, Grade 1A, +/- 1% accuracy with range approximately twice working pressure.
- C. All gauges to be fitted with gauge cocks.

2.02 PRESSURE GAUGE TAPPINGS

- A. Needle Valve: Brass, 1/4 inch NPT for minimum 300 psi.
- B. Ball Valve: Brass 1/4 inch NPT for 250 psi.
- C. Pulsation Damper: Pressure snubber brass with 1/4 inch NPT connections.
- D. Siphon: Steel, Schedule 40, 1/4 inch NPT angle or straight pattern.

2.03 STEM TYPE THERMOMETERS

- A. Manufacturers:
 - 1. Miljoco-Weiss
 - 2. Terice
 - 3. Engineer approved equal.
- B. Thermometer: ASTM E1, blue organic-filled glass tube, lens front tube, cast aluminum case with enamel finish.
- C. Size: Six inch (6") scale where less than six foot (6') above floor, nine inch (9") scale where higher than six inch (6") above floor.
- D. Window: Polyester/glass mixture or acrylic.
- E. Stem: Aluminum, 3/4 inch NPT, 3-1/2 inch
- F. Accuracy: Two percent.
- G. Range: Approximately 20% greater than expected operating temperature.
- H. Calibration: Degree F.
- I. Accessories: Manufacturer's 3-1/2 inch stem lead-free thermowell.

2.04 DIAL THERMOMETERS

- A. Manufacturers:
 - 1. Miljoco-Weiss
 - 2. Terice
 - 3. Winters Instruments.
 - 4. Engineer approved equal.
- B. Thermometer: ASTM E1, stainless steel case, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem and variable angle face.

- C. Size: Three inch diameter dial.
- D. Lens: Clear glass.
- E. Accuracy: One percent.
- F. Range: Approximately 20% greater than expected operating temperature.
- G. Calibration: Degree F.
- H. Accessories: Manufacturer's lead-free thermowell.

2.05 THERMOMETER SUPPORTS

- A. Socket: Brass separable sockets for thermometer stem with or without extensions as required.

2.06 TEST PLUGS

- A. Test Plug: Brass 1/4 inch fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 deg F.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install one pressure gauge per pump with taps before strainers and on suction and discharge of pump; pipe to gauge.
- B. Install gauge taps in piping.
- C. Install pressure gauges with pulsation dampers. Provide ball valve to isolate each gauge. Extend nipples and siphons to allow clearance from insulation.
- D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- E. Coil and conceal excess capillary on remote element instruments.
- F. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degree off vertical.
- G. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- H. Locate test plugs adjacent thermometers and thermometer sockets adjacent to pressure gauges and pressure gauge taps.
- I. Refer to schematics and details on drawings for additional locations.

3.02 SCHEDULES

- A. See details on drawings.

END OF SECTION

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SECTION 22 0529
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe hangers and supports
- B. Accessories
- C. Flashing
- D. Equipment bases
- E. Sleeves

1.02 RELATED SECTIONS

- A. Specification Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment
- B. Specification Section 22 1116 - Domestic Water Piping

1.03 REFERENCES

- A. ASME B31.9 - Building Services Piping
- B. ASTM F708 - Design and Installation of Rigid Pipe Hangers
- C. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer
- D. MSS SP69 - Pipe Hangers and Supports - Selection and Application
- E. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices

1.04 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents
 - 4. Have options clearly indicated as applicable to each submittal
- B. Construction submittal
 - 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data
 - b. Design Data, indicating load capacity of hangers

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable code for support of piping.

PART 2 PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. Anvil International
 - 2. Tolco/Cooper B-Line
 - 3. Engineer approved equal.
- B. Plumbing Piping - Drain, Waste and Vent:
 - 1. Conform to ASME B31.9; ASTM F708
 - 2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inch: Carbon steel adjustable swivel, split ring.
 - 3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

RENOVATION & ADDITION

4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 5. Wall Support for Pipe Sizes to 3 Inches: Cast iron bracket.
 6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
 7. Vertical Support: Steel riser clamp.
 8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 9. Copper Pipe Support: Carbon steel ring, adjustable, and copper plated.
 10. Provide zinc coated hangers and supports for all non air conditioned areas.
 11. Provide stainless steel hangers and supports in locker rooms and other high humidity area.
 12. Provide zinc coated (hot dipped galvanized) hangers and supports for all exterior applications.
- C. Plumbing Piping - Water:
1. Conform to ASME B31.9; ASTM F708.
 2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Carbon steel adjustable swivel, split ring. Anvil International Figure 104.
 3. Hangers for Cold Pipe Sizes 2 Inch and Over: Carbon steel, adjustable, clevis.
 4. Hangers for Hot Pipe Sizes 2 Inch to 4 Inch: Carbon steel, adjustable, clevis.
 5. Hangers for Hot Pipe Sizes 6 Inch and Over: Adjustable steel yoke, cast iron roll, single hanger.
 6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded spacers and hanger rods, cast iron roll.
 8. Wall Support for Pipe Sizes to 3 Inches: Cast iron bracket.
 9. Wall Support for Pipe Sizes 4 Inches Over: Welded steel bracket and wrought steel clamp.
 10. Wall Support for Hot Pipe Sizes 6 Inches and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
 11. Vertical Support: Steel riser clamp.
 12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 13. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 14. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
 15. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
 16. Provide zinc coated hangers and supports for all non air conditioned areas.
 17. Provide stainless steel hangers and supports in locker rooms and other high humidity area.
 18. Provide zinc coated (hot dipped galvanized) hangers and supports for all exterior applications.

2.02 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, threaded one end or continuous threaded.

2.03 FLASHING

- A. Metal Flashing: 26 gauge galvanized steel.
- B. Metal Counter Flashing: 22 gauge galvanized steel.
- C. Flexible Flashing: 47 mil thick sheet butyl compatible with roofing.

RENOVATION & ADDITION

- D. Caps: Steel, 22 gauge minimum; 16 gauge at fire resistant elements.

2.04 EQUIPMENT BASES

- A. Provide housekeeping pads of concrete, minimum four inch (4") thick and extending six inches (6") beyond supported equipment.

2.05 SLEEVES

- A. Sleeves for pipes through wall below grade shall be Schedule 40, two pipe diameters larger than pipe. Seal with Linkseal.
- B. Sleeves for pipes through non-fire rated floors shall be 18 gauge galvanized steel.
- C. Sleeves for pipes through non-fire rated beams, walls, footings, and potentially wet floors shall be Schedule 40 steel pipe or 18 gauge galvanized steel.
- D. Sleeves for pipes through fire rated and fire resistive floors and walls, and fire proofing to be a fire rated sleeve assembly including seals, UL listed.
- E. Stuffing and Firestopping Insulation: Fiberglass type, non-combustible per UL tested assembly type.
- F. Sealant Manufacturers:
 - 1. Dow Corning Silicone RTV Foam.
 - 2. 3-M Fire Barrier Caulk and Putty.
 - 3. Thomas & Betts Flame Safe Fire Stop System.
 - 4. Engineer approved equal.

PART 3 EXECUTION**3.01 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.

3.02 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as scheduled.
- B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- C. Place hangers within 12 inch of each horizontal elbow.
- D. Use hangers with 1-1/2 inch minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub with 5 foot maximum spacing between hangers.
- F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Provide copper plated hangers and supports for copper piping.
- J. Design hangers for pipe movement without disengagement of supported pipe.
- K. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.03 EQUIPMENT BASES AND SUPPORTS

- A. Provide housekeeping pads of concrete, minimum four inch (4") thick and extending six inches (6") beyond all floor supported equipment.
- B. Provide templates, anchor bolts and accessories for mounting and anchoring equipment.

RENOVATION & ADDITION

- C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.04 FLASHING

- A. Provide flexible flashing and metal counter flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting three inch (3") minimum above finished roof surface with 24" x 24" sheet size. Turn flanges back into wall and caulk, metal counterflash, and seal for pipes through outside walls. Refer to architectural drawings and specifications for additional information.
- C. Flash floor drains in floors with topping over finished areas with waterproof membrane ten inch (10") clear on sides with minimum 36" x 36" sheet size. Fasten flashing to drain clamp device.
- D. Seal floor, shower, and mop sink drains watertight to adjacent materials.
- E. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.05 SLEEVES

- A. Set sleeves in position in formwork. Provide reinforcing around sleeves.
- B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- C. Extend sleeves through floor one inch above finished floor level. Caulk sleeves.
- D. Provide sleeves where piping penetrates floor, ceiling or wall fire rated assemblies. Close off space between pipe and adjacent work with fire stopping insulation and caulk.
- E. Provide close fitting metal collar or escutcheon covers at both sides of penetration. Install chrome plated steel escutcheons at finished surfaces and within cabinets.

3.06 SCHEDULES

HANGER ROD PIPE SIZE	MAX. HANGER SPACING FEET	DIAMETER INCHES
1/2 to 1-1/4	6.5	3/8
1-1/2 to 2	10.0	3/8
2-1/2 to 3	10.0	1/2
4 to 6	10.0	5/8
8 to 12	14.0	7/8
14 and Over	20.0	1
PVC (all sizes)	6.0	3/8
C.I. Bell & Spigot (or No-Hub) and at Joints	5.0	5/8

END OF SECTION

SECTION 22 0553
IDENTIFICATION FOR PLUMBING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates
- B. Tags
- C. Pipe markers
- D. Labels
- E. Schedule

1.02 REFERENCES

- A. ASME A13.1 - Scheme for the Identification of Piping Systems
- B. NFPA 99 - Standard for Health Care Facilities

1.03 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents
 - 4. Have options clearly indicated as applicable to each submittal
- B. Construction submittal
 - 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data, including a list of wording, symbols, letter size, and color-coding for mechanical identification.
- C. Closeout submittal
 - 1. After project substantial completion, provide (1) submittal including all products listed in this specification section. Provide the following for each product.

PART 2 PRODUCTS

2.01 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.02 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- C. Information Tags: Clear plastic with printed "Danger, "Caution" or "Warning" and message; size 3-1/4" x 5-5/8" with grommet and self-locking nylon ties.
- D. Tag Chart: Typewritten letter size list in anodized aluminum frame plastic laminated.

2.03 PIPE MARKERS

- A. Color and Lettering: Conform to ASME A13.1.
- B. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6" W x 4" mil thick, manufactured for direct burial service.

RENOVATION & ADDITION

22 0553 - 2

- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings indicating flow direction arrow and identification of fluid being conveyed.

2.04 LABELS

- A. Description: Laminated Mylar, size 1.9" x 0.75" adhesive backed with printed identification.

PART 3 EXECUTION**3.01 PREPARATION**

- A. De-grease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Install identifying devices after completion of coverings and painting.
- B. Install plastic nameplates with corrosive-resistant mechanical fasteners or adhesive.
- C. Install labels with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer. Apply paint primer before applying labels for unfinished canvas covering.
- D. Install tags using corrosion resistant chain. Number tags consecutively by location.
- E. Install underground plastic pipe markers six inch (6") to eight inch (8") below finished grade, directly above buried pipe.
- F. Tag automatic controls, instruments, and relays. Key to control schematic.
- G. Identify piping, concealed or exposed as indicated in schedule below. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 foot on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure and at each obstruction. Identify on both sides of any wall.
- H. Conform to owner's existing identification scheme. Verify with owner prior to bid.

3.03 IDENTIFICATION SCHEDULE

COMPONENT	IDENTIFICATION
Plumbing Equipment (softener, Water Heater, etc.)	Plastic Nameplates
Pumps (1 HP and Above)	Plastic Nameplates
Pumps (Below 1 HP)	Tags
All Valves	Tags
Control Panels and Other Major Control Components	Plastic Nameplates
Automatic Controls, Instruments, Relays	Tags
Piping (Larger than 3/4")	Plastic Tape Pipe Markers
Piping (3/4" and Smaller)	Plastic Tape Pipe Markers

END OF SECTION

**SECTION 22 0719
DOMESTIC PLUMBING INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiberglass
- B. Flexible elastomeric foam insulation
- C. Jackets

1.02 RELATED SECTIONS

- A. Specification Section 22 0553 - Identification for Plumbing Piping and Equipment

1.03 REFERENCES

- A. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
- B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus
- D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement
- E. ASTM C240 - Standard Test Methods of Testing Cellular Glass Insulation Block
- F. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
- G. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
- H. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
- I. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
- J. ASTM C547 - Standard Specification for Mineral Fiber Preformed Pipe Insulation
- K. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation
- L. ASTM C578 - Standard Specification for Preformed, Cellular Polystyrene Thermal Insulation
- M. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation
- N. ASTM C610 - Standard Specification for Expanded Perlite Block and Pipe Thermal Insulation
- O. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
- P. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
- Q. ASTM D1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
- R. ASTM D1667 - Standard Specification for Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers
- S. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
- T. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics

- U. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- V. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials
- W. NAIMA National Insulation Standards
- X. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials
- Y. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials

1.04 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents
 - 4. Have options clearly indicated as applicable to each submittal
- B. Construction submittal
 - 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years experience.

1.06 REGULATORY REQUIREMENTS

- A. Conform to maximum flame spread/smoke developed rating of 25/50 in accordance with ASTM E84.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Accept materials on site, labeled with manufacturer's identification, product density and thickness.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS**2.01 FIBERGLASS**

- A. Manufacturers:
 - 1. Johns Manville Micro-Lok HP
 - 2. Owens Corning
 - 3. Knauff
 - 4. Engineer approved equal.
- B. Insulation: ASTM C547 rigid molded, noncombustible.
- C. "K" Value: ASTM C335, 0.23 at 75 deg F.
- D. Minimum Service Temperature: 0 deg F.
- E. Maximum Service Temperature: 800 deg F.
- F. Maximum Moisture Absorption: <5% by weight.

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- G. Vapor Barrier Jacket: ASTM C1136, white Kraft paper with fiberglass yarn, bonded to aluminized film.
- H. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches.
- I. Secure with self-sealing longitudinal laps and butt strips.
- J. Surface Burning: ASTM E84; Flame Spread-25, Smoke Developed-50
- K. VOC Content: ASTM D5116; 0.15 g/l

2.02 FLEXIBLE ELASTOMERIC FOAM INSULATION

- A. Manufacturers:
 - 1. Armacell: AP Armaflex
 - 2. Aerocel
 - 3. K-flex
 - 4. Engineer approved equal.
- B. Insulation: ASTM C534 flexible cellular elastomeric molded sheet.
- C. "K" Value: ASTM C177 or C518; 0.27 at 75 deg F.
- D. Minimum Service Temperature: -40 deg F.
- E. Maximum Service Temperature: 220 deg F.
- F. Maximum Moisture Absorption: ASTM D1056, 5.0% by weight gain.
- G. Maximum Water Vapor Permeability: ASTM E96; 0.05 perm-in.
- H. Maximum Flame Spread: ASTM E84; 25
- I. Maximum Smoke Developed: ASTM E84; 50
- J. Insulated Pipe Hangers: Refer to the requirements for elastomeric insulation contained in the Inserts and Shields portion of this section.
- K. Elastomeric Foam Adhesive:
 - 1. Manufacturers:
 - a. Armstrong #BLV 520
 - b. Aeroflex
 - c. Halstead/K-Flex
 - d. Engineer approved equal.
 - 2. Air-dried contact adhesive, compatible with insulation.
 - 3. VOC Content: 0 g/L as calculated and reported by SCAQMD 1168.

2.03 JACKETS

- A. PVC Plastic:
 - 1. Manufacturers:
 - a. Johns Manville Zeston
 - b. Owens Corning
 - c. PIC Plastics
 - d. Engineer approved equal.
 - 2. Jacket: ASTM C921, UV resistant, one piece molded type fitting covers and sheet material, off white color.
 - 3. Minimum Service Temperature: 0 deg F.
 - 4. Maximum Service Temperature: 150 deg F.
 - 5. Moisture Vapor Transmission: ASTM E96; 0.002 perm inches.
 - 6. Maximum Flame Spread: ASTM E84; 25
 - 7. Maximum Smoke Developed: ASTM E84; 50
 - 8. Thickness: 20 mil.
 - 9. Connections: Brush on welding adhesive.
- B. Covering Adhesive Mastic:

1. Manufacturers:
 - a. Johns Manville Perma-Weld
 - b. PIC Plastics
 - c. Engineer approved equal.
2. Compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry with foreign material removed.

3.02 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. Insulated Dual Temperature Pipes or Cold Pipes Conveying Fluids Below Ambient Temperature:
 1. Provide vapor barrier jackets, factory applied or field applied.
 2. Insulate fittings, joints and valves with molded insulation of like material and thickness as adjacent pipe.
 3. Provide PVC fitting covers.
 4. Continue insulation through walls (unless in firewall sleeves), pipe hangers and other pipe penetrations.
 5. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
 6. Vapor seal insulation ends every 20 feet.
- D. Insulated Pipes Conveying Fluids Above Ambient Temperature:
 1. Provide standard jackets with vapor barrier, factory applied.
 2. Insulate fittings, joints and valves with insulation of like material and thickness as adjoining pipe.
 3. Provide PVC fitting covers.
 4. Continue insulation through walls (unless in firewall sleeves) pipe hangers and other pipe penetrations.
- E. Inserts and Shields:
 1. Manufacturers:
 - a. Jeff Company/Buckaroo
 - b. Amacell
 - c. Cooper/Eaton
 - d. TPS
 - e. Engineer approved equal.
 2. Shields: Galvanized saddle with flared edges between pipe hangers or pipe hanger rolls and inserts.
 3. Insert Location: Between support shield and piping and under the vapor barrier and finish jacket.
 4. Insert Configuration: Minimum six inch (6") long of same thickness and contour as adjoining insulation; may be factory fabricated.
 5. Insert Type:
 - a. Polystyrene and Fiberglass Insulation: 360 degree polyisocyanurate or phenolic foam cylindrical insert capable of supporting piping system. Pre-fabricated, insulated and jacketed supports are acceptable. Blocks, plugs, or wood material are not acceptable.
 - b. Flexible Elastomeric Foam Insulation: Pre-fabricated 360 degree insulated pipe hanger with polyethylene inserts (Armacell "Armafix" or equal). Match

thickness of pipe insulation. Hanger shall have PVC or aluminum jacket.
Provide friction tape on inside of pipe clamp/support to avoid slipping.

- F. Insulation shall be continuous at all hangers. Hanger shall not be in direct contact with pipe.
- G. Insulation on piping served by heat trace shall be sized large enough to enclose the pipe and the heat wire.

3.03 TOLERANCE

- A. Substituted insulation materials shall provide thermal resistance within 10% at normal conditions, as materials indicate.

3.04 SCHEDULE

A. FIBERGLASS INSULATION

PIPING SYSTEMS	PIPE SIZE	THICKNESS
Domestic Hot Water and Re-Circulation	Less than 1.5"	1"
Domestic Hot Water and Re-Circulation	1.5" and Larger	1.5"
Plumbing Vents within 10' of Exterior	All	1"
Domestic Cold Water	All	1"
Condensate Drain from Cooling Coil	All	1"
Horizontal Storm Downspouts in Building and Roof Drain Sumps	All	1"
Vertical Storm Downspouts in Building when PVC Piping is used	All	1"
Pumped Storm Water	All	1"
PVC Piping Installed in a Return Air Plenums (including Mechanical Rooms)	All	1.5"
All Storm Piping within 10' of Exterior	All	1"

B. FLEXIBLE ELASTOMERIC FOAM INSULATION

PIPING SYSTEMS	PIPE SIZE	THICKNESS
Domestic Hot Water and Re-Circulation	Less than 1.5"	1"
Domestic Hot Water and Re-Circulation	1.5" and Larger	1.5"
Plumbing Vents Within 10' of Exterior	All	3/4"
Domestic Cold Water	All	3/4"

C. PIPE JACKET SCHEDULE

PIPE LOCATION	JACKET MATERIAL
Refrigerant Piping	PVC

END OF SECTION

SECTION 22 1116
DOMESTIC PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sanitary sewer piping (below grade)
- B. Sanitary sewer piping (above grade)
- C. Chemical resistant sewer piping
- D. Water piping (above grade)
- E. Water piping (press fittings)
- F. Ball valves
- G. Butterfly valves
- H. Flow controls
- I. Spring loaded check valves
- J. Water pressure reducing valves
- K. Relief valves
- L. Strainers
- M. Fire stop systems
- N. Calibrated balance valves
- O. Drain ball valves
- P. Pipe accessories
- Q. Post indicator valve
- R. Equipment drains and overflows

1.02 RELATED SECTIONS

- A. Specification Section 22 0553 - Identification for Plumbing Piping and Equipment

1.03 REFERENCES

- A. ASME B31.1 - Power Piping
- B. ASME B31.9 - Building Service Piping
- C. ASME Section 9 - Welding and Brazing Qualifications
- D. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800
- E. ASME B16.3 - Malleable Iron Threaded Fittings
- F. ASME B16.4 - Cast Iron Threaded Fittings Class 125 and 250
- G. ASME B16.18 - Cast Bronze Solder - Joint Pressure Fittings
- H. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings
- I. ASME B16.23 - Cast Copper Alloy Solder-Joint Drainage Fittings – DWV
- J. ASME B16.26 - Cast Bronze Fittings for Flared Copper Tubes
- K. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings - DWV
- L. ASME B16.32 - Cast Copper Alloy Solder-Joint Fittings for Solvent Drainage Systems
- M. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless
- N. ASTM A74 - Cast Iron Soil Pipe and Fittings
- O. ASTM B32 - Solder Metal

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- P. ASTM B43 - Seamless Red Brass Pipe
- Q. ASTM B88 - Seamless Copper Water Tube
- R. ASTM B306 - Copper Drainage Tube (DWV)
- S. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings
- T. ASTM D1785 - Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80 and 120
- U. ASTM D2683 - Socket type Polyethylene fillings for outside diameter controlled polyethylene pipe
- V. AWS A5.8 - Brazing Filler Metal
- W. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids
- X. AWWA C110 - Ductile Iron Gray Iron Fittings three inch (3") through 48 inch for Water and Other Liquids
- Y. AWWA C111 - Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings
- Z. AWWA C651 - Disinfecting Water Mains
- AA. AWWA C900 - Poly Vinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, Four Inch (4") Through Sixty Inch (60")
- BB. AWWA C907 - Injection-Molded Polyvinyl Chloride (PVC) Pressure Fittings, Four Inch (4") Through Twelve Inch (12"), For Water, Wastewater, and Reclaimed Water Service
- CC. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems
- DD. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems
- EE. NSF/ANSI 61 - Drinking Water System Components - Health Effects
- FF. NSF/ANSI 372 - Drinking Water System Components - Lead Content

1.04 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents
 - 4. Have options clearly indicated as applicable to each submittal
- B. Construction submittal
 - 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data
 - b. Schedule of all system types and piping and fitting types provided, clearly indicating which submitted piping and fittings are associated to each system on the project. Schedule shall be at the beginning of piping submittal.
 - c. Installation Instructions
- C. Closeout submittal
 - 1. After project substantial completion, provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Operation and Maintenance Information, including spare parts list and exploded assembly views.
- D. Project Record Documents
 - 1. Indicate final installed locations of all valves on a PDF floor plan

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with the State of Iowa.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.
- D. Welder's Certification: In accordance with ASME Section IX.
- E. Identify pipe with marking including size, material classification, specification, potable water certification and water pressure rating.
- F. Maintain one copy of each document on site.
- G. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or be prior approved by engineer.
- H. All cast iron soil pipe and fittings shall be installed according to the latest edition of the Cast Iron Soil Pipe and Fittings Handbook.

1.06 REGULATORY REQUIREMENTS

- A. Perform work in accordance with local jurisdiction plumbing code.
- B. Conform to applicable code for installation of back flow prevention devices.
- C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of back flow prevention devices.
- D. Wetted surfaces of brass and bronze components shall contain <0.25% weighted average lead content (lead free) as defined by NSF/ANSI Standards 61 and 372.

1.07 DELIVERY, STORAGE AND PROTECTION

- A. Deliver, store, protect and handle products to site.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work and isolating parts of completed system.

1.08 WARRANTY

- A. Provide a 25-year non-prorated warranty on PEX tubing.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS**2.01 SANITARY SEWER PIPING (BELOW GRADE)**

- A. PVC Pipe: Schedule 40
 - 1. ASTM D2665.
 - 2. Fittings: PVC.
 - 3. Joints: ASTM D2855 solvent weld with ASTM D2564 solvent cement.
- B. PVC Pipe:
 - 1. ASTM D2665.
 - 2. Fittings: PVC.
 - 3. Joints: ASTM F477, elastomeric gaskets.

2.02 SANITARY SEWER PIPING (ABOVE GRADE)

- A. Cast Iron Pipe:

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1. CISPI 301 hubless service weight three inch (3") and larger.
 2. Fittings: Cast iron.
 3. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies conforming to CISPI 310.
 4. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or be prior approved by engineer.
- B. PVC Pipe:
1. ASTM D2665.
 2. Fittings: PVC.
 3. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.03 WATER PIPING (ABOVE GRADE)

- A. Copper Tubing:
1. ASTM B88, type #L hard drawn.
 2. Fittings: ASME B16.22, wrought copper and bronze.
 3. Joints: ASTM B32, solder, Grade 95TA.

2.04 WATER PIPING (PRESS FITTINGS)

- A. Manufacturers:
1. Viega (Propress)
 2. Nibco
 3. Engineer approved equal.
- B. Material:
1. Tubing Standard:
 - a. Copper tubing shall conform to ASTM B75 or ASTM B88.
 2. Press Fitting:
 - a. Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117 or ASME B16.51. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed and of the same manufacturer.

2.05 BALL VALVES (UP TO AND INCLUDING 2 INCHES)

- A. Manufacturers:
1. Apollo #77CLF-140/240
 2. Watts #LFB 6080/6081 G2-SS
 3. Nibco #S/T-585-66-LF
 4. Milwaukee #UPBA-400S/450S
 5. Engineer approved equal.
- B. Bronze two piece full port body, stainless steel ball and stem, RPTFE seats and thrust washer, lever handle, solder or threaded ends.

2.06 BUTTERFLY VALVES (OVER 2 INCHES)

- A. Manufacturers:
1. DeZurik
 2. Apollo
 3. Milwaukee
 4. Engineer approved equal.
- B. Body: Cast iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck.
- C. Disc: Stainless steel 316.
- D. Stem: Stainless steel 316.
- E. Operator: Ten position lever handle. All butterfly valves six inch and larger shall have gear operated handles.

2.07 FLOW CONTROLS

- A. Manufacturer:
 - 1. Bell & Gossett
 - 2. Engineer approved equal.
- B. Over 4 Inches: Provide as circuit sensor.
- C. Construction: Bronze body brass ball four inch and larger cast iron flanged body temperature and pressure test plug on inlet blow down/back flush drain.
- D. Calibration: Control flow within 5% of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum pressure up to three inch equals 300 psig, four inch and larger equals 125 psig.
- E. Provide preformed molded insulated cover for each device supplied.
- F. Provide portable readout meter with carrying case and slide rule chart.

2.08 SPRING LOADED CHECK VALVES

- A. Manufacturer:
 - 1. NIBCO
 - 2. Watts
 - 3. Apollo
 - 4. Engineer approved equal.
- B. Check Valves:
 - 1. Up to 2 Inches: Spring loaded, silent water check valve, bronze body and trim. Stainless steel spring, threaded ends, 300 psi W.O.G. Renewable parts.
 - 2. Over 2 Inches: Spring loaded globe type, silent check valve, iron body, bronze trim. Stainless steel spring, 250 psi ASA flanged, 250 psi W.O.G. renewable parts.

2.09 WATER PRESSURE REDUCING VALVES

- A. Manufacturers:
 - 1. Apollo #PR-LF
 - 2. Engineer approved equal.
- B. Up to 2 Inches: Bronze body, stainless steel and thermo-plastic internal parts, fabric-reinforced diaphragm, strainer, threaded and single union ends.
- C. Over 2 Inches: Cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.10 RELIEF VALVES

- A. Manufacturers:
 - 1. Bell & Gossett
 - 2. Taco
 - 3. Conbraco
 - 4. Engineer approved equal.
- B. Pressure Relief: Bronze body, Teflon seat, steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

2.11 STRAINERS

- A. Manufacturers:
 - 1. Metraflex
 - 2. Watts
 - 3. Engineer approved equal.
- B. Size 2 Inches and Under: Screwed brass body for 175 psig working pressure, "Y" pattern with 1/32 inch stainless steel perforated screen.

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- C. Size 2-1/2" to 4 Inches: Flanged iron body for 175 psig working pressure, "Y" pattern with 3/64 inch stainless steel perforated screen.
- D. Size 5" and Larger: Flanged iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

2.12 FIRE STOP SYSTEMS

- A. Manufacturers:
 - 1. 3M
 - 2. Engineer approved equal.
- B. General Purpose Fire Stopping Sealant: Water based, non-slumping, premixed sealant with intumescent properties, rated for 3 hours per ASTM E814 and UL 1479.
- C. General Purpose Vibration Resistant Fire Stopping Sealant: Silicone based, non-slumping, premixed sealant with intumescent properties, vibration and moisture resistant, rated for three hours per ASTM E814 and UL 1479.
- D. DWV Plastic Pipe Systems Fire Stopping Sealant: Silicone based, premixed sealant with intumescent properties, vibration and moisture resistant, rated for three hours per ASTM E814 and UL 1479 with metal collars.

2.13 CALIBRATED BALANCE VALVES

- A. Manufacturers:
 - 1. B & G Circuit Setter Plus
 - 2. Taco
 - 3. Watts
 - 4. Victaulic
 - 5. Engineer approved equal.
- B. Construction:
 - 1. Up to 3 Inches: Lead free brass.
 - 2. Temperature and pressure test plug on inlet and outlet.
 - 3. Memory stop.

2.14 DRAIN BALL VALVES

- A. Manufacturers:
 - 1. Apollo #95-ALF
 - 2. Engineer approved equal.
- B. Bronze two-piece full port body chrome plated ball and stem.
- C. Teflon seats and stuffing, box ring, lever handle, drain cap and seal.

2.15 PIPE ACCESSORIES

- A. Fittings:
 - 1. All fittings shall be of the same material as the pipe. Material joining the fitting to the pipe shall be free from cracks and shall adhere tightly to each joining surface.
 - 2. All fittings shall be capped with a plug of the same material as the pipe, and gasketed with the same gasket material as the pipe joint or be of material approved by the engineer. The plug shall be able to withstand all test pressures involved without leakage.

2.16 EQUIPMENT DRAINS AND OVERFLOWS

- A. Copper Tubing: ASTM B88, type #M, hard drawn.
 - 1. Fittings: ASME B16.18 cast brass.
 - 2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony or tin and silver with melting range 430 deg F to 535 deg F.
- B. PVC Pipe:
 - 1. ASTM D2665, Schedule 40

2. Fittings: Schedule 40 PVC
3. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to conserve building space and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints or connected equipment.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.
- I. Establish elevations of buried sanitary and storm sewer piping outside the building to ensure not less than four feet (4') of cover unless otherwise noted.
- J. Where pipe support members are welded to structural building frame, scrape, brush clean and apply one coat of zinc rich primer to welding.
- K. Provide support for utility meters in accordance with requirements of utility companies.
- L. Prepare exposed, unfinished pipe, fittings, supports and accessories not pre-finished, ready for finish painting.
- M. Install bell and spigot pipe with bell end upstream.
- N. Install valves with stems upright or horizontal, not inverted.
- O. Install water piping to ASME B31.9.
- P. Sleeve pipes passing through partitions, walls and floors.
- Q. Clean out all sanitary sewers to remove any debris prior to substantial completion.
- R. All cast iron soil pipe shall be installed in accordance with cast iron soil pipe institute handbook (latest edition).
- S. All cast iron soil pipe shall be marked with the trademark of the soil pipe institute.
- T. Where static water pressure in the water supply piping exceeds 80 psi, a water pressure reducing valve preceded by a strainer shall be installed and the static pressure reduced to 80 psi or less. Pressure regulator(s) equal to or exceeding 1-1/2 inches shall not require a strainer.

3.03 PRESS FITTING INSTALLATION

- A. The installing contractor shall examine the copper tubing and fittings for defects, sand holes or cracks. There shall be no defects of the tubing or fittings. Any damaged tubing or fittings shall be rejected.

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- B. The installing contractor shall ensure that sealing elements are properly in place and free from damage. For sizes 2-1/2" to 4", installer should ensure that the stainless steel grip ring is in place.
- C. Copper tubing shall be cut with a wheeled tubing cutter or approved copper tubing cutting tool. The tubing shall be cut square to permit proper joining with the fittings.
- D. Remove scale, slag, dirt, and debris from inside and outside of tubing and fittings before assembly. The tubing end shall be wiped clean and dry. The burrs on the tubing shall be reamed with a deburring or reaming tool.
- E. Press connections: Copper and copper alloy press connections shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fittings. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tools approved by the manufacturer.

3.04 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

3.05 ERECTION TOLERANCES

- A. Establish invert elevations, slopes for drainage to 1/8 inch per foot 1% minimum. Maintain gradients.
- B. Slope water piping minimum 0.25% and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. The plumbing contractor is responsible for providing disinfection of domestic water piping system as outlined in this section.
- B. Prior to starting work, verify system is complete, flush and clean.
- C. The plumbing contractor is to make sure sanitary sewer lines are running smooth by running a snake through the sanitary sewer lines prior turning the facility over to the owner.
- D. Ensure pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- E. Inject disinfectant, free chlorine in liquid, powder or tablet form throughout system to obtain 50-to 80 mg/L residual.
- F. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15% of outlets.
- G. Maintain disinfectant in system for 24 hours.
- H. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- I. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- J. Take samples no sooner than 24 hours after flushing from 10% of outlets and from water entry and analyze in accordance with AWWA C651. Submit written report to owner.
- K. Work in this section shall be by a pre-approved water treatment contractor.

3.07 TESTING

- A. This contractor shall, before concealing, test all systems installed under this contract as called for in these specifications and as required by local codes. Tests shall be made in the presence of the engineer, local authorities or their duly authorized representative.

Any defects discovered in testing shall be corrected and the tests repeated until all defects are eliminated.

- B. This contractor shall be held responsible for all damage resulting from defects in the system.
- C. Domestic Water Testing:
 - 1. At conclusion of construction (before any covering up, painting, or finishing) each portion of the piping or of the entire hot and cold water supply system, it shall be initially tested to be proved tight under 50 psi air pressure. All piping shall withstand test pressures without leaking for a period of time not less than 15 minutes.
 - 2. The system shall not be filled with water until immediately prior to disinfection. A hydrostatic test to a water pressure of 1.5x working pressure up to a maximum of 150 psi shall be performed. All piping shall withstand test pressures without leaking for a period of time not less than 4 hours.
- D. Sanitary and Storm Testing:
 - 1. A hydrostatic test to a water pressure of 10 feet shall be performed. All piping shall withstand test pressures without leaking for a period of time not less than 4 hours.
- E. No covering or backfilling of sewer lines shall be done until inspected by the architect or local inspector. Test T's shall be provided on all waste and vent stacks 4'-6" above each floor as required for testing the plumbing system.
- F. After completion of installation, the systems shall be given tests under full operating conditions and pressures and all adjustments shall be made to make the system operative as required. All safety devices shall be tested for correct operation.

3.08 SERVICE CONNECTIONS

- A. Provide new sanitary and storm sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves and sand strainer.
 - 1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Caulk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
 - 2. Install service piping and valves as indicated on the site drawing. Provide thrust blocks at all changes in direction. Verify the local city requirements prior to bid.
 - 3. Install remote meter readout and associated wiring. Coordinate location with utility company.
- C. The plumbing contractor is responsible to contact and inform the utility companies, prior to the utility companies coming to the site, of any underground utilities and piping they may be aware of.
- D. Charges by the utility company to provide services shall not be included in the bid and shall be paid directly by the owner.

3.09 UTILITY CONNECTIONS

- A. Connect to existing utility services as shown on the drawings or as required by site conditions.
- B. Before running any new sewer piping, verify elevations where connections are to be made and layout the new sewer. If grades do not allow connection, verify with architect or engineer what procedures to use.
- C. Use caution on sewer extensions so that grades do not become too shallow.
- D. Coordinate equipment and installation requirements with local utility company.

- E. Verify requirements prior to bid.
- F. Charges by the utility company to provide services shall not be included in the bid and shall be paid directly by the owner.
- G. The plumbing contractor is responsible to contact and inform the utility companies, prior to the utility companies coming to the site, of any underground utilities and piping they may be aware of.

3.10 SCHEDULES

- A. See the drawings.

END OF SECTION

SECTION 22 1119
DOMESTIC PLUMBING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Floor drain
- B. Floor sink
- C. Trench drain
- D. Clean out
- E. Hose bib
- F. Wall hydrant
- G. Recessed valve box
- H. Back water valve
- I. Backflow preventer
- J. Thermostatic mixing valve (TBV)
- K. Water hammer arrestor
- L. Sediment interceptor
- M. Catch basin

1.02 RELATED SECTIONS

- A. Specification Section 22 1116 - Domestic Plumbing Piping
- B. Specification Section 22 3000 - Plumbing Equipment
- C. Specification Section 22 4000 - Plumbing Fixtures

1.03 REFERENCES

- A. ASME A113.6.3; Floor and Trench Drains
- B. ASME A113.6.4 - Roof, Deck and Balcony Drains
- C. ASSE 1010-01; Water Hammer Arrestors
- D. ASSE 1011 - Hose Connection Vacuum Breakers
- E. ASSE 1012 - Backflow Preventers with Immediate Atmospheric Vent
- F. ASSE 1013 - Backflow Preventers, Reduced Pressure Principle
- G. ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types
- H. ASTM C478 - Precast Reinforced Concrete Manhole Sections (ASTM C478M - Precast Reinforced Concrete Manhole Sections)
- I. AWWA C506 - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types
- J. PDI G-101 - Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data
- K. PDI WH-201 - Water Hammer Arrestors
- L. NSF/ANSI 61 - Drinking Water System Components - Health Effects
- M. NSF/ANSI 372 - Drinking Water System Components - Lead Content

1.04 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years

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3. Complete and in sufficient detail to allow ready determination of compliance with contract documents
4. Have options clearly indicated as applicable to each submittal
- B. Construction submittal
 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data: Provide component sizes, rough-in requirements, service sizes and finishes.
 - b. Shop Drawings: Indicate dimensions, weights and placement of openings and holes.
 - c. Certificates: Certify that grease interceptors meet or exceed specified requirements.
 - d. Installation Instructions
- C. Closeout submittal
 1. After project substantial completion, provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Operation and Maintenance Information, including required frequency of treatment for interceptors, spare parts lists, and exploded assembly views.
- D. Project Record Documents
 1. Record actual locations of tagged valves, including valve tag numbers.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.06 DELIVERY, STORAGE AND PROTECTION

- A. Accept specialties on site in original factory packaging. Inspect for damage.

1.07 REGULATORY REQUIREMENTS

- A. Wetted surfaces of brass and bronze components shall contain <0.25% weighted average lead content (lead free) as defined by NSF/ANSI Standards 61 and 372.

PART 2 PRODUCTS**2.01 FLOOR DRAIN**

- A. Manufacturers:
 1. Watts #FD-100
 2. Smith
 3. Zurn
 4. Josam
 5. Wade
 6. Engineer approved equal.
- B. Assembly: ASME A112.6.3.
- C. Epoxy coated cast iron floor drain with anchor flange, reversible clamping collar with primary and secondary weepholes and adjustable strainer.
- D. Accessories:
 1. Provide with membrane clamp on all floor drains installed above slab on grade.
 2. Provide with strainer extension to accommodate thick fills as required.
- E. Strainer: Seven inch (7") diameter nickel bronze strainer.
- F. Contractor shall select outlet type.
- G. Outlet size: As noted on drawings.
- H. Options:
 1. Sediment bucket.

2. Trap primer.

2.02 FLOOR SINK

- A. Manufacturers:
 1. Watts #FS-740
 2. Smith
 3. Zurn
 4. Josam
 5. Wade
 6. Engineer approved equal.
- B. Assembly: ASME A112.6.3
- C. Square 12" x 8" deep sanitary floor sink with white porcelain enamel coated interior, loose set porcelain enamel coated cast iron grate and aluminum dome bottom strainer.
- D. Accessories:
 1. Sediment bucket.
 2. Flange with weep holes.
 3. Flashing clamp on all floor drains installed above slab on grade.
- E. Contractor shall select outlet type.
- F. Outlet Size: As noted on drawings.

2.03 TRENCH DRAIN

- A. Manufacturers:
 1. Zurn Perma-Trench
 2. Ancon
 3. Josam
 4. Wade
 5. Dura Trench
 6. Engineer approved equal.
- B. Perma-Trench Z-882, twelve inches (12") wide with modular ninety-six inch (96") sections with interlocking ends and ductile iron heavy duty slotted grate. Load rating type E.C. Total trench length shall be as indicated on drawings.

2.04 CATCH BASIN (CB-1)

- A. Manufacturers:
 1. Zurn Perma-Trench
 2. Ancon
 3. Josam
 4. Wade
 5. Dura Trench
 6. Engineer approved equal.
- B. Provide a 6" x 24" catch basin with removable basket strainer, ductile iron heavy duty slotted grate and end outlets, and structural composite reinforced body. Load rating type E.

2.05 CLEAN OUT

- A. Manufacturers:
 1. Watts
 2. Smith
 3. Josam
 4. Wade
 5. Sun Drainage
 6. Engineer approved equal.

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- B. Interior Finished Sub or On Grade Floors:
 - 1. Watts #C0-200-R
 - 2. Lacquered cast iron bodies with integral anchor flange, neoprene "O" ring secondary test seal and adjustable combined access cover and plug with gasket seal. Nickel-bronze scoriated cover in service area and round with depressed cover to accept floor finish in finished floor areas.
- C. Interior Finished Membrane Floor Areas:
 - 1. Watts #CO-200-C-R
 - 2. Lacquered cast iron, two piece body with double drainage flange, weep holes, reversible clamping collar and adjustable nickel-bronze strainer round with scoriated cover in service areas and round with depressed cover to accept floor finish in finished floor areas.
- D. Interior Finished Wall Areas:
 - 1. Watts #CO-380-RD
 - 2. Line type with lacquered cast iron body and round epoxy coated gasket cover and round stainless steel access cover secured with machine screw.
- E. Interior Unfinished Accessible Areas: Caulked or threaded type. Provide bolted stack clean out on vertical rainwater leaders and on horizontal accessible pipes.
- F. Exterior Cleanouts:
 - 1. Provide with bronze plug and round heavy duty cast iron or nickel bronze cleanout cover equal to JOSAM 58680-CO.
 - 2. Refer to detail on drawings.
- G. Cleanout size shall be equal to pipe size up to 4 inches.

2.06 HOSE BIB

- A. Manufacturers:
 - 1. Woodford #B24
 - 2. Prier #C155CP.75
 - 3. Engineer approved equal.
- B. Interior: Brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated lockable box and removable key, integral vacuum breaker in conformance with ASSE 1011.

2.07 WALL HYDRANT

- A. Manufacturers:
 - 1. Woodford #B67
 - 2. Prier #C-634BX
 - 3. Engineer approved equal.
- B. Type: ASSE 1019 non-freeze, self draining type with chrome plated lockable recessed box hose thread spout, lockshield and removable key with integral double check backflow preventer.
- C. 3/4" inlet and outlet.
- D. Architect to select finish.

2.08 RECESSED VALVE BOX

- A. Manufacturers:
 - 1. Guy Gray #82032 Galvanized
 - 2. Engineer approved equal.
- B. Washing Machine: Pre-formed rough-in box with 1/2" brass long shank water valves with wheel handles, socket for two inch (2") threaded center drain and slip in finishing cover.

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- C. Provide a stainless steel sleeve extension with wall flange, where recessed valve box is installed in a block wall.

2.09 RECESSED VALVE BOX (DRAIN ONLY)

- A. Manufacturers:
 - 1. Guy Gray #87204 Plastic
 - 2. Engineer approved equal.
- B. Pre-formed rough-in box with socket for two inch (2") center drain and slip in finishing cover.
- C. Provide a stainless steel sleeve extension with wall flange, where recessed valve box is installed in a block wall.

2.10 BACKFLOW PREVENTERS (RPZ, 2" AND SMALLER)

- A. Manufacturers:
 - 1. Watts LF919
 - 2. Zurn/Wilkins
 - 3. Conbraco/Apollo
 - 4. Febco
 - 5. Ames
 - 6. Engineer approved equal.
- B. Description: Reduced Pressure Zone Assembly consisting of two independent check valves with a pressure monitored chamber in between. The chamber contains a differential pressure relief valve that relieves excess pressure preventing back flow or back siphonage.
- C. Construction:
 - 1. Springs: Stainless Steel
 - 2. Discs: Silicone
 - 3. Access ports: Device shall have 3 access ports. One for each check valve and one for the relief valve assembly. A single access port is not acceptable.
- D. Accessories:
 - 1. Strainer: Y-type lead free strainer
 - 2. Air Gap Fitting: Provided by BFP manufacturer
 - 3. Shut off Valves: Quarter turn ball valves
- E. Approvals:
 - 1. ASSE 1013
 - 2. Approved by the Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California.
 - 3. NSF/ANSI 61 (Less than 0.25% Lead by weight)
 - 4. UL Classified (not valves)

2.11 BACKFLOW PREVENTERS (RPZ, 2-1/2" AND LARGER)

- A. Manufacturers:
 - 1. Watts LF957
 - 2. Zurn/Wilkins
 - 3. Conbraco/Apollo
 - 4. Febco
 - 5. Ames
 - 6. Engineer approved equal.
- B. Description: Reduced Pressure Zone Assembly consisting of two independent check valves with a pressure monitored chamber in between. The chamber contains a differential pressure relief valve that relieves excess pressure preventing back flow or back siphonage.

- C. Construction:
 - 1. Housing and Sleeve: 304 Stainless Steel
 - 2. Springs: Stainless Steel
 - 3. Discs: Silicone
- D. Accessories:
 - 1. Strainer: Stainless Steel Y-type lead free strainer
 - 2. Air Gap Fitting: Provided by BFP manufacturer
 - 3. Shut off Valves: Butterfly Valves
- E. Approvals
 - 1. ASSE 1013
 - 2. Approved by the Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California
 - 3. NSF/ANSI 61 (Less than 0.25% Lead by weight)
 - 4. UL Classified (less valves)

2.12 BEVERAGE DISPENSING BACKFLOW PREVENTERS (CARBONATED BEVERAGE, COFFEE MAKERS, ETC)

- A. Manufacturers:
 - 1. Watts SD-3
 - 2. Zurn
 - 3. Apollo
 - 4. Engineer approved equal.
- B. Description: 3/8" dual check device with atmospheric vent port designed to protect the domestic water supply from direct connect beverage machines. Manufacturer provided wye strainer. Vent port opens to atmosphere in the event of second check valve failure.
- C. Construction:
 - 1. Body: 316 Stainless Steel
 - 2. Internal Components: FDA approved rubber
 - 3. Strainer: NSF approved acetal plastic
- D. Accessories
 - 1. Shut-off: Stainless steel ball valve
- E. Approvals:
 - 1. ASSE 1032
 - 2. NSF/ANSI Standards 18 and 61
- F. Installation
 - 1. Able to be installed horizontally or vertically.
 - 2. Install so that strainer and valve are accessible for service and maintenance. Device shall not be installed within a wall cavity.
 - 3. Connect a vent discharge line to the vent outlet and route to nearby floor drain or floor sink.

2.13 THERMOSTATIC BALANCING VALVE [TBV]

- A. Manufacturers
 - 1. ThermOmegaTech Circuit Solver
 - 2. Engineer approved equal
- B. Provide a self contained, self-acting thermostatic balancing valve which automatically and continuously maintains the end of each domestic hot water supply line at the specified water temperature 110°F.
- C. This thermostatic balancing valve shall regulate the flow of recirculated domestic hot water based on entering water temperature regardless of system operating pressure.

1. Even when fully closed, the valve shall bypass a small amount of hot water to maintain dynamic control of the recirculating loop.
 2. Provide valve at each location matching pipe size from 1/2" to 2".
- D. Valve body and all internal components shall be constructed of stainless steel with major components constructed of type 303 stainless steel and NSF-61 certified for use in all domestic water systems.
1. Thermal actuator shall be spring loaded and self cleaning, delivering closing thrust sufficient to keep orifice opening free of scale deposits.
 2. Valve shall be rated to 200 psig maximum working pressure and 300°F maximum working temperature.
- E. Install valve in each domestic hot water return piping branch beyond last hot water device in that branch.
1. Provide line size isolation valves on both sides of TBV. Isolation valves may be installed separately or the TBV with an integrated union assembly may be installed with a union and ball valves.
 2. Provide access panel as required in non-accessible ceilings and walls. Coordinate size and locations with Design Team prior to piping rough-in.

2.14 WATER HAMMER ARRESTOR

- A. Manufacturers:
1. Zurn "Shoktro" #Z-1700
 2. Sioux Chief
 3. Engineer approved equal.
- B. ANSI A112.26.1; sized in accordance with PDI WH-201 pre-charged suitable for operation in temperature range of -100 deg F to 250 deg F and maximum 350 psig working pressure.

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordinate cutting and forming of roof and floor construction to receive drains to require invert elevations.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend clean out to finished floor or wall surface. Lubricate threaded clean out plugs with mixture of graphite and linseed oil. Ensure clearance at clean out for rodding of drainage system. Coordinate all cleanout locations with the architect.
- C. Furnish and install cleanouts at locations as specified and required by local plumbing code.
- D. Pipe relief from backflow preventer to nearest drain.
- E. Encase exterior clean out in concrete flush with grade.
- F. Install floor clean out at elevation to accommodate finished floor.
- G. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior hose bibbs and exterior wall hydrants.
- H. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures. Fabricate same size as supply pipe or 3/4 inch minimum and minimum 18 inch long.
- I. Install air gap fittings at all equipment drains when equipment is connected to domestic water.

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- J. Provide floor drains installed above slab on-grade with membrane clamp and 3' x 3' vinyl membrane. Membrane is by the mechanical contractor.
- K. Coordinate all floor drain locations with associated equipment.
- L. Coordinate all wall mounted device locations with architect.
- M. Install back water valves where required by local codes. Coordinate with architect.
- N. Route grease interceptor vent pipes back through building to roof. Coordinate routing with engineer and architect prior to rough-in.

END OF SECTION

**SECTION 22 3000
PLUMBING EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Residential sealed combustion water heater
- B. Diaphragm type expansion tank
- C. Water softener
- D. In-line circulator pump

1.02 REFERENCES

- A. ASHRAE 90A - Energy Conservation in New Building Design
- B. ASME Section 8D - Pressure Vessels
- C. NFPA 30 - Flammable and Combustible Liquids Code
- D. NFPA 54 - National Fuel Gas Code
- E. NFPA 58 - Storage and Handling of Liquefied Petroleum Gases
- F. NFPA 70 - National Electrical Code
- G. UL 1453 - Electric Booster and Commercial Storage Tank Water Heaters
- H. UL 174 - Household Electric Storage Tank Water Heaters
- I. ASME Section VIII D - Pressure Vessels; Boiler and Pressure Vessel Codes
- J. ANSI/NEMA 250 - Enclosure for Electrical Equipment (1000 volts max.)
- K. NSF/ANSI 61 - Drinking Water System Components - Health Effects
- L. NSF/ANSI 372 - Drinking Water System Components - Lead Content

1.03 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents
 - 4. Have options clearly indicated as applicable to each submittal
- B. Construction submittal
 - 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data:
 - 2. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
 - 3. Indicate pump type, capacity, power requirements, and affected adjacent construction.
 - 4. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
 - 5. Provide electrical characteristics and connection requirements.
 - a. Shop Drawings:
 - 6. Indicate heat exchanger dimensions, size of tapings, and performance data.
 - 7. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tapings, and drains.
- C. Closeout submittal
 - 1. After project substantial completion, provide (1) submittal including all products listed in this specification section. Provide the following for each product.

- a. Operation and Maintenance Information, including inspection data, replacement part numbers, availability, service depot location, and telephone number.
- b. Warranty: Submit manufacturer warranty and ensure forms have been completed in owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.
- B. Provide pumps with manufacturer's name, model number, and rating/capacity identified.
- C. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:
 1. American Gas Association (AGA)
 2. National Sanitation Foundation (NSF)
 3. American Society of Mechanical Engineers (ASME)
 4. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI)
 5. National Electrical Manufacturers' Association (NEMA)
 6. Underwriters Laboratories (UL)
- D. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation; operate within 25% of midpoint of published maximum efficiency curve.

1.05 REGULATORY REQUIREMENTS

- A. Conform to NSF, NBBPVI, and ANSI/NFPA requirements for water heaters.
- B. Conform to ASME Section VIII for manufacture of pressure vessels for heat exchangers.
- C. Conform to ASME Section VIII for tanks.
- D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.
- E. Wetted surfaces of brass and bronze components shall contain <0.25% weighted average lead content (lead free) as defined by NSF/ANSI Standards 61 and 372.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver, store, protect and handle products to site under provisions of Architectural Specification Sections.
- B. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.07 WARRANTY

- A. Provide five-year manufacturer warranty under provisions of Architectural Specification Sections.
- B. Provide a two-year manufacturer warranty for the variable speed packaged pumping system.
- C. Provide five-year manufacturer warranty for water-to-water heat exchanger.

1.08 MAINTENANCE PRODUCTS

- A. Supply two 50 lb. bags of water softener salt.
- B. Provide each water softener system full of salt at substantial completion.

1.09 EXTRA MATERIALS

- A. Provide two pump seals.

2.01 RESIDENTIAL SEALED COMBUSTION WATER HEATER

- A. Manufacturers:
 - 1. A.O. Smith
 - 2. Lochinvar
 - 3. Bock
 - 4. Ruud
 - 5. PVI
 - 6. Laars
 - 7. Engineer approved equal.
- B. Provide PVC sealed combustion and power vent pipe complete with intake and flue terminations.
- C. Type: Automatic, natural gas-fired, vertical storage with sealed combustion and direct power vent.
- D. Performance: See schedule.
- E. Tank: Glass lined welded steel, four inch (4") diameter inspection port, thermally insulated with minimum two inch (2") fiberglass and encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.
- F. Accessories: Brass water connections and dip tube, drain valve, magnesium anode, and ASME temperature and pressure relief valve. Pipe relief valve to above floor drain.
- G. Approval: By AGA as automatic storage water heater and automatic circulating tank water heater for operation at 140 deg F.
- H. Controls: Automatic water thermostat with temperature range adjustable from 120-180 deg F gas pressure regulator, multi-ribbon or tubular burner, 100% safety shut off and thermocoupler, flue baffle, draft hood, and intermittent pilot operation with automatic flue power vent fan.
- I. Provide PVC flue to stack or through roof, per manufacturer's installation recommendations. Provide roof flashing, counter flashing and rain cap.
- J. Provide one diaphragm expansion tank rated for a maximum allowable working pressure equal to or greater than the pressure of the water heater. Refer to drawings for expansion tank sizing.

2.02 DIAPHRAGM-TYPE EXPANSION TANK

- A. Manufacturer:
 - 1. Amtrol
 - 2. Taco
 - 3. American Wheatley
 - 4. Engineer approved equal.
- B. Construction: Welded steel, tested and stamped in accordance with Section VIII of ASME Code; supplied with National Board Form U-1, rated for a maximum allowable working pressure equal to or greater than the pressure of the water heater with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
- C. Accessories: Pressure gauge and air-charging fitting, tank drain; pre-charge to 55 psig. Verify pressure with system water pressure.
- D. Size: When water heater size is over 120 gallons or 200 MBH provide ASME rated tank. Refer to water heater size for requirements.

2.03 IN-LINE CIRCULATOR PUMP

- A. Manufacturer:
 - 1. B & G

2. Taco
 3. Grundfos
 4. Engineer approved equal.
- B. Performance: See schedule on drawings.
- C. Casing: Bronze, rated for 125 psig working pressure.
- D. Impeller: Bronze or stainless steel.
- E. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
- F. Seal: Carbon rotating against a stationary ceramic seat.
- G. Drive: Flexible coupling.

PART 3 EXECUTION

3.01 WATER HEATER INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Coordinate with plumbing piping and related fuel piping, gas venting, and, electrical work to achieve operating system.
- C. Install unit with clearance for removal without disturbing other installed equipment or piping.
- D. Pipe relief valves and drains to nearest floor drain.
- E. Install flue vent system as indicated on the drawings and in accordance to manufacturer's recommendations.
- F. Install power vent as per manufacturer's instructions.
- G. Insulate vent and intake piping in attic space in accordance to manufacturer's recommendations.
- H. Provide FEMA 361 compliant 1/4" thick steel elbow fastened to the FEMA 361 enclosure where penetrating the FEMA 361 enclosure. Fastening method shall be similar to the duct fastening method. See safe room duct work penetration for additional information.

3.02 PUMP INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Ensure shaft length allows sump pumps to be located 25 inch minimum below lowest invert into sump pit and six inch (6") minimum clearance from bottom of sump pit.
- C. Provide air cock and drain connection on horizontal pump casings.
- D. Provide line sized isolating valve and strainer on suction.
- E. Provide line sized soft-seated check valve and balancing valve on discharge.
- F. Decrease from line size with long radius reducing elbows or reducers.
- G. Support piping adjacent to pump such that no weight is carried on pump casings.
- H. Provide supports under elbows on pump suction and discharge line sizes four inch (4") and over.
- I. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation and operate within 25% of midpoint of published maximum efficiency curve.
- J. Install aquastat on hot water recirculation pipe to control water heater re-circulation pump.
- K. Low voltage wiring shall be by the mechanical contractor unless otherwise noted.

3.03 CONNECTION TO EQUIPMENT FURNISHED BY OWNER

- A. This contractor shall furnish all connections to equipment furnished by the owner.
- B. This equipment shall include, but not be limited to the following:
 - 1. Air compressor.
 - 2. Washer.
 - 3. Hose dryer.
 - 4. Shop vac.
 - 5. Power washer.
 - 6. Station for filling breathing tanks.
 - 7. Stove range hood.

END OF SECTION

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**SECTION 22 4000
PLUMBING FIXTURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. See plumbing fixture schedules on drawings.

1.02 RELATED SECTIONS

- A. Specification Section 22 0529 - Hangers and Supports for Plumbing Piping and Equipment
- B. Specification Section 22 1116 - Domestic Plumbing Piping
- C. Specification Section 22 1119 - Domestic Plumbing Specialties
- D. Specification Section 22 3000 - Plumbing Equipment

1.03 REFERENCES

- A. ANSI Z358.1 - Emergency Eye Wash and Shower Equipment
- B. ARI 1010 - Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers
- C. ASME A112.6.1 - Supports for Off-the-Floor Plumbing Fixtures for Public Use
- D. ASME A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings
- E. ASME A112.19.1 - Enameled Cast Iron Plumbing Fixtures
- F. ASME A112.19.2 - Vitreous China Plumbing Fixtures
- G. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use)
- H. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures
- I. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks, and Urinals
- J. NFPA 70 - National Electrical Code
- K. NSF/ANSI 61 - Drinking Water System Components - Health Effects
- L. NSF/ANSI 372 - Drinking Water System Components - Lead Content

1.04 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents
 - 4. Have options clearly indicated as applicable to each submittal
- B. Construction submittal
 - 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data: Provide catalog illustrations of fixtures, sizes, rough in dimensions, utility sizes, trim, and finish.
 - b. Installation Instructions
 - c. Note: The mechanical contractor shall coordinate all fixtures with general construction and cabinetry prior to submitting for review.
- C. Closeout submittal
 - 1. After project substantial completion, provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Operation and Maintenance Information, including fixture trim exploded view and replacement parts lists.

- b. Warranty: Submit manufacturer warranty and ensure forms have been completed in owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.06 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.
- B. Wetted surfaces of brass and bronze components shall contain <0.25% weighted average lead content (lead free) as defined by NSF/ANSI Standards 61 and 372.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Accept fixtures on site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.08 WARRANTY

- A. Provide manufacturer's standard warranty for electric water cooler.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.
- C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks prior to ordering.
- D. Confirm that hole drillings are of appropriate number and spacing for trim.

3.02 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install each fixture with trap, easily removable for servicing and cleaning.
- C. Provide chrome plated rigid or flexible supplies to fixtures with 1/4 turn loose key stops, reducers and escutcheons.
- D. Install components level and plumb.
- E. Install and secure fixtures in place with wall supports or wall carriers and bolts.
- F. Seal fixtures to wall and floor surfaces with sealant. Color to match fixture.
- G. Solidly attach water closets to floor with lag screws. Flashing is not intended to hold fixture in place.
- H. Coordinate electronic faucet under deck mixing valve and control module installation such that they do not extend passed the footprint of the plumbing fixture. The control module shall be installed over the low voltage junction box.
- I. Water Coolers: Confirm mounting height of all water coolers with the architect and AHJ prior to rough in.

- J. Water Coolers: Power source shall be a GFCI circuit breaker. A GFCI receptacle is not permissible. Coordinate with the electrical contractor.

3.04 INTERFACE WITH OTHER PRODUCTS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise or overflow.

3.06 CLEANING

- A. Clean plumbing fixtures and equipment.

END OF SECTION

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**SECTION 23 0050
BASIC HVAC REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Basic HVAC Requirements specifically applicable to Mechanical Division Specification Sections.
- B. Division 23 Specification requirements also include, by reference, all Division 00 and 01 specification sections. This contractor is responsible to review these specification sections. Requirements of these specification sections are included as a part of this contract.

1.02 WORK BY OWNER

- A. The Following Work or Sub Contracts Will Be Supplied and Furnished By The Owner:
 - 1. Plyovent Exhaust System
- B. The Following Products Will Be Furnished By The Owner:
 - 1. Washer/Dryer
 - 2. Air Compressor
- C. Owner's Responsibility:
 - 1. Arrange for and deliver owner reviewed shop drawings, product data and samples to contractor.
 - 2. Arrange and pay for product delivery to site.
 - 3. On delivery, inspect products jointly with contractor.
 - 4. Submit claims for transportation damage and replace damaged, defective or deficient items.
- D. Contractor's Responsibility:
 - 1. Review owner reviewed shop drawings, product data and samples.
 - 2. Review and unload owner purchased materials at site, inspect for completeness and/or damage jointly with the owner.
 - 3. Handle, store, install and finish products. Install electrical wiring and devices.
 - 4. Repair and/or replace items damaged after receipt.

1.03 OWNER OCCUPANCY

- A. The owner will occupy the premises during the construction period.
- B. Limit use of site and premises to allow owner occupancy.
- C. Cooperate with the owner to minimize conflict and to facilitate owner's operations.
- D. Schedule the work to accommodate this requirement.

1.04 REGULATORY REQUIREMENTS

- A. This contractor shall give proper authorities all requisite notices relating to work in their charge, obtain official permits, licenses for temporary construction and pay proper fees for it.
- B. This contractor is to be solely answerable for and shall promptly make good all damage, injury or delay to other contractors, to neighboring premises or to persons or property of the public by themselves, by their employees or through any operation under their charge, whether in the contract or extra work.
- C. No attempt has been made to reproduce in these specifications any of the rules or regulations contained in city, state or federal ordinances and codes pertaining to the work covered by these specifications that the contractor be thoroughly familiar with all such ordinances and codes.

- D. The fact that said various rules, regulations and ordinances are not repeated in this specification does not relieve the contractor of the responsibility of making the entire installation in accordance with the requirement of those authorities having jurisdiction.
- E. All work shall comply with the applicable recommendations of:
 - 1. The National Board of Fire Underwriters
 - 2. American Gas Association
 - 3. The National Fire Protection Association (NFPA)
 - 4. The Occupations Safety and Health Act (OSHA)
 - 5. Current IBC Building Code
 - 6. Current applicable city building codes.
 - 7. Current International Energy Conservation Code
- F. Mechanical: Conform to current mechanical code.
- G. Plumbing: Conform to current plumbing code.
- H. Obtain permits and request inspections from authority having jurisdiction.

1.05 PROJECT/SITE CONDITIONS

- A. Install work in locations shown on the drawings unless prevented by project conditions.
- B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other sections. Obtain permission of owner and architect/engineer before proceeding.
- C. This contractor, before submitting their bid, shall visit their the site of the project to familiarize themselves with locations and conditions affecting their work.
- D. It is the intent of this specification that the contractor furnishes all labor and material required completing the installation as outlined in the drawings and specifications. No additions to the contract price shall be allowed due to the failure of this contractor to properly evaluate the effect of existing conditions on the work to be done under this contract.
- E. Whenever renovation or remodeling or relocation of existing equipment is included in the contract, it is imperative that all locations of existing piping, ductwork, equipment, services and grades be noted on the job site before bid is submitted and that all elevations and grades be verified before roughing in new work.
- F. This contractor shall provide holes as necessary for the installation of their work and in accordance with other specification sections in materials other than the structure.

1.06 SEQUENCING AND SCHEDULING

- A. This contractor shall arrange their work in order that it progresses along with the general construction of the building.
- B. This contractor shall be kept informed as to the work of other trades engaged in the project and shall execute their work in such a manner so as not to delay or interfere with progress of other contractors.
- C. Where space for mechanical and electrical lines and piping is limited, it is imperative that all such trades coordinate their work so as to ensure concealment in space provided. Where conflict exists, the engineer shall decide priority of space. If work is not properly coordinated, the engineer may require removal and relocation of work without additional compensation.

1.07 GUARANTEE

- A. This contractor shall guarantee all of the apparatus, materials, equipment furnished and labor installed under this contract for a period of one year after date of final acceptance, unless a longer period is specified.
- B. Neither final certificate of payment, nor any provisions in the contract documents, nor partial or complete occupancy of premises by owner, nor substantial completion of the

work, shall constitute an acceptance for work not done in accordance with contract documents, or relieve the contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship.

- C. Should any defects arise as the result of defective workmanship or material within the guarantee period set forth, this contractor shall make the necessary correction at their own expense.

1.08 ENGINEER APPROVED EQUAL PRODUCTS

- A. When the engineer, at the request of the interested parties, including the contractor, supplier and manufacturer approved "engineer approved equal" products for this project, such products are approved on the assumption that they will equal or exceed the performance of the products specified.
- B. If such products do not do so after being installed on this project, this contractor shall replace or modify the particular product as necessary to equal the performance of the products specified at no expense to the owner, architect or engineer.
- C. Request for "engineer approved equal" products shall be received by the architect/engineer prior to the last addendum being issued. Requests for substitutions received after this date will not be considered. Substitution requests shall clearly state which products are being considered for substitution. Substitution requests shall include all pertinent product information needed to evaluate the substitution as an "equal".
- D. Similar products shall be all of the same manufacturers and style. There is no exception to this unless prior approval has been granted from engineer.

1.09 OWNER'S RIGHT OF SALVAGE

- A. Before beginning construction, this contractor shall check and verify with the owner each item of existing equipment that must be removed.
- B. The owner will designate which items of material or equipment not reused that they may wish to keep. The contractor shall then remove these items with care and store in a location designated by the owner for the owner's disposal.
- C. All other items of equipment to be removed and not specified for reuse in new construction or reserved by the owner for their use shall become the property of the contractor and shall be removed from site.

1.10 PROTECTION AND MAINTENANCE

- A. Where necessary to connect to any existing utility service, this contractor shall contact the owner and shall coordinate any building service connection with the owner so that normal operation to the building is disrupted as little as possible.
- B. Any work to be done in existing structures shall be coordinated with the owner and arrangements made so that traffic flow may be maintained and areas finished where possible before other areas are begun.
- C. This contractor shall protect existing equipment in finished areas from dirt, dust and damage as a result of their work.
- D. Coordinate protection requirements with department heads before beginning construction.
- E. Protect any building openings from unauthorized entry. Coordinate with owner where building entry must be controlled.

1.11 DEMOLITION

- A. This contractor shall be responsible for the demolition and removal of all existing mechanical elements within the project area except as follows:
 - 1. Elements shown on the drawings as "existing to remain and/or to be relocated".
 - 2. Elements serving adjacent areas.

3. Elements required for the support of the newly remodeled areas.
 4. All elements to be removed are subject to the Owner's Right of Salvage.
- B. Preserve services to the existing facility. Extend/reroute/reconnect existing systems as required providing for the continued function of these systems.

1.12 TEMPORARY HEATING, VENTILATION, AND AIR CONDITIONING

- A. Coordinate provisions for temporary heating, cooling, ventilation, and/or dehumidification with the general contractor as required in Division 01.
- B. Coordinate construction heating gas requirements with the utility company prior to the start of construction.
- C. If permanent HVAC units are to be operated prior to substantial completion, the mechanical contractor shall take steps as necessary to prevent construction dust and debris from entering the HVAC system and preserve the manufacturer's warranty.
1. The general and mechanical contractors shall receive permission from the owner and architect in writing prior to operating the permanent HVAC equipment.
 2. At no point shall the permanent HVAC system be in operation during installation and sanding of drywall, grinding of floors, or any other construction activities that generate dust.
 - a. For existing systems that serve other spaces that must remain active, close off all supply, return, and exhaust grilles/diffusers in the space where dust-generating activities are taking place. Only after the dust has settled and the affected space has been cleaned can grilles/diffusers be put back into service.
 3. Install temporary filters with a minimum efficiency of MERV 8 on all return and/or exhaust grilles and louvers. Check filters on a weekly basis and replace as necessary and as directed by the owner or architect.
 4. Install temporary MERV 8 filters in all air handling equipment. Check filters on a weekly basis and replace as necessary and as directed by the owner or architect. Replace all filters after substantial completion with new filters.
 5. This contractor shall be responsible for any maintenance or warranty items prior to substantial completion if equipment is used for temporary space conditioning.
- D. On projects with multiple phases, the contractor shall assist the owner in developing a filter checking and replacement schedule for areas that are complete. This shall be done to prevent construction dust from plugging filters in finished areas. The owner shall be responsible for providing replacement filters.

1.13 CUTTING AND PATCHING

- A. This contractor shall do all cutting and patching necessary for the installation of their work in all existing and new buildings unless otherwise noted.
- B. This contractor shall arrange for openings in the building as required for the installation of equipment furnished under this contract. Where ductwork and piping must be extended or changed, patching with concrete will be done in the building. Patching shall be at both the top and bottom of sleeves where above grade.
- C. In areas where the integrity of new or existing fire separation assembly/wall is compromised by the work, contractor shall be responsible to patch and/or seal openings as necessary to maintain/return fire separation to rating as required by applicable codes.
- D. This contractor shall do all cutting and patching required for their work beyond the remodeled areas unless otherwise noted. All finish work shall include patching to match existing adjacent surfaces. Painting shall be by others.

1.14 CLEANING AND RUBBISH

- A. The Contractor shall coordinate with the owner special cleaning requirements and acceptable routes for transporting building material and rubbish removal.
- B. Hazardous waste shall not be disposed of using sanitary or storm drains, or owner's waste disposal facilities. Hazardous waste shall be removed from the project site and lawfully disposed of at the contractor's expense.
- C. Daily Requirements:
 - 1. The Contractor shall maintain the work area each day to prevent hazardous accumulation of waste from the work site.
 - 2. At the end of each working day, the contractor shall remove all their debris, rubbish, tools, and surplus materials from the project work area. The work area shall appear broom clean and left in a neat and orderly condition. The contractor for the removal of debris from the project shall not use the owner's waste disposal facilities.
 - 3. All equipment shall be cleaned, and the premises left in excellent condition, free of dirt, debris, dust, grease, oil.
- D. End of Project Requirements:
 - 1. The Contractor, upon completion of their work, shall remove all rubbish and debris resulting from their operation and shall remove it from site at their own expense.
 - 2. At the end of construction, all equipment and surfaces in the project area shall be left in a clean condition. Except for protective coatings and surfaces, equipment shall be cleaned to be free of dirt, dust, debris, oil, and grease. Fingerprints, palmprints, and footprints shall be cleaned from visible surfaces. Equipment rooms shall have surfaces cleaned, floor shall be broom clean and mopped. Spaces that are to be occupied within the work area shall have all surfaces dusted, cleaned, and disinfected. Floors shall be vacuum cleaned and mopped (if applicable).

1.15 SEALING AND PENETRATION

- A. Clearance around the piping passing through fire or smoke rated construction shall be sealed to maintain the rated integrity of the construction (1 hr. 2 hrs. etc.). One and two-hour rated assemblies are to be patched on both sides of the assembly.
- B. This contractor shall verify rating and location of all such construction with the architectural drawings and seal all penetrations.
- C. Manufacturer offering products to comply with the requirements include the following:
 - 1. Dow Corning "Silicone RTV Foam"
 - 2. 3-M Corporation "Fire Barrier Caulk and Putty"
 - 3. Thomas & Betts "Flame Safe Fire Stop System"
- D. Installation of these products to be in strict accordance with manufacturer's recommendations and architectural specification sections or equivalent fire stopping architectural specification section.
- E. This contractor shall submit shop drawings showing approved sealing assemblies to be utilized on this project.

1.16 ELECTRICAL CONNECTIONS

- A. This contractor shall turn over all magnetic starters, thermal protective switches, and speed changing switches furnished under this contract for all motor driven equipment to the electrical contractor who will install such starters and switches and wire them to their respective motors as a part of the electrical contract.

1.17 UTILITY COMPANY

- A. Any fees by the utility company are to be billed directly to the owner.

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- B. The contractor is required to assist the owner in the preparation of all utility company rebate forms that deal with equipment furnished and/or installed as a part of this contractor.

1.18 HAZARDOUS MATERIALS

- A. If the contractor stores any hazardous solvents or other materials on the site, they shall obtain copies of the safety data sheets for the materials and post them on the site. The contractor shall inform the owner and all employed of any potential exposure to this material.
- B. At no time shall any product containing asbestos be incorporated into the work.
 - 1. If asbestos materials are encountered, report to the owner. The owner will be responsible for asbestos removal.

1.19 RECORD DRAWINGS

- A. This contractor shall provide at the conclusion of the project one clean, non-torn, neat, and legible "as-built" set of drawings to the owner. These drawings shall show the routing of pipes, ductwork and equipment drawn in at scaled locations. All dimensions indicated shall be referenced to a column line. A set of construction blue prints will be furnished for this work.
- B. All mechanical systems installed shall be shown on the "as-built" drawings. This includes all addendum items and change orders.
- C. Refer to respective architectural specification section for additional information.
- D. This contractor shall update these drawings during the project at least every week.

1.20 REVIEW OF MATERIALS

- A. This contractor shall submit to the engineer for review one (1) electronic copy giving a complete list of materials and equipment they propose to furnish. The brochure shall contain complete information as to the make of equipment, type, size, capacities, dimensions and illustration. One of these returned copies shall be kept on the job at all times.
- B. Checking of submittal drawings by the engineer does not relieve the contractor of the responsibility for the accuracy of such drawings and for their conformity to drawings and specifications unless the contractor notifies engineer in writing of such deviation at time such drawings are furnished.
- C. All submittals shall have the date marked on them when the contractor receives them from the supplier. Submittals shall be submitted through the contractor and shall not come direct from the supplier to the architect or engineer.
- D. This contractor shall mark the date and sign each set that they have checked each of them in their entirety before submitting to the engineer. Submittals that are not dated and signed by the contractor will not be accepted, or checked and will be marked "resubmit" and sent back to the contractor.

1.21 TEST OF SYSTEMS

- A. This contractor, before concealed, shall test all systems installed under this contract as called for in these specifications and as required by local codes. Tests shall be made in the presence of the engineer, local authorities or their duly authorized representative. Any defects discovered in testing shall be corrected and the tests repeated until all defects are eliminated.
- B. This contractor shall be held responsible for all damage resulting from defects in the system.
- C. At the conclusion of construction (before any covering up, painting or finishing) each element of the system shall be thoroughly tested against leakage, with appropriate

pressure tests, as outlined herein and in appropriate sections of the specifications. All testing shall be hydrostatic unless permission is granted otherwise.

1. Water: 100 psi maintained 8 hours
 2. Under Floor Pipes: 200 psi maintained 8 hours
- D. Fluid lines other than the above 1.5 times operating with a minimum pressure of 60 psig.
- E. After completion of installation, the systems shall be given tests under full operating conditions and pressures and all adjustments shall be made to make the system operative as required. All safety devices shall be tested for correct operation.

1.22 SCOPE OF WORK

- A. All work shall be performed by well-qualified and licensed mechanics with a thorough knowledge of the various systems involved in this building. It shall be this contractor's responsibility to see that their mechanics are familiar with all the various codes and tests applicable to this work.
- B. All equipment shall be new and of the type as specified by the engineer unless otherwise noted in these specifications or on the drawings to remain and or be reused.
- C. The intent of the drawings and specifications is for complete installation of the systems outlined in the drawings and specifications so that at the conclusion of construction the system will be turned over to the owner complete and ready for safe and efficient operation.
- D. This contractor shall be required to furnish and install all such items normally included on systems of this type, which, while not mentioned directly herein or on the drawings are obviously essential to the installation and operation of the system and which are normally furnished on quality installation of this type. The drawings and specifications cannot deal individually with the many minute items that may be required by the nature of the systems.
- E. If there is a discrepancy between the drawings and the specifications or within either document, the more stringent requirement shall be estimated unless brought to the engineer's attention and an addendum is issued for clarification.
- F. The HVAC Contractor shall establish system elevations prior to fabrication and installation. The HVAC Contractor shall coordinate elevations with other trades. All elevations shall be coordinated with all trades in the field prior to installation. When a conflict between trades arises, the design team shall be notified immediately prior to further installation however priority shall be as follows:
1. Lighting Fixtures
 2. Gravity flow piping, including steam and condensate
 3. Electrical bus duct
 4. Sheet metal
 5. Cable trays, including access space
 6. Other piping
 7. Conduits and wireway

1.23 VERIFICATION OF ELEVATION OF EXISTING LINES

- A. This contractor shall before starting any new work, verify the elevations of all existing piping to which they must connect under this contract. The contractor shall report any discrepancies between drawing elevations and actual elevations to the engineer before proceeding with the work. Failure of the contractor to do so shall make them liable for the cost of extra work involved.

1.24 WELDING PERMIT

- A. Form titled "Permit For Cutting and Welding With Portable, Gas or Arch Equipment" must be completed and returned to the hospitals designated representative prior to work commencing. The owner, upon request, will supply this form.

1.25 CLEANING OF MECHANICAL SYSTEMS

- A. The mechanical contractor shall clean and passivate all piping systems. Flush hydronic systems with water until free from all sand, grit, gravel, oil, etc. Provide Babcock/Wilcox Millipore and biological testing on the flush water. The flush will be considered a success when the water exiting the system contains less than 100 ppb of total suspended solids and less than 100 RLUs.
- B. Where connections are made to existing piping systems, this contractor shall provide isolation valves, threaded tees, etc., as required to facilitate the cleaning and testing of all new piping.
- C. This contractor shall thoroughly clean all rust, grease, plaster, cement, etc., from all equipment, ductwork and piping furnished and installed by them as required to leave surfaces suitable for finish painting.
- D. This contractor shall keep all pipes, ducts, etc., plugged, drained or otherwise protected during construction. All items of mechanical equipment shall be suitably protected and upon completion of project shall be equal to new condition.

1.26 TRENCHING AND BACKFILLING

- A. Each contractor is responsible for their own individual trenching and backfilling unless otherwise noted in the drawings or addendum.
- B. Prior to digging, all underground utilities, piping, etc shall be exactly located and marked. This contractor shall be held responsible for all damages caused by failure to do so.
- C. Any backfill shall be tamped and compacted to prevent future settling. The backfill shall be installed to a smooth and level grade and installed in accordance with local codes.
- D. All excess dirt shall be cleared from the area and disposed of as directed by the owner.
- E. Refer to architectural specification sections for additional requirements.

1.27 ALTERNATES

- A. Refer to General Specification Sections for alternate bid description.

1.28 DIGITAL MEDIA AGREEMENT

- A. Computer Aided Drafting (CAD) documents may be available to the contractor for some uses. Contact the engineer prior to bidding to determine what information is available to be transmitted to the contractor in digital form.
- B. When documents are determined to be available, and as requested by the contractor, they will be transmitted upon the completion and execution of the MODUS digital media agreement.

1.29 SECURE NETWORKABLE DEVICES

- A. Update network devices to the most current software/firmware.
- B. Change default password of all networkable devices.
 - 1. Passwords shall have at least eight characters.
 - 2. Include uppercase and lowercase letters, numerals, and special characters
- C. Supply MAC address and serial number of all networkable devices.
- D. Work with the Owner's IT department to align to existing IT standards.

- E. Provide to the owner a printed and/or electronic spreadsheet log of all network information including, IP addresses, MAC addresses, logins and password information during system training.

1.30 SYSTEM CONFIGURATION AND PROGRAMMING FILES

- A. Supply system configuration and programming files where export is available.
- B. Supply uncompiled programming for systems applicable.
- C. All configuration and programming shall be property of the owner at conclusion of the project.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

END OF SECTION

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**SECTION 23 0090
MINOR HVAC DEMOLITION FOR REMODELING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. The requirements of the Contract Forms, the Conditions of the Contract, Division 1 - General Requirements and Specification Section 23 0050 - Basic Mechanical Requirements "General Provisions" apply to this section.

1.02 SCOPE

- A. This contractor shall be responsible for the demolition and removal of all existing mechanical elements within the project area except as follows:
 - 1. Elements shown on the drawings as "existing to remain and/or to be relocated".
 - 2. Elements serving adjacent areas.
 - 3. Elements required for the support of the newly remodeled areas.
- B. Preserve services to the existing facility. Extend, reroute, and reconnect existing systems as required providing for the continued function of these systems.
- C. This contractor shall be responsible for the cutting and capping of all existing gas, water, sewer, and any other utility service.
- D. Demolition shall be accomplished by the proper tools and equipment for the work to be removed. Personnel shall be experienced and qualified in the type of work to be performed.
- E. This contractor shall remove all abandon equipment, piping, ductwork, supports, equipment curbs, and bases associated with the remodeled areas unless noted otherwise.
- F. This contractor is responsible to provide temporary HVAC protection during this project.

1.03 MATERIALS

- A. All elements to be removed are subject to the Owner's Right of Salvage.
- B. All materials removed shall be the property of the removing contractor and shall be removed from the site by them, unless otherwise specified.
- C. The owner may designate and have salvage rights to any material herein demolished by this contractor. The contractor shall coordinate with the owner prior to start of demolition.

1.04 WORK BY OTHERS

- A. Unless specifically noted under other contracts, this mechanical contractor shall assume they will perform all required work. In general, the following will be performed by others:
 - 1. The electrical contractor will disconnect all electrical service and remove conduit back to behind finished surfaces, close and cap ends of conduits.

1.05 EXISTING CONDITIONS

- A. If any piping serving existing fixtures or equipment (that are to remain) are disturbed by operations under this contract, this contractor shall provide pipe and insulation required to re-establish continuity of such piping systems.
- B. This contractor shall arrange for the general contractor to repair and patch all construction with material necessary to match surrounding due to the removal of equipment, piping, and ductwork.
- C. This contractor shall furnish all required labor and material, where required, to extend new work to connect to similar work for extension of existing systems.

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- D. Demolition drawings are based on casual field observation and existing record documents. Report discrepancies to the owner before disturbing existing installation. Beginning of demolition means installer accepts existing conditions.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 23 0529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe hangers and supports
- B. Accessories
- C. Flashing
- D. Equipment bases
- E. Sleeves

1.02 RELATED SECTIONS

- A. Specification Section 23 2300 - Refrigerant Piping

1.03 REFERENCES

- A. ASME B31.1 - Power Piping
- B. ASME B31.2 - Fuel Gas Piping
- C. ASME B31.5 - Refrigeration Piping
- D. ASME B31.9 - Building Services Piping
- E. ASTM F708 - Design and Installation of Rigid Pipe Hangers
- F. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer
- G. MSS SP69 - Pipe Hangers and Supports - Selection and Application
- H. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices

1.04 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents
 - 4. Have options clearly indicated as applicable to each submittal
- B. Construction submittal
 - 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data
 - b. Design Data, indicating load capacity of hangers

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable code for support of piping.

PART 2 PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. Anvil International
 - 2. Cooper B-Line/Tolco
 - 3. Engineer approved equal.
- B. Refrigerant Piping:
 - 1. Conform to ASME B31.5 or ASTM F708.
 - 2. Hangers for Pipe Sizes 1/2" to 1-1/2": Carbon steel adjustable swivel, split ring.
 - 3. Hangers for Pipe Sizes 2" and Over: Carbon steel, adjustable, clevis.

4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3": Cast iron hook.
6. Wall Support for Pipe Sizes 4" and Over: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
10. Exterior Support: Zinc coated Unistrut.
11. Provide stainless steel hangers and supports in locker rooms and other high humidity areas.
12. Provide zinc coated (hot dipped galvanized) hangers and supports for all exterior applications.

2.02 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, threaded one end or continuous threaded.

2.03 FLASHING

- A. Metal Flashing: 26 gauge galvanized steel.
- B. Metal Counter Flashing: 22 gauge galvanized steel.
- C. Flexible Flashing: 47 mil thick sheet butyl compatible with roofing.
- D. Caps: Steel, 22 gauge minimum; 16 gauge at fire resistant elements.
- E. Provide curbs for mechanical roof installations 14 inch minimum high above roofing surface unless noted otherwise. Flash and counterflash with sheet metal and seal watertight. Attach counter flashing mechanical equipment and lap base flashing on roof curbs. Flatten and solder joints.

2.04 EQUIPMENT BASES

- A. Provide housekeeping pads of concrete, minimum four inch (4") thick and extending six inch (6") beyond supported equipment.

2.05 SLEEVES

- A. Sleeves for pipes through wall below grade shall be Schedule 40, two pipe diameters larger than pipe. Seal with Linkseal.
- B. Sleeves for pipes through non-fire rated floors shall be 18 gauge galvanized steel.
- C. Sleeves for pipes through non-fire rated beams, walls, footings, and potentially wet floors shall be Schedule 40 steel pipe or 18 gauge galvanized steel.
- D. Sleeves for pipes through fire rated and fire resistive floors and walls, and fire proofing to be a fire rated sleeve assembly including seals, UL listed.
- E. Stuffing and Firestopping Insulation: Fiberglass type, non-combustible per UL tested assembly type.
- F. Sealant Manufacturers:
 1. Dow Corning Silicone RTV Foam.
 2. 3-M Fire Barrier Caulk and Putty.
 3. Thomas & Betts Flame Safe Fire Stop System.
 4. Engineer approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.02 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as scheduled.
- B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- C. Place hangers within 12 inches of each horizontal elbow.
- D. Use hangers with 1-1/2 inch minimum vertical adjustment.
- E. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- F. Support riser piping independently of connected horizontal piping.
- G. Provide copper plated hangers and supports for copper piping.
- H. Design hangers for pipe movement without disengagement of supported pipe.
- I. Support vertical piping every ten feet or on every floor.

3.03 EQUIPMENT BASES AND SUPPORTS

- A. Provide housekeeping pads of concrete, minimum four inch (4") thick and extending six inches (6") beyond all floor supported equipment.
- B. Provide templates, anchor bolts and accessories for mounting and anchoring equipment.
- C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.04 FLASHING

- A. Provide flexible flashing and metal counter flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
- B. Provide curbs for mechanical roof installations 14 inches minimum high above roofing surface unless noted otherwise. Flash and counterflash with sheet metal; seal watertight. Attach counter flashing mechanical equipment and lap base flashing on roof curbs. Flatten and solder joints.

3.05 SLEEVES

- A. Set sleeves in position in formwork. Provide reinforcing around sleeves.
- B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- C. Extend sleeves through floor one inch (1") above finished floor level. Caulk sleeves.
- D. Provide sleeves where piping penetrates floor, ceiling or wall fire rated assemblies. Close off space between pipe and adjacent work with fire stopping insulation and caulk.
- E. Provide close fitting metal collar or escutcheon covers at both sides of penetration. Install chrome plated steel escutcheons at finished surfaces and within cabinets.

3.06 SCHEDULES

HANGER ROD	MAX. HANGER SPACING	DIAMETER
Pipe Size	Feet	Inches
1/2 to 1-1/4	6.5	3/8
1-1/2 to 2	10.0	3/8
2-1/2 to 3	10.0	1/2
4 to 6	10.0	5/8
8 to 12	14.0	7/8

14 and Over	20.0	1

END OF SECTION

SECTION 23 0548
VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vibration isolation

1.02 PERFORMANCE REQUIREMENTS

- A. Provide vibration isolation on motor driven equipment over 0.5 hp plus connected piping and ductwork.
- B. Provide minimum static deflection of isolators for equipment as specified or scheduled on drawings.
- C. Upper floor locations shall be considered critical unless otherwise indicated.

1.03 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents
 - 4. Have options clearly indicated as applicable to each submittal
- B. Construction submittal
 - 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data, including schedule of isolator type with location and load
 - b. Shop Drawings
 - c. Installation Instructions
 - d. Manufacturer's Certificate verifying proper installation
- C. Closeout submittal
 - 1. After project substantial completion, provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Operation and Maintenance Information
- D. Project Record Documents
 - 1. Indicate final installed locations of all hangers on a PDF floor plan

PART 2 PRODUCTS

2.01 VIBRATION ISOLATORS

- A. Manufacturers:
 - 1. Kinetics
 - 2. Mason Industries
 - 3. Amber Booth
 - 4. Engineer approved equal.
- B. Neoprene Pad:
 - 1. Rubber or neoprene waffle pads.
 - a. 50 durometer.
 - b. Maximum loading 45 psi.
 - c. Height of ribs shall not exceed 0.7 times width.
 - d. Configuration: Single layer 3/4 inch thick waffle pads.
 - e. Assembly: Mason Industries type #SW
- C. Rubber Mount or Hanger:
 - 1. Molded rubber designed for 0.5 inch deflection with threaded insert.

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2. Isolator: Mason Industries type #HD.
- D. Fiberglass Pads: Neoprene jacketed pre-compressed molded fiberglass.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install isolation for motor driven equipment.
- C. Provide a neoprene pad below all base mounted pumps unless otherwise noted.
- D. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- E. Support piping connections to isolated equipment resiliently as follows:
 1. Diameter Up to 4 Inches: First three points of support.
 2. Diameter 5 Inch to 8 Inches: First four points of support.
 3. Diameter 10 Inch and Over: First six points of support.
 4. Select three hangers closest to vibration source for minimum one inch (1") static deflection or static deflection of isolated equipment. Select remaining isolators for minimum one inch (1") static deflection or 1/2 static deflection of isolated equipment.
- F. Connect wiring to isolated equipment with flexible hanging loop.
- G. Housekeeping pads are by the mechanical contractor unless otherwise noted.
- H. Pad mounted equipment deflection shall be .25 inches.
- I. Refer to schedule and details on the drawings.

3.02 MANUFACTURER'S FIELD SERVICES

- A. Inspect isolated equipment after installation and submit report. Include static deflections.

END OF SECTION

**SECTION 23 0553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates
- B. Tags
- C. Pipe markers
- D. Labels

1.02 REFERENCES

- A. ASME A13.1 - Scheme for the Identification of Piping Systems

1.03 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents
 - 4. Have options clearly indicated as applicable to each submittal
- B. Construction submittal
 - 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data, including a list of wording, symbols, letter size, and color-coding for mechanical identification.
- C. Closeout submittal
 - 1. After project substantial completion, provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Project Record Documents
 - 1. Record actual locations of tagged valves, including valve tag numbers.

PART 2 PRODUCTS

2.01 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.02 TAGS

- A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- B. Information Tags: Clear plastic with printed "Danger, "Caution" or "Warning" and message; size 3-1/4" x 5-5/8" with grommet and self-locking nylon ties.

2.03 PIPE MARKERS

- A. Color and Lettering: Conform to ASME A13.1.
- B. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6" W x by 4" mil thick, manufactured for direct burial service.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings indicating flow direction arrow and identification of fluid being conveyed.

2.04 LABELS

- A. Description: Laminated vinyl, size 0.75" adhesive backed with printed identification.

PART 3 EXECUTION

3.01 PREPARATION

- A. De-grease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces for stencil painting.

3.02 INSTALLATION

- A. Install identifying devices after completion of coverings and painting.
- B. Install plastic nameplates with corrosive-resistant mechanical fasteners or adhesive.
- C. Install labels with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer. Apply paint primer before applying labels for unfinished canvas covering.
- D. Install tags using corrosion resistant chain. Number tags consecutively by location.
- E. Install underground plastic pipe markers six inch (6") to eight inch (8") below finished grade, directly above buried pipe.
- F. Tag automatic controls, instruments, and relays. Key to control schematic.
- G. Identify piping, concealed or exposed as indicated in schedule below. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure and at each obstruction. Identify on both sides of any wall.
- H. Identify ductwork with air handling unit identification number and area served. Locate identification at air handling unit at each side of penetration of structure or enclosure and at each obstruction.
- I. Conform to owner's existing identification scheme. Verify with owner prior to bid.

END OF SECTION

**SECTION 23 0593
TESTING, ADJUSTING, AND BALANCING FOR HVAC**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems
- B. Measurement of final operating condition of HVAC systems

1.02 REFERENCES

- A. AABC - National Standards for Total System Balance
- B. ADC - Test Code for Grilles, Registers, and Diffusers
- C. ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems
- D. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems
- E. SMACNA - HVAC Systems Testing, Adjusting, and Balancing

1.03 SUBMITTALS

- A. Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- B. Submit name of adjusting and balancing agency for approval within 30 days after award of Contract.
- C. Construction submittal (prior to commencing work)
 - 1. Provide (1) submittal including the following.
 - a. Report forms or outlines indicating adjusting, balancing, and equipment data required.
 - b. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty.
- D. Closeout report submittal
 - 1. Provide report with set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
 - 2. Provide final copies to Architect/Engineer and for inclusion in operating and maintenance manuals.
 - 3. Indicate test report data on AABC National Standards for Total System Balance Forms.
- E. Project Record Documents
 - 1. Record actual locations of flow measuring stations, balancing valve, and rough setting.

1.04 QUALITY ASSURANCE

- A. Perform total system balance in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance.
- B. Maintain one copy of each document on site.

1.05 QUALIFICATIONS

- A. Independent agency specializing in the testing, adjusting and balancing of systems specified in this section with minimum three years experience.
- B. Perform work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor.

1.06 PRE-BALANCING CONFERENCE

- A. Convene a conference one week prior to commencing work of this section.

1.07 SEQUENCING

- A. Sequence work to commence after completion of systems and schedule completion of work before substantial completion of project.

1.08 SCHEDULING

- A. Schedule and provide assistance in final adjustment and test of life safety system with the fire authority.

PART 2 PRODUCTS**2.01 NOT USED****PART 3 EXECUTION****3.01 EXAMINATION**

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Fire, smoke, and volume dampers are in place and open.
 - 8. Air coil fins are cleaned and combed.
 - 9. Access doors are closed and duct end caps are in place.
 - 10. Air outlets are installed and connected.
 - 11. Duct system leakage is minimized.
 - 12. Pumps are rotating correctly.
 - 13. Proper strainer baskets are clean and in place.
 - 14. Service and balance valves are open.
- B. Submit field reports. Report defects and deficiencies noted during performance of services that prevents system balance.
- C. Beginning of work means acceptance of existing conditions.

3.02 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to the engineer to facilitate spot checks during testing.
- B. Provide additional balancing devices as required.

3.03 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within +/- 5% of design for supply systems and +/- 10% of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within + 10% and - 5% of design to space. Adjust outlets and inlets in space to within +/- 10% of design.

3.04 ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

- E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the owner.
- F. Check and adjust systems approximately six months after final acceptance and submit report.

3.05 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to extent those adjustments do not create objectionable air motion or sound levels. Affect the volume control by duct internal devices (such as dampers and splitters).
- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50% loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.
- L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inch positive static pressure.
- M. Adjust airflow switches for proper operation for water applications.

3.06 SCHEDULES

- A. Equipment Requiring Testing, Adjusting, and Balancing:
 - 1. Plumbing Pumps
 - 2. Energy Recovery Units
 - 3. Forced Air Furnaces
 - 4. Packaged Roof Top Heating/Cooling Units
 - 5. Unit Air Conditioners
 - 6. Air Coils
 - 7. Terminal Heat Transfer Units
 - 8. Air Handling Units
 - 9. Fans
 - 10. Air Filters
 - 11. Air Inlets and Outlets
- B. Report Forms
 - 1. Title Page:

- a. Name of Testing, Adjusting, and Balancing Agency
- b. Address of Testing, Adjusting, and Balancing Agency
- c. Telephone number of Testing, Adjusting, and Balancing Agency
- d. Project Name
- e. Project Location
- f. Project Architect
- g. Project Engineer
- h. Project Contractor
- i. Project Altitude
- j. Report Date
2. Summary Comments:
 - a. Design versus final performance.
 - b. Notable characteristics of system.
 - c. Description of systems operation sequence.
 - d. Summary of out door and exhaust flows to indicate amount of building pressurization.
 - e. Nomenclature used throughout report.
 - f. Test conditions.
3. Instrument List:
 - a. Instrument
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Range
 - f. Calibration date
4. Electric Motors:
 - a. Manufacturer
 - b. Model/Frame
 - c. HP/BHP
 - d. Phase, voltage, amperage; nameplate, actual, no load
 - e. RPM
 - f. Service factor
 - g. Starter size, rating, heater elements
 - h. Sheave Make/Size/Bore
5. V-Belt Drive:
 - a. Identification/location
 - b. Required driven RPM
 - c. Driven sheave, diameter and RPM
 - d. Belt, size and quantity
 - e. Motor sheave diameter and RPM
 - f. Center to center distance, maximum, minimum, and actual
6. Pump Data:
 - a. Identification/number
 - b. Manufacturer
 - c. Size/Model
 - d. Impeller
 - e. Service
 - f. Design flow rate, pressure drop, BHP
 - g. Actual flow rate, pressure drop, BHP
 - h. Discharge pressure
 - i. Suction pressure
 - j. Total operating head pressure
 - k. Shut off, discharge and suction pressures

- l. Shut off, total head pressure
7. Air Cooled Condenser:
 - a. Identification/number
 - b. Location
 - c. Manufacturer
 - d. Model number
 - e. Serial number
 - f. Entering DB air temperature, design and actual
 - g. Leaving DB air temperature, design and actual
 - h. Number of compressors
8. Cooling Coil Data:
 - a. Identification/Number
 - b. Location
 - c. Service
 - d. Manufacturer
 - e. Air flow, design and actual
 - f. Entering air DB temperature, design and actual
 - g. Entering air WB temperature, design and actual
 - h. Leaving air DB temperature, design and actual
 - i. Leaving air WB temperature, design and actual
 - j. Water flow, design and actual
 - k. Water pressure drop, design and actual
 - l. Entering water temperature, design and actual
 - m. Leaving water temperature, design and actual
 - n. Saturated suction temperature, design and actual
 - o. Air pressure drop, design and actual
9. Heating Coil Data:
 - a. Identification/Number
 - b. Location
 - c. Service
 - d. Manufacturer
 - e. Air flow, design and actual
 - f. Water flow, design and actual
 - g. Water pressure drop, design and actual
 - h. Entering water temperature, design and actual
 - i. Leaving water temperature, design and actual
 - j. Entering air temperature, design and actual
 - k. Leaving air temperature, design and actual
 - l. Air pressure drop, design and actual
10. Electric Heat Duct:
 - a. Manufacturer
 - b. Identification/Number
 - c. Location
 - d. Model number
 - e. Design kW
 - f. Number of stages
 - g. Phase, voltage, amperage
 - h. Test voltage (each phase)
 - i. Test amperage (each phase)
 - j. Air flow, specified and actual
 - k. Temperature rise, design and actual
11. Air Moving Equipment:
 - a. Location

- b. Manufacturer
- c. Model number
- d. Serial number
- e. Arrangement/Class/Discharge
- f. Air flow, specified and actual
- g. Return air flow, specified and actual
- h. Outside air flow, specified and actual
- i. Total static pressure (total external), specified and actual
- j. Inlet pressure
- k. Discharge pressure
- l. Sheave make/size/bore
- m. Number of belts/make/size
- n. Fan RPM
- 12. Return Air/Outside Air Data:
 - a. Identification/Location
 - b. Design air flow
 - c. Actual air flow
 - d. Design return air flow
 - e. Actual return air flow
 - f. Design outside air flow
 - g. Actual outside air flow
 - h. Return air temperature
 - i. Outside air temperature
 - j. Required mixed air temperature
 - k. Actual mixed air temperature
 - l. Design outside/return air ratio
 - m. Actual outside/return air ratio
- 13. Exhaust Fan Data:
 - a. Location
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Air flow, specified and actual
 - f. Total static pressure (total external), specified and actual
 - g. Inlet pressure
 - h. Discharge pressure
 - i. Sheave Make/Size/Bore
 - j. Number of Belts/Make/Size
 - k. Fan RPM
- 14. Duct Traverse:
 - a. System zone/branch
 - b. Duct size
 - c. Area
 - d. Design velocity
 - e. Design air flow
 - f. Test velocity
 - g. Test air flow
 - h. Duct static pressure
 - i. Air temperature
 - j. Air correction factor
- 15. Terminal Unit Data:
 - a. Manufacturer
 - b. Type, constant, variable, single, dual duct

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- c. Identification/number
 - d. Location
 - e. Model number
 - f. Size
 - g. Minimum static pressure
 - h. Minimum design air flow
 - i. Maximum design air flow
 - j. Maximum actual air flow
 - k. Inlet static pressure
 - l. Air temperature rise across reheat coil
16. Air Distribution Test Sheet:
- a. Air terminal number
 - b. Room number/location
 - c. Terminal type
 - d. Terminal size
 - e. Area factor
 - f. Design velocity
 - g. Design air flow
 - h. Test (final) velocity
 - i. Test (final) air flow
 - j. Percent of design air flow

END OF SECTION

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**SECTION 23 0713
DUCT INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiberglass (flexible duct wrap)
- B. Fiberglass (duct liner)

1.02 RELATED SECTIONS

- A. Specification Section 23 3100 - HVAC Ducts and Casings
- B. Specification Section 23 3300 - Air Duct Accessories

1.03 REFERENCES

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- B. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
- C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
- D. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
- E. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Fiberglass, Duct Lining Material)
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- G. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials
- H. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source
- I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
- J. ASTM C612: Standard Specification for Mineral Fiber Block and Board Thermal Insulation
- K. ASTM C1290: Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts
- L. ASTM E2336: Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems
- M. ASTM C1338: Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings
- N. NAIMA National Insulation Standards
- O. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials
- P. SMACNA - HVAC Duct Construction Standards - Metal and Flexible
- Q. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials

1.04 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents

4. Have options clearly indicated as applicable to each submittal
- B. Construction submittal
 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section approved by manufacturer.

1.06 REGULATORY REQUIREMENTS

- A. Materials: Flame spread/smoke developed rating of 25/50 in accordance with ASTM E84.
- B. Identification: External duct insulation and factory insulated flexible duct shall be legibly printed or identified at intervals not greater than 36 inch with name of manufacturer, the thermal resistance R-value at the specified thickness; and the flame spread and smoke developed indexes of the composite material.

1.07 DELIVERY, STORAGE AND PROTECTION

- A. Deliver, store, protect and handle products to site.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 FIBERGLASS (FLEXIBLE DUCT WRAP)

- A. Manufacturers:
 1. Owens Corning
 2. Knauff
 3. Johns Manville
 4. CertainTeed
 5. Engineer approved equal.
- B. Insulation: ASTM C1290; flexible, noncombustible blanket.
 1. "K" Value: ASTM C518, 0.27 at 75 deg F.
 2. Installed R-value (compressed to 25%) for 1-1/2": 4.5
 3. Maximum Service Temperature: ASTM C411; 250 deg F.
 4. Maximum Moisture Absorption: ASTM C1104; 5% by weight
 5. Density: 1.0 lb./cu. ft. (0.75 lb/cu ft for attic insulation)
 6. Microbial Growth: ASTM C1338; does not support the growth of mold, fungi and bacteria.
 7. Maximum Flame Spread/Smoke Developed Index: ASTM E84; 25/50
- C. Vapor Barrier Jacket:
 1. Kraft paper reinforced with fiberglass yarn and bonded to aluminized film.
 2. Maximum Moisture Vapor Transmission: ASTM E96; 0.02 perm.

- D. Vapor Barrier Tape Pressure sensitive tape approved by the manufacturer.

2.02 FIBERGLASS (DUCT LINER)

- A. Manufacturers:
1. Johns Manville Permacote Linacoustic
 2. Owens Corning
 3. CertainTeed Ultralite
 4. Knauff
 5. Engineer approved equal.
- B. Insulation:
1. ASTM C1071, flexible noncombustible blanket air surface coated with acrylic coating treated with ASTM G21 and G22 anti-microbial agent to resist growth.
 2. "K" Value: ASTM C518, 0.25 at 75 deg F.
 3. Maximum Service Temperature: 250 deg F.
 4. Maximum Velocity on Coated Air Side: 5,000 FPM
 5. Noise Reduction Coefficient: 0.50 or higher in accordance with ASTM C423. (1/2" thickness)
 - a. Noise reduction coefficient will drive density for each manufacturer may vary by manufacturer to achieve.
 6. Maximum Flame Spread/Smoke Developed Index: ASTM E84; 25/50
- C. Adhesive: Adhesive: ASTM C916 adhesive as recommended by manufacturer.
- D. Liner Fasteners: Galvanized steel welded with integral head.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that ductwork has been tested before applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed and dry.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Insulated Ductwork Conveying Air Below Ambient Temperature:
1. Provide insulation with vapor barrier jackets.
 2. Finish with tape and vapor barrier jacket.
 3. Continue insulation through walls, sleeves, hangers and other duct penetrations.
 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, expansion joints, reheat coils, and any other item exposed to ductwork air temperature.
- C. Insulated Ductwork Conveying Air Above Ambient Temperature:
1. Provide with standard vapor barrier jacket.
 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- D. Duct Liner Application:
1. Adhere insulation with adhesive for 100% coverage.
 2. Secure insulation with mechanical liner fasteners. Refer to SMACNA Standards for spacing. Pin length as required to limit compression of liner.
 3. Seal and smooth joints. Seal and coat all exposed edges.
 4. Seal liner surface penetrations with adhesive.

3.03 SCHEDULES

A. **FIBERGLASS FLEXIBLE DUCT WRAP**

DUCTWORK	THICKNESS
Supply Ducts	1-1/2"

**STATE CENTER FIRE DEPARTMENT
RENOVATION & ADDITION**

DUCT INSULATION
23 0713 - 4

Outside Air Ducts	2"

B. FIBERGLASS DUCT LINER

DUCTWORK	THICKNESS
Transfer Ducts	1/2"

END OF SECTION

**SECTION 23 0719
HVAC PIPING INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flexible elastomeric cellular insulation
- B. Piping jackets

1.02 RELATED SECTIONS

- A. Specification Section 23 2300 - Refrigerant Piping

1.03 REFERENCES

- A. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
- B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus
- D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement
- E. ASTM C240 - Standard Test Methods of Testing Cellular Glass Insulation Block
- F. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
- G. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
- H. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
- I. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
- J. ASTM C547 - Standard Specification for Mineral Fiber Preformed Pipe Insulation
- K. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation
- L. ASTM C578 - Standard Specification for Preformed, Cellular Polystyrene Thermal Insulation
- M. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation
- N. ASTM C610 - Standard Specification for Expanded Perlite Block and Pipe Thermal Insulation
- O. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
- P. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
- Q. ASTM D1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
- R. ASTM D1667 - Standard Specification for Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers
- S. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
- T. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics

- U. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- V. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials
- W. NAIMA National Insulation Standards
- X. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials
- Y. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials

1.04 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents
 - 4. Have options clearly indicated as applicable to each submittal
- B. Construction submittal
 - 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years experience.

1.06 REGULATORY REQUIREMENTS

- A. Conform to maximum flame spread/smoke developed rating of 25/50 in accordance with ASTM E84.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Accept materials on site, labeled with manufacturer's identification, product density and thickness.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS**2.01 FLEXIBLE ELASTOMERIC CELLULAR INSULATION**

- A. Manufacturers:
 - 1. Armacell: AP Armaflex
 - 2. Aerocel
 - 3. K-flex
 - 4. Engineer approved equal.
- B. Insulation: ASTM C534 flexible cellular elastomeric molded foam
- C. "K" Value: ASTM C177 or C518; 0.27 at 75 deg F.
- D. Minimum Service Temperature: -40 deg F.
- E. Maximum Service Temperature: 220 deg F.
- F. Maximum Moisture Absorption: ASTM D1056, 5.0% by weight gain
- G. Maximum Water Vapor Permeability: ASTM E96; 0.05 perm-in

- H. Maximum Flame Spread: ASTM E84; 25
- I. Maximum Smoke Developed: ASTM E84; 50
- J. Insulated Inserts:
 - 1. Description: 360 degree cylindrical insert provided by insulation manufacturer capable of supporting the piping system at each hanger location.
 - 2. Material: High density foam, with EPDM/Polymer outer membrane
 - 3. Compressive Strength: 130 psi
 - 4. Thermal Conductivity: 0.312 k-factor or less. ASTM C-518
 - 5. Surface Burning: Self Extinguishing (ASTM D-635)
 - 6. Vapor Barrier Jacket: Acrylic jacket with self sealing lap tape.
 - 7. Permeability (Membrane): 0 Perm-in (ASTM-E96)
 - 8. Service Temperature (fluid temp): 0F to 170F
- K. Elastomeric Foam Adhesive:
 - 1. Manufacturers:
 - a. Armstrong #BLV 520
 - b. Halstead/K-Flex
 - c. Aeroflex
 - d. Engineer approved equal.
 - 2. Air-dried contact adhesive, compatible with insulation
 - 3. VOC Content: 0 g/L as calculated and reported by SCAQMD 1168

2.02 PIPING JACKETS

- A. PVC Plastic:
 - 1. Manufacturers:
 - a. Johns Manville Zeston
 - b. Owens Corning
 - c. PIC plastics
 - d. Engineer approved equal.
 - 2. Jacket: ASTM C921, UV resistant one piece molded type fitting covers and sheet material, off white color.
 - 3. Minimum Service Temperature: -40 deg F.
 - 4. Maximum Service Temperature: 150 deg F.
 - 5. Moisture Vapor Transmission: ASTM E96; 0.002 perm inches.
 - 6. Maximum Flame Spread: ASTM E84; 25
 - 7. Maximum Smoke Developed: ASTM E84; 50
 - 8. Thickness: 20 mil for indoor applications, 30 mil for outdoor applications
 - 9. Connections: Brush on welding adhesive.
 - 10. Covering Adhesive Mastic Manufacturers:
 - a. Johns Manville Perma-Weld
 - b. Engineer approved equal.
 - 11. Compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry with foreign material removed.

3.02 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. Insulated Dual Temperature Pipes or Cold Pipes Conveying Fluids Below Ambient Temperature:

1. Provide vapor barrier jackets, factory applied or field applied.
 2. Insulate fittings, joints and valves with molded insulation of like material and a thickness as adjacent pipe.
 3. PVC fitting covers may be used.
 4. Continue insulation through walls (unless in firewall sleeves), pipe hangers and other pipe penetrations.
 5. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
 6. Vapor seal insulation ends every 20 feet.
- D. Insulated Pipes Conveying Fluids Above Ambient Temperature:
1. Provide standard jackets with vapor barrier, factory applied.
 2. Insulate fittings, joints and valves with insulation of like material and thickness as adjoining pipe.
 3. PVC fitting covers may be used.
 4. Hot piping conveying fluids 140 deg F or less do not insulate flanges and unions at equipment, but level and seal ends of insulation.
 5. Hot piping conveying fluids over 140 deg F, insulate flanges and unions at equipment.
- E. Shields: Provide insulation shields at every hanger location.
- F. Insulation shall be continuous at all hangers. Insulated inserts shall be used to prevent direct contact between pipe and hanger.
- G. Insulation shall be continuous through all wall, roof and curb penetrations.
- H. Heat traced piping insulate fittings, joints and valves with insulation of like material, thickness and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer.

3.03 TOLERANCE

- A. Substituted insulation materials shall provide thermal resistance within 10% at normal conditions, as materials indicate.

3.04 SCHEDULE

A. **FLEXIBLE ELASTOMERIC FOAM INSULATION**

PIPING SYSTEMS	PIPE SIZE	THICKNESS
Cooling Coil Condensate Drains:	ALL	1"
Refrigerant Suction Lines:	ALL	1"
Refrigerant Liquid Lines:	ALL	1"
Refrigerant Hot Gas Bypass Lines:	ALL	0.75"

- B. Note: Pre-insulated refrigerant piping from the manufacturer shall be approved for use.

PIPE JACKET SCHEDULE

PIPE LOCATION	JACKET MATERIAL
Piping in Mechanical/Electrical/Storage Rooms within 10' of floor (excluding racked piping)	PVC
Exterior Piping	Aluminum
All other piping exposed to UV rays	PVC

- C. Note: Jacketing shall cover the entire piping system including, but not limited to the pipe, joints, fittings and tees.

END OF SECTION

**SECTION 23 1123
NATURAL GAS PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Natural gas piping
- B. Gas control vents
- C. Flanges, unions, and couplings
- D. Gas pressure regulators
- E. Plug valves
- F. Gas ball valves

1.02 REFERENCES

- A. ANSI LC-4/CSA 6.32 Press-connect Metallic Fittings for Use in Fuel Gas Distribution Systems
- B. ASHRAE 90A - Energy Conservation in New Building Design
- C. ASME Section 8D - Pressure Vessels
- D. ASME B16.3 Standard for Malleable Iron Threaded Fittings: Classes 150 and 300
- E. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
- F. ASTM A420 Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Low-Temperature Service
- G. NFPA 30 - Flammable and Combustible Liquids Code
- H. NFPA 54 - National Fuel Gas Code
- I. NFPA 70 - National Electrical Code

1.03 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents
 - 4. Have options clearly indicated as applicable to each submittal
- B. Construction submittal
 - 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data
- C. Project Record Documents
 - 1. Indicate final installed locations of all valves on a PDF floor plan

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three-years experience.
- B. All welders shall be certified under ASME Section IX.

1.05 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver, store, protect and handle products to the site.
- B. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS**2.01 NATURAL GAS PIPING (ABOVE GRADE)**

- A. Steel Pipe:
 - 1. ASTM A53 Schedule 40 black.
 - 2. Fittings: ASME B16.3, malleable iron or ASTM A234/A234M, forged steel welding type.
 - 3. Joints: NFPA 54, threaded or welded to ANSI B31.1.

2.02 GAS CONTROL VENTS

- A. All gas control vents shall be vented separately to the exterior of the building. Terminate with screwed vent cap.

2.03 FLANGES, UNION, AND COUPLINGS

- A. Pipe Size Under 2 Inches:
 - 1. Ferrous Pipe: Class 150 psig malleable iron threaded unions.
 - 2. Copper Tube and Pipe: Class 150 psig bronze unions with soldered joints.
- B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, and water impervious isolation barrier.

2.04 GAS PRESSURE REGULATORS

- A. Manufacturers:
 - 1. Fisher
 - 2. Engineer approved equal.
- B. Direct-operated, spring-loaded regulator with internal relief. Regulator shall have internal relief across diaphragm to minimize overpressure. Any outlet pressure above the start-to-discharge point of the nonadjustable relief valve spring shall be allowed to bleed out through a relief vent.

2.05 PLUG VALVES

- A. Up To and Including 2 Inches:
 - 1. Manufacturers:
 - a. Homestead Valve #612
 - b. Engineer approved equal.
 - 2. Full port body, lubricated plug type, without taper, close tolerance between plug and body sealing surfaces, Teflon reinforced stem seal, leak-proof spring loaded check valve, combination lubricant screw and button head. Valve plugs shall be floated on low-friction Teflon surfaces. Lubricant system shall have sufficient pressure to force lubricant over all seating surfaces.
 - 3. Valves shall handle natural gas at temperature and pressure indicated.

2.06 GAS BALL VALVES

- A. Up To and Including 2 Inches:
 - 1. Manufacturers:
 - a. Apollo #80-100
 - b. Watts #B-6000-UL
 - c. Nibco #T-580-70-UL
 - d. Engineer approved equal.
 - 2. Bronze two piece body, standard or full port, chrome plated ball, Teflon seats and stuffing box ring, lever handle, threaded ends. UL listed for natural gas service.

3.01 INSTALLATION

- A. This contractor shall furnish all labor and material necessary to install gas piping to all items of equipment shown on the drawings as requiring gas.
- B. Accessible piping smaller than two inch (2") may be screwed.
- C. All concealed gas pipe and all gas piping two inch (2") and larger shall be fabricated using weld type fittings.
- D. All steel gas piping buried in earth shall be Schedule 40 black steel mill wrapped and all joints shall be welded.
- E. Underground joints shall be wrapped with Minnesota Mining and manufacturing Scotchwrap.
- F. All gas piping shall be tested at 50-psi air pressure for a 24-hour period.
- G. This contractor shall furnish and install a gas cock shut off in the branch line to each gas-consuming piece of equipment. Provide plug valves where noted on the plans.
- H. This contractor shall begin at the meter and shall run gas piping to all gas using equipment as shown on the drawings.
- I. Verify all piping regulations and regulators required with local gas company before running gas lines.
- J. All gas piping that is run exposed to weather shall be given two coats of rust resisting paint.
- K. All gas piping in trenches, tunnels and concealed above inaccessible ceilings shall be welded construction.
- L. All gas piping carrying 1 psig or more shall be welded.
- M. Install horizontal press pipe fittings with pipe supports no further than 2 feet from either end of fitting to prevent pipe sag that could affect integrity of fitting connection.
- N. Install rigid gas piping free of sags or bends.

3.02 GAS REVISIONS

- A. The present natural gas service shall remain in its' present location. This contractor shall connect to the present gas manifold and shall re-work manifold as required.
- B. Provide new natural gas service. Coordinate equipment and installation requirements with local utility company. Verify requirements prior to bid.
- C. Any charges by the gas utility company to provide service to the building shall be included in this contractor's bid.
- D. The gas line shall run and be connected to all the new natural gas loads to include new furnaces, radiant heaters, and new water heaters.
- E. The present natural gas service to the existing building shall be disconnected and removed to the meter.
- F. Coordinate construction heating gas requirements with utility company prior to start of construction.

END OF SECTION

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**SECTION 23 2300
REFRIGERANT PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping
- B. Refrigerant
- C. Flexible connections

1.02 RELATED SECTIONS

- A. Specification Section 23 5400 - Furnaces
- B. Specification Section 23 6213 - Packaged Air Cooled Refrigerant Compressor and Condensing Units
- C. Specification Section 23 8126 - Ductless Split System Units
- D. Specification Section 23 8216 - Air Coils

1.03 REFERENCES

- A. ASHRAE 15 - Safety Code for Mechanical Refrigeration
- B. ASHRAE 34 - Number Designation of Refrigerants
- C. ASME - Boiler and Pressure Vessel Codes, Section IX - Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators
- D. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
- E. ASME B16.26 - Cast Copper Alloy Fittings For Flared Copper Tubes
- F. ASME B31.5 - Refrigeration Piping
- G. ASME B31.9 - Building Services Piping
- H. ASME SEC 8D - Boilers and Pressure Vessels Code, Rules for Construction of Pressure Vessels
- I. ASTM B1003 - Standard Specification for Seamless Copper Tube for Linesets
- J. ASTM B88 - Seamless Copper Water Tube
- K. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
- L. ASTM F708 - Design and Installation of Rigid Pipe Hangers
- M. AWS A5.8 - Brazing Filler Metal
- N. AWS D1.1 - Structural Welding Code, Steel
- O. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer
- P. MSS SP69 - Pipe Hangers and Supports - Selection and Application
- Q. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices

1.04 SYSTEM DESCRIPTION

- A. Flexible Connectors: Utilize at or near compressors where indicated on plans.

1.05 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents

4. Have options clearly indicated as applicable to each submittal
- B. Construction submittal
 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.
 - b. Product Data: Provide general assembly of specialties, including manufacturers catalog information. Provide manufacturers catalog data including load capacity.
 - c. Design Data: Submit design data indicating pipe sizing. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
 - d. Installation Instructions
- C. Closeout submittal
 1. After project substantial completion, provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Operation and Maintenance Information
- D. Project Record Documents
 1. Indicate final installed locations of all equipment and refrigeration accessories on a PDF floor plan

1.06 QUALIFICATIONS

- A. Installer: Company specializing in performing the work of this section with minimum three years experience.
- B. Design piping system under direct supervision of a professional engineer experienced in design of this work and licensed in Iowa.
- C. All welders shall be certified under ASME Section IX.

1.07 REGULATORY REQUIREMENTS

- A. Conform to ASME B31.9 for installation of piping system.
- B. Welding Materials and Procedures: Conform to ASME Section IX and applicable state labor regulations.
- C. Welder's Certification: In accordance with ASME Section IX.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Architectural Specification.
- B. Deliver and store piping in shipping containers with labeling in place.
- C. Protect piping from entry of contaminating material by leaving end caps and plugs in place until installation.
- D. Dehydrate and charge piping. Seal prior to shipment, and until connected into system.

1.09 MAINTENANCE MATERIALS

- A. Provide two refrigeration oil test kits each containing everything required to conduct one test.

PART 2 PRODUCTS

2.01 PIPING

- A. Copper Tubing (all sizes) ASTM B280, type #ACR hard drawn
 1. Fittings: ASME B16.50 wrought copper alloy
 2. Joints: Brazed, ANSI/AWS A5.8 filler metal
- B. Flexible Line Sets:
 1. Tubing: ASTM B280 or B1003 copper tubing

2. Joints: Flared
3. Insulation:
 - a. Type: Closed Cell Elastomeric (Polyethylene Foam is not acceptable), Insulation must be factory applied. Field installation is not acceptable.
 - b. Thickness: 1/2" on Suction and Liquid Lines (R 3.0). Provide 1" insulation on tubing 1" and larger.
 - c. Standards: ASTM C534 (moisture resistance) and UL-94 or ASTM E84 compliant (smoke/flame spread)
 - d. Jacket: Abrasion and UV resistant coating (5 year warranty). ASTM E96 for permeability

2.02 REFRIGERANT

- A. See individual equipment specification or schedule on drawings.

2.03 FLEXIBLE CONNECTORS

- A. Manufacturers:
 1. Parker
 2. Alco
 3. Engineer approved equal
- B. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum nine inches (9") long with copper tube ends; for maximum working pressure 500 psig.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

- A. Route piping in orderly manner with plumbing parallel to building structure and maintain gradient.
- B. Install piping to conserve building space and not interfere with use of space.
- C. Group piping whenever practical at common elevations and locations.
- D. Install piping to allow for expansion and contraction without stressing pipe, joints or connected equipment.
- E. Arrange piping to return oil to compressor. Provide traps and loops in piping and provide double risers as required. Slope piping per manufacturer's recommendations. Pipe size to be provided by unit manufacturer.
- F. Provide clearance for installation of insulation and access to valves and fittings.
- G. Provide access to concealed fittings. Coordinate size and location of access doors.
- H. Flood piping system with nitrogen when brazing.
- I. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.
- J. Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting.
- K. Insulate piping and equipment.
- L. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.
- M. Tighten flared fittings to manufacturer-required torque levels.
- N. Fully charge completed system with refrigerant after testing.

- O. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.
- P. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

3.03 FIELD QUALITY CONTROL

- A. Field inspection and testing shall be performed under provisions of Architectural Specification Sections.
- B. Test refrigeration system in accordance with ASME B31.5.
- C. Pressure test system with dry nitrogen to the operating pressure of the system. Hold pressure and ensure no leaks for 1 hour. Ensure test conforms to current code and manufacturer requirements.
- D. Vacuum test system at 500 microns vacuum. System shall maintain a vacuum of no more than 1,500 microns after 10 minutes.

END OF SECTION

SECTION 23 3100
HVAC DUCTS AND CASING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Materials
- B. Ductwork fabrication
- C. Manufactured ductwork and fittings
- D. Exposed spiral ductwork

1.02 RELATED SECTIONS

- A. Specification Section 23 0593 - Testing, Adjusting, and Balancing for HVAC
- B. Specification Section 23 0713 - Duct Insulation.
- C. Specification Section 23 3300 - Air Duct Accessories.
- D. Specification Section 23 3700 - Air Outlets and Inlets.

1.03 REFERENCES

- A. ASTM A 36 - Structural Steel
- B. ASTM A 90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
- C. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
- D. ASTM A 366 - Steel, Sheet, Carbon, Cold Rolled, Commercial Quality
- E. ASTM A 480 - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
- F. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
- G. ASTM A 527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality
- H. ASTM A 568 - Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled
- I. ASTM A 569 - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality
- J. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate
- K. AWS D9.1 - Welding of Sheet Metal
- L. NBS PS 15 - Voluntary Product Standard for Custom Contact-Molded Reinforced-Polyester Chemical Resistant Process Equipment
- M. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
- N. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems
- O. NFPA 91 - Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying
- P. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment
- Q. SMACNA - HVAC Air Duct Leakage Test Manual
- R. SMACNA - HVAC Duct Construction Standards - Metal and Flexible
- S. UL 181 - Factory-Made Air Ducts and Connectors

1.04 PERFORMANCE REQUIREMENTS

- A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.05 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents
 - 4. Have options clearly indicated as applicable to each submittal
- B. Construction submittal
 - 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data
 - b. Shop Drawings: Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration for four inch (4") pressure class and higher and kitchen hood exhaust systems.
- C. Project Record Documents
 - 1. Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.06 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- B. Maintain one copy of document on site.

1.07 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three-years experience.
- B. Installer: Company specializing in performing the work of this section with minimum three-years experience.

1.08 REGULATORY REQUIREMENTS

- A. Construct ductwork to NFPA 90A Standards.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures during and after installation of duct sealants.

PART 2 PRODUCTS**2.01 MATERIALS**

- A. Galvanized Steel Ducts: ASTM A924 and ASTM A653 galvanized steel sheet, lock-forming quality, having G60 zinc coating of in conformance with ASTM A90.
- B. Insulated Flexible Duct
 - 1. Manufacturers:
 - a. Thermaflex G-KM
 - b. Flexmaster
 - c. Atco
 - d. Engineer approved equal.

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2. UL 181, Class 1, NFPA 90A and 90B compliant, interlocking spiral of steal wire, fiberglass insulation with R value of 4.2 or greater; core shall be chlorinated polyethylene vapor barrier film. (Polyester is not acceptable). Outer shell/vapor barrier shall be metalized polyester or polyethylene film.
 3. Pressure Rating: Six inch (6") positive and one inch (1") negative.
 4. Maximum Velocity: 5000 fpm.
 5. Temperature Range: -20 to 180 deg F.
 6. Vapor Transmission: 0.1 perms or less (ASTM E96)
 7. Flex Elbows: Flex duct 90 degree elbow splines for connections to diffusers. Flex elbows shall prevent kinks in flex duct. Elbow spline shall be UL-2043 listed for use in plenums.
- C. Fasteners: Rivets, bolts or sheet metal screws.
- D. Duct Sealant
1. Manufacturers:
 - a. Design Polymerics (DP1010)
 - b. Ductmate
 - c. Durodyne
 - d. Hardcast
 - e. Engineer approved equal.
 2. Description: Water based, non hardening, high velocity/high pressure duct sealant intended for indoor and outdoor HVAC ducts.
 3. Pressure Rating: 10" water column minimum.
 4. Service Temperature: -20 to 200F
 5. Listings
 - a. ASTM E-84/UL723 Flame/Smoke Spread: 25/50 or less.
 - b. UL-181B listed for use on Flex Duct connections.
 - c. Conforms to NFPA 90A & 90B requirements.
 - d. Approved for use on interior of ducts.
 6. VOC Content
 - a. 250 g/l or less (SCAQMD Rule 1168 limitations)
 - b. CDPH Standard Method v1.1 (14 days): Less than 5.0 mg/m3.
- E. Hanger Rod: ASTM A36; steel, galvanized; threaded both ends, threaded one end.

2.02 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gauges, reinforcing and sealing for operating pressures indicated.
- B. Increase duct sizes gradually, not exceeding 15 degree divergence wherever possible; maximum 30 degree divergence upstream of equipment and 45 degree convergence downstream.
- C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide airfoil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with fiberglass insulation.
- D. Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum four inch (4") cemented slip joint, brazed or electric welded. Prime coat welded joints.
- E. Provide standard 45 degree lateral wye takeoffs or 90 degree conical tee takeoffs.
- F. Fabricate all exposed ductwork using paint grip galvanized sheet metal.
- G. All outside air intake or relief ductwork above finished areas shall be caulked to be watertight. An auxiliary continuous drain pan shall be provided beneath these ducts to

prevent damage in case of a waterproofing failure. Line this drain pan with 1/2 inch duct liner and turn up all edges.

- H. All joints in rectangular, round or oval ductwork that exceed 100 inches in perimeter length shall be made with Ductmate, TDC, or TDF connections.

2.03 MANUFACTURED DUCTWORK AND FITTINGS

- A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.
- B. Round Ducts: Machine made from round spiral lock seam duct with light reinforcing corrugations, fittings manufactured at least two gauges heavier metal than duct.

2.04 EXPOSED SPIRAL DUCTWORK

- A. Galvanized spiral duct construction and gauge shall be in accordance with SMACNA HVAC Duct Construction Standards.
- B. Fittings: All fittings shall be self-sealing, double lipped, gasket type fittings with EPDM rubber gasket. No external sealant or tape is allowed. Fittings shall be galvanized steel constructed in accordance with ASTM A653 and A924.
- C. Elbows: Elbows shall be gored elbows. 45° elbows shall be 3-piece elbows and 90° elbows shall be 5-piece elbows.
- D. Hangers: Exposed spiral duct hangers shall be steel aircraft quality zinc coated wire hangers or 1/8" thick, 1" wide galvanized steel strap with threaded rod.
- E. Taps: System shall utilize high efficiency shoe type saddle taps.
- F. Reducers: All spiral reducers in exposed areas shall be concentric to keep centerline of duct at consistent elevation.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- C. All ductwork shall be sealed to provide a SMACNA Seal Class A installation for all longitudinal seams, all transverse seams and all duct penetrations. Flame spread rating shall not exceed 25 and smoke developed shall not exceed 50 when tested in compliance with ASTM-E-84-87.
- D. Sealant shall be non-hardening and water resistant. Sealant shall be capable of being applied with a brush and shall be applied in accordance with manufacturer's instructions. Each seam or penetration shall be dressed after application of sealant for neat appearance.
- E. Ductwork shall be installed following essentially lines indicated on the drawings. Install offsets, and angles. Transitions may be required to avoid interference with other work and existing conditions. Maintain full capacity of ductwork.
- F. Flex Duct Installation:
 - 1. Maximum length of flex duct: 5ft
 - 2. Provide 90 deg elbow splines to prevent flex duct kinking, especially when connecting to ceiling diffusers
 - 3. Connections to rigid ducts and fittings: Peel back insulation and place flexible inner core over fitting and seal with two layers of duct tape (minimum 2" overlap on fitting and flex duct core). Install clamps over the top of the duct tape. Stretch insulation back over fitting and wrap with two layers of duct tape. Duct Sealant/Mastic may be substituted for the tape that seals the inner core to the

fitting. Refer to manufacturer's instructions. Duct tape, mastic/sealant and clamps shall be UL181 listed.

- G. Duct sizes are net outside dimensions. Maintain outside sizes for lined ducts. Do not increase duct dimensions.
- H. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- I. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal cap with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- J. Use crimp joints with or without bead for joining round duct sizes eight inch (8") and smaller with crimp in direction of airflow.
- K. Use double nuts and lock washers on threaded rod supports.
- L. Connect terminal units to supply ducts directly with rigid duct. Do not use flexible duct.
- M. Connect diffusers to low pressure ducts directly or with five foot (5') maximum length of flexible duct held in place with strap or clamp.
- N. Connect flexible ducts to metal ducts with draw bands.
- O. Set plenum doors six inch (6") to 12 inches above floor. Arrange door swing so that fan static pressure holds door in closed position.
- P. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- Q. For units with filtered return air grilles (furnaces, etc.), remove the unit filter and connect the return air ductwork tight to the unit. The return duct shall match the size of the unit return air opening.

3.02 SCHEDULES

A. DUCTWORK MATERIAL

AIR SYSTEM	MATERIAL
Low Pressure Supply	Galvanized Steel
Medium & High Pressure Supply	Galvanized Steel
Return and Relief	Galvanized Steel
General Exhaust	Galvanized Steel
Outside Air Intake	Galvanized Steel
Combustion Air	Galvanized Steel

B. DUCTWORK PRESSURE CLASS

AIR SYSTEM	PRESSURE CLASS
Supply	1"
Return and Relief	1"
General Exhaust	1"
Intake and Exhaust	1"
Outside Air Intake	1/2"

DUCT PRESSURE CLASS (IN.)	SYSTEM FAN EXTERNAL STATIC PRESSURE
1/2" w.g.	Up to 1/2" w.g.
1" w.g.	Over 1/2" up to 1 w.g.
2" w.g.	Over 1" up to 2" w.g.

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3" w.g.	Over 2" up to 3" w.g.
4" w.g.	Over 3" up to 4" w.g.

C.

END OF SECTION

**SECTION 23 3300
AIR DUCT ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Backdraft dampers
- B. Duct access doors
- C. Duct test holes
- D. Flexible duct connections
- E. Rectangular Manual Balance Dampers
- F. Round Manual Balance Dampers
- G. Iris Manual Balance Dampers with flow measurement
- H. Rectangular control dampers
- I. Recessed Vent Dryer Box

1.02 RELATED SECTIONS

- A. Specification Section 23 0548 – Vibration and Seismic Controls for HVAC Piping and Equipment
- B. Specification Section 23 3100 - HVAC Ducts and Casings.

1.03 REFERENCES

- A. AMCA 500-D – Laboratory Methods of Testing Dampers
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- C. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
- D. NFPA 92A - Smoke Control Systems
- E. NFPA 70 - National Electrical Code
- F. SMACNA - HVAC Duct Construction Standards - Metal and Flexible
- G. UL 33 - Heat Responsive Links for Fire-Protection Service
- H. UL 555 - Fire Dampers and Ceiling Dampers
- I. UL 555S - Leakage Rated Dampers for use in Smoke Control Systems

1.04 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents
 - 4. Have options clearly indicated as applicable to each submittal
- B. Construction submittal
 - 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data, including electrical characteristics if applicable
 - b. Shop Drawings
 - c. Installation Instructions
- C. Project Record Documents
 - 1. Indicate final installed locations of all components on a PDF floor plan, including remote test switches for life safety dampers

RENOVATION & ADDITION**1.05 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.06 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Architectural Specification Sections.
- B. Protect dampers from damage to operating linkages and blades.

1.08 EXTRA MATERIALS

- A. Provide two of each size and type of fusible link for each style or type of fire damper or combination fire/smoke damper furnished for this project.

PART 2 PRODUCTS**2.01 BACKDRAFT DAMPERS**

- A. Backdraft Dampers (Standard)
 - 1. Manufacturers:
 - a. Ruskin BD6
 - b. Greenheck
 - c. United Enertech
 - d. Air Balance
 - e. Pottorff
 - f. Engineer approved equal.
 - 2. Construction:
 - a. Frame: Extruded aluminum, 0.07" thick, 2" deep assembly
 - b. Blades: Extruded aluminum, 0.05" thickness with neoprene or vinyl seals, mechanically attached (no adhesive).
 - c. Bearings: Nylon
 - d. Axles: 1/2" extruded aluminum
 - e. Linkage: Located in airstream
 - 3. Orientation: Horizontal or "airflow up"
 - 4. Performance:
 - a. Max velocity: 2500 fpm at 24"
 - b. Leakage: 8.7 cfm/ft² @ 1" w.g. (24"x24")
 - 5. Mounting: See plans
- B. Adjustable Backdraft Dampers
 - 1. Manufacturers
 - a. Tamco Series 7600CWA
 - b. No approved equal
 - 2. Construction:
 - a. Frame: Extruded aluminum, 4" deep
 - b. Blades: Extruded aluminum, 0.9" thickness, rounded heads. Seals shall be extruded silicone secured via a slot (no adhesive). Each blade is fitted with an internal counterweight.
 - c. Bearings: Celcon
 - d. Axles: 7/16" extruded aluminum
 - e. Hardware: Aluminum or Stainless Steel
 - 3. Orientation: Horizontal, "airflow up" and "airflow down"
 - 4. Adjustable Weight

- a. Location: Outside the air stream.
- b. Performance:
 - 1) Begin to open: 20 fpm or 0.015"
 - 2) Fully open: 1625 fpm or 0.17"
 - 3) Adjustments to counterweights shall be achieved outside the airstream.
Weights requiring access to the inside of the duct are not acceptable.
- 5. Performance Testing: AMCA 500-D
- 6. Mounting: See plans

2.02 DUCT ACCESS DOORS

- A. Manufacturers:
 - 1. Ruskin
 - 2. Nailor
 - 3. Ductmate
 - 4. Acudor
 - 5. Engineer approved equal.
- B. Frame: 22 gauge galvanized steel
- C. Door: 22 gauge double skin galvanized
- D. Seal: Neoprene
- E. Insulation: 1" Fiberglass (on insulated duct only)
- F. Configuration:
 - 1. Less Than 12 Inch Square: Secure with two (2) Cam locks.
 - 2. Up to 24 inch Square: Continuous plated steel hinge and two Cam locks.
 - 3. Walk Through Access Doors (Plenum Door): Continuous plated steel hinge with two
 - a. dual acting handles.
 - 4. Spiral Duct Doors: Dual plate covers with large hand tightening knobs.
- G. Access doors with sheet metal screw fasteners are not acceptable.
- H. Windows: Provide where noted on plans

2.03 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches or neoprene plugs.
- B. Permanent Test Holes: Factory fabricated, airtight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.04 FLEXIBLE DUCT CONNECTIONS

- A. Manufacturers
 - 1. Ductmate ProFlex
 - 2. DuroDyne
 - 3. DynAir/Carlisle
 - 4. Engineer Approved Equal
- B. Description: Flexible duct connections to isolate vibration from HVAC equipment
- C. Materials:
 - 1. Duct Connections: 24 gauge galvanized sheet metal
 - 2. Fabric Type: Fiberglass core with Neoprene coating. Provide a Hypalon coating (UV resistant) on exterior duct connections.
- D. Size:
 - 1. Metal: 3" (both ends)
 - 2. Fabric: 3". Provide 6" fabric on connections with circumferences greater than 100"
- E. Service Temp: -35F to 200F

- F. Surface Burning characteristics: Meets ASTM-E84 and NFPA 701

2.05 RECTANGULAR MANUAL BALANCE DAMPERS

- A. Size and Application:
1. 18" wide x 12" tall and smaller: Field/Shop Fabricated or Factory Provided.
 2. Larger than 18" wide x 12" tall: Factory Provided.
- B. Field/Shop Fabricated Rectangular Balance Dampers
1. Fabricate in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible, current addition and per the below:
 - a. Blade: 24 Gage minimum, but not thinner than two gages thinner than duct gage. Blade must have hemmed edges and be 1/8" smaller than the duct on all sides.
 - b. Rod: 3/8" minimum. Rod shall be continuous on 2" pressure class and above.
 - c. Bearings: Provide closed end bearings for rod penetrations
 - d. Locking Device: Provide quadrant locking device to keep damper in fixed position.
 2. Stand-off plate: On insulated ducts, provide a 2" stand-off plate to allow for damper operation after insulation installation.
 3. Sealing: Damper component penetration of ducts must be sealed to maintain a Class A Seal rating.
- C. Factory Fabricated Manual Balance Dampers
1. Manufacturers
 - a. Greenheck MBD
 - b. Ruskin
 - c. Pottorff
 - d. United Enertech
 - e. Engineer approved equal
 2. Description: Rectangular damper intended for balancing purposes (not for positive shut-off or control)
 3. Construction:
 - a. Frame: Galvanized, 16 gauge
 - b. Blades: Galvanized, 16 gauge, Opposed blade orientation, 20 gauge blade stops
 - c. Control Shaft: Steel, 3/8" diameter (minimum)
 - d. Bearings: Synthetic Nylon
 - e. Linkage: Concealed in frame
 - f. Stand-off Plate: 2" stand-off plate to allow for damper operation after insulation installation.
 - g. Operator: Locking Hand Quadrant
 4. Remote Cable Operator (when indicated on the plans):
 - a. Cable Operator: Worm gear operator in lieu of lock hand quadrant.
 - b. Cable: Steel, with coupling and clips to secure to operator.
 - c. Ceiling Cup/Wall Plate: Galvanized steel and fire rated bracket. See plans for type and location.
 5. Performance:
 - a. Max Velocity: 1500 fpm
 - b. Max Pressure: 2.5" W.C.
 - c. Temperature range: -40 to 180 degrees f

2.06 ROUND MANUAL BALANCE DAMPER

- A. Field/Shop Fabricated Round Balance Dampers
1. Fabricate in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible, current addition and per the below:

- a. Blade: 24 Gage minimum, but not thinner than two gages more than duct gage
 - b. Rod: 3/8" minimum. Rod shall be continuous on 2" pressure class and above. Rod shall also be continuous on all ducts 12" and larger.
 - c. Bearings: Provide closed end cast alloy bearings for rod penetrations
 - d. Locking Device: Provide quadrant locking device to keep damper in fixed position.
 - e. Stand-off plate: Provide a 2" stand-off plate to allow for damper operation after insulation installation.
 2. Sealing: Damper component penetration of ducts must be closed and sealed to maintain a Class A system rating.
- B. Factory Fabricated Manual Balance Dampers
 1. Manufacturers
 - a. Greenheck MBDR
 - b. Ruskin
 - c. Pottorff
 - d. United Enertech
 - e. Engineer approved equal
 2. Description: Circular damper intended for balancing purposes (not for positive shut-off or control)
 3. Construction:
 - a. Frame: Galvanized, 20 gauge
 - b. Blade: Galvanized, 20 gauge
 - c. Shaft: Steel, 3/8" diameter (minimum)
 - d. Bearings: Synthetic Nylon
 - e. Stand-off Plate: 2" stand-off plate to allow for damper operation after insulation installation.
 - f. Operator: Locking Hand Quadrant
 4. Performance:
 - a. Max Velocity: 1500 fpm
 - b. Max Pressure: 1" W.C.
 - c. Temperature range: -25 to 180 degrees

2.07 IRIS MANUAL BALANCE DAMPERS WITH FLOW MEASUREMENT

- A. Manufacturers
 1. Fantech "IR"
 2. Continental Fan
 3. United Enertech
 4. Young Regulator
 5. Engineer Approved equal
- B. Description: Circular damper with pressure taps upstream and downstream of the adjustable orifice blades for airflow balancing/measurement.
- C. Construction
 1. Blades and Casing: Galvanized Steel
 2. Connector Gasket: EPDM
- D. Operation: Factory supplied spanner wrench.
- E. Accuracy: +/- 5% when installed in a straight duct per the installation manual.
- F. Sizing: Damper size shall be determined by the required airflow, not the line size noted on the plans. Provide necessary transitions to allow for the appropriately sized damper. Adhere the manufacturer's requirements for straight duct distances upstream and downstream of the damper.

2.08 RECESSED VENT DRYER BOX

- A. Manufacturers:
 - 1. Guy Gray #82425 or #82426 (Steel)
 - 2. Deflect-o #DVBOX (Plastic)
 - 3. Engineer approved equal.
- B. 22 gauge aluminized steel to be installed between wall studs. Top center vent opening for upward exhaust direction.

PART 3 EXECUTION**3.01 PREPARATION**

- A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

- A. Install duct pressure relief doors in ductwork serving the scheduled equipment.
- B. Install duct pressure relief doors in easily observable location.
- C. Adjust duct pressure relief doors to the specified pressure relief setting.
- D. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- E. Provide backdraft dampers on exhaust ducts nearest to outside and where indicated.
- F. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers at fire dampers, combination fire and smoke dampers and elsewhere as indicated. Review locations prior to fabrication.
- G. Provide duct test holes where indicated and required for testing and balancing purposes.
- H. Provide fire dampers, combination fire and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, and breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- I. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.
- J. Demonstrate re-setting of fire dampers to owner's representative.
- K. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment and supported by vibration isolators.
- L. Provide volume balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum two duct widths from duct take-off. Drawings may not indicate all volume damper locations.
- M. Provide volume balancing dampers on duct take-off to diffusers, grilles and registers, regardless of whether dampers are specified as part of the diffuser, grille or register assembly. Locate as close as possible yet accessible to the main trunk duct. Drawings may not indicate all volume damper locations.
- N. The electrical contractor shall wire smoke damper operators.
- O. Provide turning vanes in all supply, return and exhaust ductwork unless noted otherwise. Turning vanes shall not be installed in kitchen hood exhaust, dishwasher hood exhaust and kiln hood exhaust.
- P. Provide original installation inspection during construction and 11-month re-inspection after substantial completion of all existing and new fire/smoke/fire smoke dampers in all HVAC systems serving project's construction area. Mechanical Contractor shall adjust,

fix or replace any damper found not to meet installation requirements. Provide an electronic log of all dampers with size, location, pre-inspection condition and post-inspection condition to Owner and Design Team after original inspection and after re-inspection of fire/smoke/fire smoke dampers.

END OF SECTION 23 3300

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**SECTION 23 3416
INLINE HVAC FANS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Square inline centrifugal fans (Belt driven)
- B. Square inline centrifugal fans (Direct drive)

1.02 RELATED SECTIONS

- A. Specification Section 23 0713 - Duct Insulation
- B. Specification Section 23 3100 - HVAC Ducts and Casings
- C. Specification Section 23 3300 - Air Duct Accessories
- D. Specification Section 23 2923 - Variable Frequency Drives

1.03 REFERENCES

- A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings
- B. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings
- C. AMCA 99 - Standards Handbook
- D. ANSI/AMCA Standard 204-05 - Balance Quality and Vibration Levels for Fans
- E. AMCA 210 - Laboratory Methods of Testing Fans for Rating
- F. AMCA 300 - Reverberant Room Method for Sound Testing of Fans
- G. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data
- H. NEMA MG1 - Motors and Generators
- I. NFPA 70 - National Electrical Code
- J. SMACNA - HVAC Duct Construction Standards - Metal and Flexible
- K. UL Standard 705 - Power Ventilators

1.04 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents
 - 4. Have options clearly indicated as applicable to each submittal
- B. Construction submittal
 - 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.
 - b. Shop Drawings
- C. Closeout submittal
 - 1. After project substantial completion, provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Warranty documentation, fully filled out and including start-up and start date information.
 - b. Operation and Maintenance Information

1.05 WARRANTY

- A. Assembly: Free from defects in material and workmanship for a period of 12 months from the purchase date.
- B. Motor: Motor Warranty is warranted by the motor manufacturer for a period of one year.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Transport, handle, store, and protect products under provisions of Architectural Specification.
- B. Protect motors, shafts, and bearings from weather and construction dust.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated and fan has been test run under observation.

1.08 EXTRA MATERIALS

- A. Supply an extra belt for each fan.

1.09 QUALITY ASSURANCE

- A. Performance Ratings: Fans shall conform to AMCA 210 and AMCA 211.
- B. Vibration and Balancing: Fans shall be given an electronic vibration analysis per AMCA 204.
- C. Fans shall be tested to AMCA 300 for sound ratings.
- D. Fan assemblies shall be listed to UL 705.
- E. Spark resistant fans shall meet AMCA 99 fabrication standards.

PART 2 PRODUCTS**2.01 SQUARE INLINE CENTRIGUFAL FANS (BELT DRIVEN)**

- A. Manufacturers:
 - 1. Greenheck BSQ
 - 2. Twin City Fan
 - 3. Cook
 - 4. Acme
 - 5. Pennbarry
 - 6. Carnes
 - 7. Engineer approved equal.
- B. Cabinet: Aluminum enclosure with duct mounting collars on inlet and outlet. A minimum of two sides shall be removable for fan and motor access. Provide inlet guards on units not connected to ductwork. Cabinet shall be lined with 1" fiberglass duct liner.
- C. Fan Wheel: Aluminum Backward inclined wheel that is statically and dynamically balanced AMCA 204-205.
- D. Motor:
 - 1. Motor Enclosure: Open Drip Proof, ODP
 - 2. Type: Premium efficiency (VFD compatible).
 - 3. Motors shall be permanently lubricated with heavy duty ball bearings.
 - 4. Motor Cover: Galvanized Steel cover shall protect motor and shaft.
- E. Shaft and Bearings:
 - 1. Shaft: Polished Steel with anti-corrosive coating
 - 2. Permanently sealed bearings. Bearing life shall have a minimum L10 life of 100,000 hours (L50 average life of 500,000 hours). On larger units with pillow block bearings provide a grease zerk terminating at the exterior housing.
 - 3. Shaft speed shall be rated at 25% beyond maximum motor operating speed.

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- F. Drive Assembly:
 - 1. Belts, pulleys and keys shall be oversized to 150% of HP rating.
 - 2. Belt: Static free and oil resistant. Provide Belt Guard.
 - 3. Pulley: Cast type keyed to wheel and motor shaft. Pulley shall be adjustable for system balancing.
- G. Isolation Supports:
 - 1. 2 Horsepower and smaller: Hanging Neoprene/Rubber mount. Steel top plate. Base plate embedded in oil resistant neoprene. Mount sized by manufacturer based on unit weight.
 - 2. 2-1/2 HP and larger: Hanging spring isolators sized by manufacturer based on unit weight.
- H. Electrical Disconnect: Factory provided NEMA 1 disconnect.

2.02 SQUARE INLINE CENTRIFUGAL FANS (DIRECT DRIVE)

- A. Manufacturers:
 - 1. Greenheck SQ
 - 2. Twin City Fan
 - 3. Cook
 - 4. Acme
 - 5. PennBarry
 - 6. Engineer approved equal.
- B. Cabinet: Galvanized enclosure with duct mounting collars on inlet and outlet. A minimum of two sides shall be removable for fan and motor access. Provide inlet guards on units not connected to ductwork. Cabinet shall be lined with 1" fiberglass duct liner.
- C. Fan Wheel: Aluminum Backward inclined wheel that is statically and dynamically balanced to AMCA 204-205.
- D. Motor:
 - 1. Motor Enclosure: Open Drip Proof
 - 2. Type: Electronic Commutation Motor (ECM) designed for fan applications. AC motors such as Permanent Split Capacitor type (PSC) are not acceptable.
 - 3. Motors shall be permanently lubricated with heavy duty ball bearings.
 - 4. Motor circuitry shall convert AC power supplied by the electrician to DC power acceptable by the ECM motor.
 - 5. Turndown: Capable of running at 20% of full speed.
 - 6. Control:
 - a. Potentiometer Dial mounted on the motor for constant volume balancing.
- E. Dampers: Provide a factory installed gravity backdraft damper.
- F. Isolation Supports: Neoprene/Rubber mount. Steel top plate. Base plate embedded in oil resistant neoprene. Mount sized by manufacturer based on unit weight.
- G. Electrical Disconnect: Factory provided NEMA 1 disconnect compatible with ECM motor controls.

PART 3 EXECUTION**3.01 INSTALLATION**

- A. Install fans with resilient mountings and flexible electrical leads.
- B. Install flexible connections between fan inlet and discharge ductwork. Ensure metal bands of connectors are parallel with minimum one inch (1") flex between ductwork and fan while running.
- C. Install fan restraining snubbers. Adjust snubbers to prevent tension in flexible connectors when fan is operating.

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- D. Provide sheaves required for final air balance.
- E. Provide safety screen where inlet or outlet is exposed.
- F. Pipe scroll drains to nearest floor drain.
- G. Provide backdraft dampers on discharge of exhaust fans and as indicated.
- H. Do not operate fans in normal operation until ductwork is clean, filters are in place, bearings are lubricated, and fan has been test run under observation.

3.02 SCHEDULES

- A. See drawings.

END OF SECTION

**SECTION 23 3418
DESTRATIFICATION FANS**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Destratification fans

1.02 RELATED SECTIONS

- A. Section 26 00 00 Electrical

1.03 REFERENCES

- A. UL 507: Underwriters Laboratory Standard for Electric Fans
- B. CE: Product is certified to meet EU consumer safety, health or environmental requirements.
- C. UL 94 5VA: Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.
- D. NEC: National Electric Code.
- E. ETL: Listed for US and Canada in Intertek Directory of Listed Products.

1.04 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents
 - 4. Have options clearly indicated as applicable to each submittal
- B. Construction submittal
 - 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data indicating fan power, fan RPM, sound power levels, electrical characteristics, connection requirements, mounting recommendations and controller information.
 - b. chop Drawings indicating product dimensions, weight, and attachment methods.
- C. Closeout submittal
 - 1. After project substantial completion, provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Warranty documentation, fully filled out and including start-up and start date information.
 - b. Operation and Maintenance Information

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with a minimum of three (3) years of product experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Transport, handle, store and protect products under provisions of Architectural Specifications.
- B. Protect motors, shafts and bearings from weather and construction dust.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Airius Air Pear

- B. Zoo Fans
- C. Engineer approved equal.

2.02 DESTRATIFICATION FANS

- A. Performance: Fans shall provide columnar laminar airflow to produce a minimum of 100 fpm at center of column at grade level when installed within 2'-0" of ceiling. Fans shall create a homogeneous air temperature from floor to ceiling.
- B. Housing: The fan housing shall be made of PC/ABS resin, rated 5VA for flame resistance.
 - 1. Housing color shall be selected by Architect.
- C. Safety Cable: Provide 6'-0" steel cable fastened to seismic restraint point integrated into housing.
- D. Accessories: Manufacturer's ceiling mounting kit. Provide safety screen where inlet or outlet is exposed.
- E. Power Cord: 6 foot, 300-volt AC, UL rated. Motors within the voltage range of 100-130VAC shall be provided with a standard 3-prong plug.
- F. Destratification Fans
 - 1. Shaded Pole Motor:
 - a. Blades molded in one piece with hub. Ball bearings shall be permanently lubricated and shielded.
 - b. Electrical Requirements:
 - 1) See schedule.
 - 2) Controls shall be coordinated with motor electrical requirements.
 - 3) Shall be an inline, wall mounted, controller for variable speed and on/off.
 - 4) Shall be an inline controller. Accepts 0-10VDC control signal from BAS.
 - 2. EC Motor:
 - a. Electronically commutated motor, up to 92% efficient. Plastic blades and hub. Ball bearings shall be permanently lubricated and shielded.
 - b. Electrical Requirements:
 - 1) See schedule.
 - 2) Controls:
 - 3) Shall be controlled by 0-10VDC control signal via BAS. Uses low voltage control circuit.
 - 4) Shall be controlled by wall mounted potentiometer. Uses low voltage control circuit.
 - 5) Shall be 2-speed, factory programmed. Wired at floor level to two single-pole switches for on/off and speed one/speed two operations. Uses mains and 3rd conductor for speed switching.
 - 3. Motor (EC or EL): Electronically commutated motor, up to 92% efficient. Steel blades welded to steel hub. Ball bearings shall be permanently lubricated and shielded.
 - a. Electrical Requirements:
 - 1) See schedule.
 - b. Controls shall be coordinated with motor selection (EC or EL).
 - 1) EC motor shall be controlled by 0-10VDC control signal via BAS. Uses low voltage control circuit.
 - 2) EC motor shall be controlled by wall mounted potentiometer. Uses low voltage control circuit.
 - 3) EL motor shall be controlled by a Controller with the ability to control/monitor speed, blade rotation direction, runtime, 24/7/365 scheduling and error reporting. Requires 120VAC, single phase power. Monitoring/control connection is made via an Ethernet cable directly to a

PC or a PC on a local area network (LAN). An Ethernet drop should be provided within 6 ft of the Controller installation location if connecting to a LAN.

(a) Wired. Daisy chained low voltage wires between fans and linked to Controller.

(b) Wireless mesh network, 2.4Ghz modified ZigBee protocol.

4. Motor (P2):

a. Permanent split capacitor, 2-pole motor. Steel blades welded to steel hub. Ball bearings shall be permanently lubricated and shielded.

b. Electrical Requirements:

1) See schedule.

c. Controls shall be coordinated with motor electrical requirements.

1) Shall be an inline, wall mounted, controller for variable speed and on/off.

2) Shall be an inline controller. Accepts 0-10VDC control signal from BAS.

5. Motor (P4): Permanent split capacitor, 4-pole motor. Steel blades welded to steel hub. Ball bearings shall be permanently lubricated and shielded.

a. Electrical Requirements:

1) See schedule.

b. Controls shall be coordinated with motor electrical requirements.

1) Shall be an inline, wall mounted, controller for variable speed and on/off.

2) Shall be an inline controller. Accepts 0-10VDC control signal from BAS.

2.03 ACCESSORIES

A. PHI Air Purification Kit: Photohydroionization cell for mitigation of airborne bacteria, viruses, odors, and VOCs.

1. Product: RGF Environmental; PHI-Cell Kit.

2. Size: Coordinate with standard or short housing size.

a. Small: 5 inch cell, sized to fit Short housings.

b. Medium: 9 inch cell, sized to fit Standard housings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until supporting structure and interior work have been properly completed.

B. Check location and availability of utility services to ensure proper voltage and installation preparation.

C. Installation of miscellaneous support, if required, electrical wire and wiring, conduit, fuses, and disconnect switches other than those provided by fan manufacturer are specified in other sections.

D. Examine the substrate and conditions under which the Fan is to be installed. Notify the Architect in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install destratification fan according to manufacturer's written recommendations.

B. Fan to be mounted at a maximum of 2'-0" from ceiling deck to ensure thermal/humidity equalization from ceiling to floor.

C. Adjust unit as required for proper operation in accordance with manufacturer's installation instructions.

3.03 PROTECTION

A. Protect installed products until completion of project.

- B. Touch-up, repair or replace damaged products before Substantial Completion.

3.04 SCHEDULE

- A. See drawings.

END OF SECTION

**SECTION 23 3423
HVAC POWER VENTILATORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cabinet and ceiling exhaust fans

1.02 RELATED SECTIONS

- A. Specification Section 23 3100 - HVAC Ducts and Casings
- B. Specification Section 23 3300 - Air Duct Accessories

1.03 REFERENCES

- A. AMCA 99 - Standards Handbook
- B. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes
- C. AMCA 261 - Directory of Products Licensed to Bear the AMCA Certified Ratings Seal
- D. AMCA 300 - Test Code for Sound Rating Air Moving Devices
- E. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices
- F. NEMA MG1 - Motors and Generators
- G. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease Vapors from Commercial Cooking Equipment
- H. UL 705 - Power Ventilators

1.04 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents
 - 4. Have options clearly indicated as applicable to each submittal
- B. Construction submittal
 - 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data indicating fan power, fan RPM, sound power levels, electrical characteristics, connection requirements, mounting recommendations and controller information.
 - b. Shop Drawings indicating product dimensions, weight, and attachment methods.
- C. Closeout submittal
 - 1. After project substantial completion, provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Warranty documentation, fully filled out and including start-up and start date information.
 - b. Operation and Maintenance Information

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.06 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.01 CABINET AND CEILING EXHAUST FANS

- A. Manufacturers:
 - 1. Greenheck
 - 2. Cook
 - 3. Carnes
 - 4. PennBarry
 - 5. Twin City Fan
 - 6. Acme
 - 7. Loren Cook
 - 8. Engineer approved equal.
- B. Performance: See drawings.
- C. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with 1/2 inch acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
- D. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes and materials indicated.
- E. Disconnect Switch: Cord and plug in housing for thermal overload protected motor.
- F. Grille: Molded white plastic or aluminum with baked white enamel finish.
- G. Sheaves: Steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
- H. Provide wall mounted solid state speed controller where indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure roof or wall exhausters with cadmium plated steel lag screws to roof curb or structure.
- C. Extend ducts to roof or wall exhausters into roof curb or structure. Counterflash duct to roof or wall or opening.
- D. Hung Cabinet Fans:
 - 1. Install fans with resilient mountings and flexible electrical leads.
 - 2. Install flexible connections between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
- E. Provide sheaves required for final air balance.
- F. Install backdraft dampers on inlet to roof and wall exhausters.
- G. Provide backdraft dampers on outlet from cabinet and ceiling exhaust fan fans.
- H. Do not operate fans until ductwork is clean, filters are in place, and bearings are lubricated.
- I. Support ceiling fans from structure.
- J. If equipment is to be operated prior to building turn over to the owner, the mechanical contractor must install filter media on all return and exhaust grilles. The contractor shall provide documentation that filters have been checked on a daily basis.

3.02 EXAMINATION

- A. Examine areas to receive fans. Notify the Design Team Engineer of conditions that would adversely affect installation or subsequent utilization and maintenance of fans.

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3.03 SCHEDULES

A. See drawings.

HVAC POWER VENTILATORS

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END OF SECTION

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**SECTION 23 3700
AIR OUTLETS AND INLETS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Diffusers/registers/grilles
- B. Louvers
- C. Goosenecks

1.02 REFERENCES

- A. ADC 1062 - Certification, Rating and Test Manual
- B. AMCA 500 - Test Method for Louvers, Dampers and Shutters
- 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 - HVAC Duct Construction Standard - Metal and Flexible
- F. NFPA 70 - National Electrical Code
- G. NFPA 90A - Installation of Air Conditioning and Ventilating Systems

1.03 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents
 - 4. Have options clearly indicated as applicable to each submittal
- B. Construction submittal
 - 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data: Contractor shall review outlets and inlets as to size, finish, and type of mounting prior to submission. Review ceiling type and style before submitting.
 - b. Schedule of outlets and inlets showing type, size, location, application, and noise level.
- C. Project Record Documents
 - 1. Indicate final installed locations of all components on a PDF floor plan

1.04 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.
- B. Test and rate louver performance in accordance with AMCA 500.

1.05 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years experience.

PART 2 PRODUCTS

2.01 DIFFUSERS/REGISTERS/GRILLES

- A. Manufacturers:
 - 1. Titus
 - 2. Carnes

3. Tuttle & Bailey
4. Price Ind.
5. Krueger
6. Nailor
7. Engineer approved equal.

B. Refer to schedule on drawings for style, size, and finish.

2.02 LOUVERS

- A. Manufacturers:
1. Ruskin
 2. American Warming
 3. Louvers and Dampers, Inc.
 4. Pottorff
 5. Greenheck
 6. United Enertech
 7. Air Balance
 8. Engineer approved equal.
- B. Type: Drainable blades on 37-1/2 degree slope, heavy channel frame bird screen with 1/2 inch square mesh for exhaust and 3/4 inch for intake. (See drawings).
- C. Fabrication: Extruded aluminum, 0.080 inch thick welded assembly with factory anodized finish. Color to be selected by architect. Architect has authority to select multiple colors.
- D. Mounting: Furnish with exterior flat flange for installation. Verify with architect prior to ordering.
- E. Interior louvers shall be constructed of 0.125 inch thickness with welded construction.
- F. Refer to drawings for louver dimensions.

2.03 GOOSENECKS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, of minimum 18 gauge galvanized steel.
- B. Mount on minimum 12 inch high curb base where size exceeds 9 inch x 9 inch.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position and type to conform to architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with airtight connection.
- D. Provide balancing dampers on duct take-off to diffusers, grilles and registers, despite 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. Provide a cable operated damper or access panel where a balancing damper is located above gypsum ceilings or in an inaccessible location. Externally cable operated damper shall be similar to Ruskin ZCDR25.

3.02 SCHEDULES

- A. See drawings.

END OF SECTION

**SECTION 23 5400
FURNACES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Furnaces
- B. Condensing units
- C. Thermostats

1.02 RELATED SECTIONS

- A. Specification Section 23 0548 - Vibration and Seismic Controls for HVAC Piping and Equipment
- B. Specification Section 23 0553 – Identification for HVAC Piping and Equipment
- C. Specification Section 23 0713 - Duct Insulation
- D. Specification Section 23 1123 – Natural Gas and Propane Piping
- E. Specification Section 23 2300 – Refrigerant Piping and Specialties

1.03 REFERENCES

- A. ANSI/AHRI 210/240 - Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment
- B. ANSI/AHRI 270 - Sound Rating of Outdoor Unitary Equipment
- C. ANSI/AHRI 520 – Performance Rating of Positive Displacement Condensing Units
- D. ASHRAE 23 – Methods of Testing for Rating the Performance of Positive Displacement Refrigerant Compressors and Condensing Units That Operate at Subcritical Temperatures
- E. ASHRAE 15 - Safety Code for Mechanical Refrigeration
- F. ASHRAE 52 - Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter
- G. ASHRAE 90 - Energy Conservation in New Building Design
- H. ASHRAE 103 - Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers
- I. NFPA 31 - Installation of Oil Burning Equipment
- J. NFPA 54 (AGA Z223.1) - National Fuel Gas Code
- K. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
- L. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems
- M. NFPA 211 - Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances
- N. UL 207 - Refrigerant-Containing Components and Accessories, Non-Electrical

1.04 SUBMITTALS

- A. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data and wiring diagrams and unit supports.
- B. Shop Drawings: Indicate assembly, required clearances, location and size of field connections.
- C. Design Data: Indicate refrigerant pipe sizing and routing.
- D. Manufacturer's Instructions: Indicate rigging, assembly and installation instructions.
- E. Project Record Documents: Record actual locations of components and connections.

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- F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating installation instructions, maintenance and repair data, and parts listing.
- G. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in owner's name and registered with manufacturer.

1.05 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.06 WARRANTY

- A. Comprehensive parts and labor warranty for furnace, condensing unit and thermostat for 12 months after start of beneficial use by owner or 18 months after date of shipment from factory, whichever is sooner.
- B. Parts warranty for compressor from end of comprehensive warranty until four years later.
- C. Parts warranty for heat exchanger from end of comprehensive warranty until nine years later.
- D. Warranties must not be pro-rated.

PART 2 PRODUCTS**2.01 FURNACES (GAS FIRED)**

- A. Manufacturer:
 - 1. Lennox
 - 2. Carrier
 - 3. Trane
 - 4. Heil
 - 5. York
 - 6. Engineer approved equal.
- B. Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, natural gas heating section, controls, and accessories; wired for single power connection with control transformer.
- C. Airflow Configuration: See schedule on drawings.
- D. Heating: Single stage natural gas fired.
- E. Electric Refrigeration: Refrigerant cooling coil and outdoor package containing compressor, condenser coil and condenser fan.
- F. Accessories: See schedule on drawings.
- G. Provide with factory external filter cabinet with one inch (1") thick MERV 6 filter.
- H. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, fiberglass insulation with reflective liner.
- I. Supply Fan: Centrifugal type rubber mounted.
- J. Motor: PSC, permanently lubricated.
- K. Heat Exchanger: Aluminized steel welded construction with aluminum finned stainless steel tube condensing coil.
- L. Gas Burner:
 - 1. Sealed combustion with blower.
 - 2. Gas valve provides 100% safety gas shut-off; 24 volt combining pressure regulation, safety pilot, pilot filtration, and automatic electric valve.
 - 3. Electronic pilot ignition with electric spark igniter.
 - 4. Non-corrosive combustion air blower with permanently lubricated motor.
- M. Gas Burner Safety Controls:

1. Thermocouple Sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.
 2. Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on excessive bonnet temperature, automatic resets.
- N. Operating Controls:
1. Room Thermostat: Cycles burner to maintain room temperature setting.
 2. Supply Fan Control: Energize from bonnet temperature independent of burner controls with adjustable timed off delay and fixed timed on delay with manual switch for continuous fan operation.
- O. Performance:
1. Ratings: Energy Efficiency Rating (EER) not less than requirements of ASHRAE 90A; seasonal efficiency to ASHRAE 103.
 2. Refer to Furnace Schedule. Gas heating capacities are sea level ratings.

2.02 CONDENSING UNITS

- A. Manufacturer:
1. Match furnace manufacturer.
- B. Construction and Ratings: In accordance with ANSI/AHRI 210/240, and UL 207. Testing: ASHRAE 14.
- C. Compressor: ANSI/AHRI 520; Scroll; hermetic, resiliently mounted integral with condenser with positive lubrication, crankcase heater, high pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling.
- D. Refrigeration Accessories: Filter drier, high pressure switch, low pressure switch, service valves and gauge ports, and thermometer well. Provide refrigerant lines, factory cleaned, dried, pressurized and sealed with insulated suction line.
- E. Air Cooled Condenser: ANSI/AHRI 520; aluminum fin and copper tube coil with direct drive axial propeller fan resiliently mounted, and galvanized fan guard. See capacity schedule on the drawings.
- F. Electrical Characteristics: See schedule on the drawings.
- G. Disconnect Switch: Field mounted disconnect by electrical contractor.
- H. Refrigeration Operating Controls:
1. Room Thermostat: Cycles condensing unit and supply fan to maintain room temperature setting.
 2. Low Ambient Kit: Provide low ambient controls to allow compressor to start and run at 30°F.

2.03 THERMOSTATS

- A. Manufacturer:
1. Honeywell Vision Pro 8000
 2. Lennox Comfortsense
 3. White-Rodgers
 4. Engineer approved equal.
- B. Electric Solid State Micro-Computer Based Room Thermostat:
1. Minimum of one stage of gas heat and two stages of cooling.
 2. Touch screen.
 3. Preferential rate control to minimize overshoot and deviation from setpoint.
 4. Set-up for four separate temperatures per day.
 5. Instant override of setpoint for continuous or timed period from one hour to 31 days.
 6. Short cycle protection.

7. Programming based on every day of the week.
8. Selection features including degree F or degree C display, 12 or 24 hour clock, keyboard disable, and fan on-auto.
9. Battery replacement without program loss.
10. Heat pump compressor lockout.
11. Keypad lockout.
12. Early startup capabilities to reach setpoint at desired time of day.
13. Thermostat Display:
 - a. Time of day.
 - b. Actual room temperature.
 - c. Programmed temperature.
 - d. Programmed time.
 - e. Duration of timed over ride.
 - f. Day of week.
 - g. System Mode Indication: Heating, cooling, auto, off, fan auto, fan on.
 - 1) If schedule is in occupied, cycle the fan with heating or cooling demand.
 - 2) Remind user to replace filter after 60 fan run days.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that the floors are ready for installation of units and openings are as indicated on the shop drawings.
- B. Verify proper power supply is available for furnace and condenser package.
- C. Verify proper fuel supply is available for connection.
- D. Verify water supply is available for humidifier.

3.02 INSTALLATION

- A. Install in accordance with NFPA 90A and NFPA 90B.
- B. Install gas fired furnaces in accordance with ANSI Z223.1 NFPA 54.
- C. Provide vent connections in accordance with NFPA 211.
- D. Install refrigeration systems in accordance with ASHRAE 15.
- E. Mount furnaces on 4" concrete pad with neoprene vibration isolators.
- F. Mount air-cooled condensing unit on four-inch concrete pad on grade. See drawings for location.
- G. This contractor is responsible for all control wiring.
- H. Provide a one-hour enclosure around PVC intake and vent piping located in a ceiling return air plenum.
- I. Insulate vent and intake piping in accordance to manufacturer's recommendations.
- J. All thermostats shall be installed per all applicable ADA Codes and Guidelines.
- K. Pipe drain from cooling coils and humidifiers to nearest floor drain. Install per manufacturer's instructions.
- L. Refrigerant piping shall be sized and installed per manufacturer requirements. Provide necessary accessories for long-line application as required.

END OF SECTION

**SECTION 23 5533
FUEL FIRED UNIT HEATERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Gas fired unit heaters
- B. High intensity infrared heaters (Vantage)
- C. Room thermostats

1.02 RELATED SECTIONS

- A. Specification Section 23 0548 - Vibration and Seismic Controls for HVAC Piping and Equipment
- B. Specification Section 23 0713 - Duct Insulation
- C. Specification Section 23 0913 - Instruments and Control Devices for HVAC
- D. Specification Section 23 5100 - Breechings, Chimneys, and Stacks

1.03 REFERENCES

- A. ASHRAE 103 - Heating Seasonal Efficiency of Central Furnaces and Boilers, Methods of Testing
- B. NEMA MG 1 - Motors and Generators
- C. NFPA 54 (AGA Z223.1) - National Fuel Gas Code
- D. NFPA 70 - National Electrical Code
- E. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
- F. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems
- G. NFPA 211 - Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's literature and data indicating rated capacities, weights, accessories, electrical nameplate data and wiring diagrams.
- B. Shop Drawings: Indicate assembly, required clearances, locations and sizes of field connections.
- C. Manufacturer's Instructions: Indicate rigging, assembly and installation instructions.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance, repair data and parts listing.
- E. Warranty: Submit manufacturers warranty and ensure forms have been filled out in owner's name and registered with manufacturer.

1.05 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.06 WARRANTY

- A. Provide manufacturers warranty for heat exchangers.

1.07 EXTRA MATERIALS

- A. Provide one set of filters to be installed when heating units are turned over to the owner.

PART 2 PRODUCTS

2.01 GAS FIRED UNIT HEATERS

- A. Manufacturer: See schedule on drawings.

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- B. Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner, controls, and accessories:
- C. Heating: Natural gas fired.
- D. Discharge Louvers: Individually adjustable horizontal louvers to match cabinet finish.
- E. Downturn Nozzle: Nozzle to match outlet and cabinet finish where applicable.
- F. Poly-Tube Outlet Adapter: Transition duct to adapt from unit outlet to round outlet flange for polyethylene tube duct where applicable.
- G. Cabinet: Galvanized steel with baked enamel finish easily removed and secured access doors, fiberglass insulation and reflective liner.
- H. Supply Fan: As per schedule on drawings.
- I. Heat Exchanger: Aluminized steel welded construction.
- J. Gas Burner:
 - 1. Atmospheric type with adjustable combustion air supply,
 - 2. Gas valve, two stage provides 100% safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (on-off), pilot filtration, automatic electric valve.
 - 3. Electronic pilot ignition with electric spark igniter.
 - 4. Combustion air damper with synchronous spring return damper motor.
 - 5. Non-corrosive combustion air blower with permanently lubricated motor.
- K. Gas Burner Safety Controls:
 - 1. Thermocouple Sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.
 - 2. Flame Roll Out Switch: Installed on burner box and prevents operation.
 - 3. Vent Safety Shutoff Sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.
 - 4. Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on excessive bonnet temperature, automatic resets.
- L. Operating Controls:
 - 1. Room Thermostat: Cycles burner to maintain room temperature setting.
 - 2. Supply Fan Control: Energize from bonnet temperature independent of burner controls with adjustable timed off delay and fixed timed on delay with manual switch for continuous fan operation.
- M. Performance: See schedule on drawings.

2.02 HIGH INTENSITY INFRARED HEATERS (VANTAGE)

- A. Manufacturer:
 - 1. Roberts Gordon Vantage III
 - 2. Detroit Radiant
 - 3. Engineer approved equal.
- B. Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, heat exchanger, burner, reflector, controls.
- C. Cabinet: Galvanized steel with baked enamel finish/sealed burner box.
- D. Tube: Heat treated aluminized steel tube.
- E. Gas Burner:
 - 1. Atmospheric type with adjustable combustion air supply,
 - 2. Gas valve provides 100% safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (on-off), pilot filtration, automatic electric valve.
 - 3. Electronic hot surface ignition with safety shut-off provided by manufacturer.

- F. Gas Burner Safety Controls: Thermo-couple sensor prevents opening of solenoid gas valve until pilot flame is proven and stops gas flow on ignition failure.
- G. Room Thermostat: 120V line voltage zone sensor.
- H. Performance: Refer to schedule on drawings.
- I. Provide Class B gas vent pipe and bird proof roof cap and terminate in accordance to manufacturer's recommendations.
- J. Provide insulated combustion air duct with bird proof intake roof cap and terminate in accordance to manufacturer recommendations.

2.03 ROOM THERMOSTATS

- A. Manufacturer:
 - 1. Honeywell
 - 2. Engineer approved equal.
- B. Adjustable Room Thermostat: Low voltage, to control burner operation, heater stages in sequence with delay between stages, compressor and condenser fan and supply fan to maintain temperature setting. Include system selector switch (heat-off-cool) and fan control switch (auto-on).
- C. Electric Solid State Microcomputer Based Room Thermostat with Remote Sensor:
 - 1. Automatic switching from heating to cooling.
 - 2. Preferential rate control to minimize overshoot and deviation from setpoint.
 - 3. Set-up for four separate temperatures per day.
 - 4. Instant override of setpoint for continuous or timed period from one hour to 31 days.
 - 5. Short cycle protection.
 - 6. Programming based on every day of the week.
 - 7. Selection features including deg F or deg C display, 12 or 24 hour clock, keyboard disable, remote sensor, fan-on-auto.
 - 8. Battery replacement without program loss.
 - 9. Thermostat Display:
 - a. Time of day.
 - b. Actual room temperature.
 - c. Programmed temperature.
 - d. Programmed time.
 - e. Duration of timed over ride.
 - f. Day of week.
 - g. System Mode Indication: Heating, cooling, auto, off, fan auto, fan on.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that space is ready for installation of units and openings are as indicated on shop drawings.
- B. Verify that proper power supply is available.
- C. Verify that proper fuel supply is available for connection.

3.02 INSTALLATION

- A. Install in accordance with NFPA 90A and NFPA 90B.
- B. Install gas fired units to NFPA 54.
- C. Provide vent connections to NFPA 211.
- D. Provide type "B" gas flue with flashing and bird proof cap.
- E. Install unit heaters and/or packaged air units with vibration isolation.

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FUEL FIRED UNIT HEATERS

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- F. Provide operating controls.
- G. Provide connection to electrical power systems.

3.03 SCHEDULES

- A. See drawings.

END OF SECTION

SECTION 23 8101

TERMINAL HEAT TRANSFER, CONVECTION HEATING, AND COOLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electric wall heaters

1.02 REFERENCES

- A. NFPA 70 - National Electrical Code
- B. UL 303 - Refrigeration and Air-Conditioning Condensing and Compressor Units

1.03 SUBMITTALS

- A. Product Data: Provide typical catalog of information including arrangements.
- B. Shop Drawings:
 - 1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
 - 2. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers and comparison of specified heat required to actual heat output provided.
 - 3. Indicate mechanical and electrical service locations and requirements.
- C. Manufacturer's Instructions: Indicate installation instructions and recommendations.
- D. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valve.
- E. Operation and Maintenance Data: Include manufacturers descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.
- F. Warranty: Submit manufacturer's warranty and ensure forms have been completed in owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three-years experience.

1.05 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.

1.06 WARRANTY

- A. Provide one-year manufacturer's warranty for condensing units and compressors.

PART 2 PRODUCTS

2.01 ELECTRIC WALL HEATERS

- A. Manufacturers:
 - 1. Berko
 - 2. Heatrex
 - 3. Indeeco
 - 4. Markel
 - 5. Raywall
 - 6. Brasch
 - 7. Engineer approved equal.
- B. Coils: Industrial grade steel finned tubular elements.

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- C. Cabinet: 18 gauge steel housing (4-1/2" deep) with Extruded aluminum heavy duty architectural grille. Provide surface, recessed, or semi-recessed mount kit. Confirm mounting type with the design team.
- D. Finish: Polyester powder paint finish. Architect shall select color from standard color chart.
- E. Fans: Propeller fan, statically and dynamically balanced, direct driven, permanently lubricated bearings.
- F. Motor: Permanently lubricated, totally enclosed motor.
- G. Control: Integral thermostat with Fan On/Auto switch.
- H. Electrical: Integral disconnect switch.
- I. Submit color chart for architectural approval.

PART 3 EXECUTION**3.01 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install equipment exposed to finished areas after walls and ceilings are finished and painted. Avoid damage.
- C. Protection: Provide finished cabinet units with protective covers during balance of construction.
- D. Unit Heaters: Hang from building structure with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.
- E. Cabinet Unit Heaters: Install as indicated. Coordinate to assure correct recess size for recessed units.
- F. Units with Cooling Coils: Provide drain pan with indirect connection to condensate drain.
- G. Install electric heating equipment, including devices furnished by the manufacturer, but not factory mounted. Furnish copy of manufacturer's wiring diagram submittal. Install electrical wiring in accordance with manufacturer's submittals.
- H. Install refrigeration systems in accordance with ASHRAE 15.
- I. Mount air-cooled condensing unit on rooftop supports. See drawings on location.

3.02 CLEANING

- A. After construction is completed, including painting, clean exposed surfaces of all units. Vacuum clean the coils and inside of the cabinets.
- B. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.
- C. Install new filters.

3.03 SCHEDULES

- A. See drawings.

END OF SECTION

**SECTION 26 0050
BASIC ELECTRICAL REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Basic Electrical Requirements specifically applicable to Electrical Division Specification Sections.
- B. Division 26 Specification requirements also include, by reference, all Division 00 and 01 specification sections. This contractor is responsible to review these specification sections. Requirements of these specification sections are included as a part of this contract.
- C. Division 26 Specification requirements also include, by reference, Specification Section 08 7100 - Door Hardware. Review and inclusion of the electrical requirements of this specification section are included as a part of this contract.

1.02 WORK BY OWNER

- A. Owner's Responsibility:
 - 1. Arrange for and deliver owner reviewed shop drawings, product data and samples to contractor.
 - 2. Arrange and pay for product delivery to site.
 - 3. On delivery, inspect products jointly with contractor.
 - 4. Submit claims for transportation damage and replace damaged, defective or deficient items.
- B. Contractor's Responsibility:
 - 1. Review owner reviewed shop drawings, product data and samples.
 - 2. Review and unload owner purchased materials at site, inspect for completeness and/or damage jointly with the owner.
 - 3. Handle, store, install and finish products. Install electrical wiring and devices.
 - 4. Repair and/or replace items damaged after receipt.
- C. Contractor shall be aware Owner may purchase equipment where Contractor has specific responsibilities.

1.03 OWNER OCCUPANCY

- A. The owner will not occupy the premises during the construction period.
- B. Limit use of site and premises to allow owner occupancy.
- C. Cooperate with the owner to minimize conflict and to facilitate owner's operations.
- D. Schedule the work to accommodate this requirement.

1.04 REGULATORY REQUIREMENTS

- A. This contractor shall give proper authorities all requisite notices relating to work in their charge, obtain official permits, licenses for temporary construction and pay proper fees for it.
- B. This contractor is to be solely answerable for and shall promptly make good all damage, injury or delay to other contractors, to neighboring premises or to persons or property of the public by themselves, by their employees or through any operation under their charge, whether in the contract or extra work.
- C. No attempt has been made to reproduce in these specifications any of the rules or regulations contained in city, state or federal ordinances and codes pertaining to the work covered by these specifications that the contractor be thoroughly familiar with all such ordinances and codes.

- D. The fact that said various rules, regulations and ordinances are not repeated in this specification does not relieve the contractor of the responsibility of making the entire installation in accordance with the requirement of those authorities having jurisdiction.
- E. All work shall comply with the applicable recommendations of:
 - 1. The National Board of Fire Underwriters
 - 2. The ANSI-NFPA 70 National Electrical Code
 - 3. The National Fire Protection Association (NFPA)
 - 4. The Occupations Safety and Health Act (OSHA)
 - 5. IBC Building Code (current) and any current applicable city building and or electrical codes.
 - 6. Fire Protection: Conform to International Fire Code (IFC) and NFPA.
 - 7. International Energy Conservation Code (IECC)
- F. Obtain permits and request inspections from authority having jurisdiction.
- G. Conform to latest approved versions of codes.

1.05 PROJECT/SITE CONDITIONS

- A. Install work in locations shown on drawings unless prevented by project conditions.
- B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other sections. Obtain permission of owner and architect/engineer before proceeding.
- C. This contractor, before submitting their bid, shall visit the site of the project to familiarize themselves with locations and conditions affecting their work.
- D. It is the intent of this specification that the contractor furnish all labor and material required to complete the installation as outlined in the drawings and specifications. No additions to the contract price will be allowed due to the failure of this contractor to properly evaluate the effect of existing conditions on the work to be done under this contract.
- E. Whenever renovation or remodeling or relocation of existing equipment is included in the contract, it is imperative that all locations of existing wiring conduits, electrical panels, equipment, services and grades be noted on the job site before bid is submitted and that all elevations and grades be verified before roughing in new work.
- F. This contractor shall provide, as necessary, for the installation of their work and in accordance with materials other than the structure.

1.06 SEQUENCING AND SCHEDULING

- A. This contractor shall arrange their work in order that it progresses along with the general construction of the building.
- B. This contractor shall be kept informed as to the work of other trades engaged in the project and shall execute their work in such a manner so as not to delay or interfere with progress of other contractors.
- C. Where space for mechanical and electrical lines and piping is limited, it is imperative that all such trades coordinate their work so as to ensure concealment in space provided. Where conflict exists, the engineer shall decide priority of space. If work is not properly coordinated, the engineer may require removal and relocation of work without additional compensation.

1.07 GUARANTEE

- A. This contractor shall guarantee all of the apparatus, materials, equipment furnished, and labor installed under this contract for a period of one year after date of final acceptance, unless a longer period is specified.
- B. Neither final certificate of payment nor any provisions in the contract documents nor partial or complete occupancy of premises by owner shall constitute an acceptance for

work not done in accordance with contract documents or relieve the contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship.

- C. Should any defects arise as the result of defective workmanship or material within the guarantee period set forth, this contractor shall make the necessary correction at their own expense.

1.08 ENGINEER APPROVED EQUAL PRODUCTS

- A. When the engineer, at the request of the interested parties, including the contractor, supplier and manufacturer approved "engineer approved equal" products for this project, such products are approved on the assumption that they will equal or exceed the performance of the products specified.
- B. If such products do not do so after being installed on this project, this contractor shall replace or modify the particular product as necessary to equal the performance of the products specified at no expense to the owner, architect or engineer.
- C. Request for "engineer approved equal" products shall be received by the architect/engineer prior to the last addendum being issued. Requests for substitutions received after this date will not be considered. Substitution requests shall clearly state which products are being considered for substitution. Substitution requests shall include all pertinent product information needed to evaluate the substitution as an "equal".
- D. Similar products shall be all of the same manufacturers and style. There is no exception to this unless prior approval has been granted from engineer.

1.09 OWNER'S RIGHT OF SALVAGE

- A. Before beginning construction, the contractor shall check and verify with the owner each item of existing equipment that must be removed.
- B. The owner will designate which items of material or equipment not reused that they may wish to keep. The contractor shall then remove these items with care and store in a location designated by the owner for the owner's disposal.
- C. All other items of equipment to be removed and not specified for reuse in new construction or reserved by the owner for their use shall become the property of the contractor and shall be removed from the site.

1.10 PROTECTION AND MAINTENANCE

- A. The work covered by these drawings and specifications may involve work in both new and remodeled areas of the building.
- B. Where necessary to connect to any existing utility service, this electrical contractor shall contact the owner and shall coordinate any building service connection with the owner so that normal operation to the building is disrupted as little as possible.
- C. Any work to be done in existing structures shall be coordinated with the owner and arrangements made so that traffic flow may be maintained and areas finished where possible before other areas are begun.
- D. This contractor shall protect existing equipment in finished areas from dirt, dust and damage as a result of their work.
- E. Coordinate protection requirements with department heads before beginning construction.
- F. Protect any building openings from unauthorized entry. Coordinate with owner where building entry must be controlled.

1.11 DEMOLITION

- A. This contractor shall be responsible for the demolition and removal of all existing electrical elements within the project area except as follows:

1. Elements shown on the drawings as "existing to remain and/or to be reused".
 2. Elements serving adjacent areas.
 3. Elements required for the support of the newly remodeled areas.
 4. All elements to be removed are subject to the Owner's Right of Salvage.
- B. Preserve services to the existing facility. Extend/reroute/reconnect the existing systems as required providing for the continued function of these systems.

1.12 CUTTING AND PATCHING

- A. This contractor shall do all cutting and patching necessary for the installation of his work in all existing and new buildings unless otherwise noted.
- B. In areas where the integrity of new or existing fire separation assembly/wall is compromised by the work, this contractor shall be responsible to patch and/or seal openings as necessary to maintain and/or return fire separation to rating as required by applicable codes.
- C. This contractor shall do all cutting and patching required for his work beyond the remodeled areas unless otherwise noted. All finish work shall include patching to match existing adjacent surfaces. Painting shall be by others.

1.13 DAILY HOUSEKEEPING AND CLEANING

- A. At the end of each workday, the contractor shall remove all of their debris, rubbish, tools, and surplus materials from the project work area. The work area shall be broom cleaned and left in a neat and orderly condition. The contractor shall not use the owner's waste disposal facility for the removal of debris from the project.
- B. At end of construction, all equipment shall be cleaned and the premises left in first class condition as far as this contractor's work is concerned.

1.14 CLEANING AND RUBBISH

- A. This contractor, upon completion of their work, shall remove all rubbish and debris resulting from their operation and shall remove it from site at their own expense.
- B. As far as their work is concerned, all equipment shall be cleaned and the premises left in first class condition.
- C. This contractor shall maintain the work area each day to prevent hazardous accumulation of waste from their work.

1.15 SEALING AND PENETRATION

- A. Clearance around the piping passing through fire or smoke rated construction shall be sealed to maintain the rated integrity of the construction (1 hr. 2 hrs. etc.). One and two-hour rated assemblies are to be patched on both sides of the assembly.
- B. This contractor shall verify rating and location of all such construction with the architectural drawings and seal all penetrations.
- C. Manufacturer offering products to comply with the requirements include the following:
1. Dow Corning "Silicone RTV Foam"
 2. 3-M Corporation "Fire Barrier Caulk and Putty"
 3. Thomas & Betts "Flame Safe Fire Stop System"
- D. Installation of these products are to be in strict accordance with the manufacturer's recommendations.
- E. This contractor shall submit shop drawings showing approved sealing assemblies to be utilized on this project.

1.16 ELECTRICAL CONNECTIONS

- A. This contractor shall mount and wire all magnetic starters, thermal protective switches, and speed changing switches furnished under the mechanical contract and install such

starters and switches and wire them to their respective motors as a part of the electrical contract.

- B. All other magnetic starter switches, safety switches and speed control devices indicated on the electrical drawings or specifications are the responsibility of the electrical contractor to furnish and install.
- C. Unless specifically stated elsewhere, the wiring of the temperature control system shall be the responsibility of the mechanical contractor.
- D. The contractor shall provide line voltage power and rough-in for Fire Alarm system. Coordinate required line voltage and installation locations prior to bid.

1.17 HAZARDOUS MATERIALS

- A. If the contractor stores any hazardous solvents or other materials on the site, they shall obtain copies of the safety data sheets for the materials and post them at the site. The contractor shall inform the owner and all employed of any potential exposure to this material.
- B. At no time shall any product containing asbestos be incorporated into the work.
 - 1. If asbestos materials are encountered, report to the owner. The owner will be responsible for asbestos removal.

1.18 AS-BUILT DRAWINGS

- A. This electrical contractor shall provide (at the conclusion of the project) one clean, non-torn, neat and legible "as-built" set of drawings to the owner. These drawings shall show the routing of conduit, wiring and equipment drawn in at scaled locations. All circuits shall be labeled and shall conform to labeled panel breakers. All dimensions indicated shall be referenced to a column line. A set of construction drawings will be furnished for this work.
- B. All electrical panels and electrical installed equipment shall be shown on the "as-built" drawings.
- C. Refer to General Specification Sections for additional requirements.
- D. This contractor shall update these drawings during the project at least once a week.

1.19 ALTERNATES

- A. Refer to description of alternate bids under General Specification Sections.

1.20 REVIEW OF MATERIALS

- A. This contractor shall submit to the engineer for review one (1) electronic copy giving a complete list of materials, fixtures, devices and panels they propose to furnish. The brochure shall contain complete information as to the make of equipment, type, size, capacities, dimensions, and illustration. One of the returned copies shall be kept on the job at all times.
- B. Checking of submittal drawings by the engineer does not relieve the contractor of the responsibility for the accuracy of such drawings and for their conformity to drawings and specifications unless the contractor notifies engineer, in writing, of such deviation at time such drawings are furnished.
- C. All submittals shall have the date marked on them when the contractor receives them from the supplier. Submittals shall be submitted through the contractor and shall not come direct from the supplier to the architect or engineer.
- D. This contractor shall mark the date and sign each set. This indicates that each of them have been checked in their entirety before submitting to the engineer. Submittals that are not dated and signed by the contractor will not be accepted or checked and will be marked "resubmit" and sent back to the contractor.

1.21 TEST OF SYSTEMS

- A. This contractor shall, before concealed, test all systems installed under this contract as called for in these specifications and as required by local codes. Tests shall be made in the presence of the engineer, local authorities or their duly authorized representative. Any defects discovered in testing shall be corrected and the tests repeated until all defects are eliminated.
- B. This contractor shall be held responsible for all damage resulting from defects in the system.
- C. Each individual feeder circuit shall be tested at the panel and in testing for insulation resistance to ground; the power equipment shall be connected for proper operation. In no case shall the insulation resistance to ground be less than that required by the National Electrical Code (NEC).
- D. For 480V systems that are 1,000 amps or greater, this contractor shall provide primary injection testing to satisfy the requirements of the National Electrical Code (NEC) to ensure the ground-fault protection system has been performance tested when first installed on-site and provide a written record of this test to the Owner once completed.

1.22 SCOPE OF WORK

- A. This contractor shall furnish all the labor and material necessary to install a complete electrical system for the building. The system shall include all items of work as outlined in these specifications and on the drawings.
- B. All work shall be performed by a well-qualified, licensed electrician with a thorough knowledge of the various systems involved in this building. It shall be this contractor's responsibility to see that their employees are familiar with all the various codes and tests applicable to this work.
- C. All equipment shall be new and of the type specified by the engineer unless otherwise noted in these specifications or on the drawings to remain and or be reused.
- D. The intent of the specifications and drawings is for complete installation of the systems outlined in the specifications and drawings so that at the conclusion of construction the system will be turned over to the owner complete and ready for safe and efficient operation. The specifications and drawings cannot deal individually with the many minute items that may be eventually required by the nature of the systems.
- E. This contractor is required to furnish and install all such items normally included on systems of this type, which, while not mentioned directly herein or on the drawings are obviously essential to the installation and operation of the system and which are normally furnished on quality installation of this type.
- F. This contractor, before proceeding with any work, shall review the architectural drawings. Any conflict between the electrical and architectural drawings shall be reported to the engineer for clarification.
- G. If there is a discrepancy between the drawings and the specifications or within either document, the more stringent requirement shall be estimated unless brought to the engineer's attention and an addendum is issued for clarification.
- H. The Electrical Contractor shall establish electrical utility elevations prior to fabrication and installation. The Electrical Contractor shall coordinate utility elevations with other trades. All elevations shall be coordinated with all trades in the field prior to installation. When a conflict between trades arises, the design team shall be notified immediately prior to further installation however priority shall be as follows:
 - 1. Lighting Fixtures
 - 2. Gravity flow piping, including steam and condensate.
 - 3. Electrical bus duct.
 - 4. Sheet metal.
 - 5. Cable trays, including access space.

- 6. Other piping.
- 7. Conduits and wireway.

1.23 ELECTRICAL UTILITY COMPANY

- A. Any fees by the utility company are to be billed directly to the owner.
- B. The contractor is required to assist the owner in the preparation of all utility company rebate forms that deal with equipment furnished and/or installed as a part of this contractor.

1.24 TELECOMMUNICATIONS UTILITY COMPANY

- A. Any fees by the telecommunications utility company are to be billed directly to the owner.
- B. The contractor shall be required to provide pathways to the property easement and/or right-of-way. Final Coordination of conduit routing and termination shall be performed by this contractor while communicating with each telecommunications utility company. This shall include telephone, cable television and internet services to the building.

1.25 WALL CONTINUITY (1 HR.)

- A. All items mounted in 1 hr. rated walls requiring an opening larger than a four inch (4") square (16 sq. inches) require the 1 hr. rating not be degraded.
- B. Any branch panel in a 1 hr. wall will require the exterior of the recessed panel be covered with 5/8 inch fire rated gypsum board. This is true for any device requiring more than a 16 sq. inch opening.

1.26 TRENCHING AND BACKFILLING

- A. Each contractor is responsible for their own individual trenching and backfilling unless otherwise noted in the drawings or addendum.
- B. All underground utilities, telephone conduit, parking lot lighting, tunnels, etc shall be exactly located prior to digging. This contractor shall be held responsible for all damages caused by failure to do so.
- C. Any backfill shall be tamped and compacted to prevent future settling. The backfill shall be installed to a smooth and level grade and installed in accordance with local codes.
- D. All excess dirt shall be cleared from the area and disposed of as directed by the owner.
- E. Refer to architectural specification sections for additional information.

1.27 LOW VOLTAGE CONDUIT INSTALLATION

- A. This contractor shall install conduit serving low voltage cables located in all mechanical rooms and non-accessible areas and exposed structural areas. Use cable trays in other areas as indicated on the drawings. Where cable trays are not accessible, use J-hooks equal to Caddy Cable CAT. Provide hooks with closure holes and cable ties. Mount hooks three foot (3') on center.
- B. This contractor shall install conduit sleeves serving low voltage cables through walls and floors.
- C. Refer to other specification sections for additional information.

1.28 TEMPORARY POWER AND LIGHTING

- A. Temporary electrical power and lighting necessary for the construction process is the responsibility of the electrical contractor and shall be included in the base bid amount.

1.29 GAS METER

- A. This contractor shall provide a 1/2 inch conduit from the interior of the power plant to the gas meter location. This conduit shall be used for telemeter of the natural gas consumption. This conduit shall be galvanized rigid steel and be terminated with

bushings. The conduit shall be bonded to the building steel or the grounding system of the electrical system.

- B. Install a telephone pair from the meter to the telephone IDF. Provide a conduit and wire 110-volt circuit to gas meter, reuse existing power source. Verify location of gas meter.

1.30 EXTRA MATERIALS AND LABOR

- A. The electrical contractor shall include in their bid additional resources for the removal and installation of 10 existing junction boxes in order to maintain access upon completion of construction. Provide new wiring as necessary where length is insufficient to maintain a complete system. The relocation requests may occur anytime during the construction process as requested by the Owner or Design Team. Junction boxes may be associated with Divisions 26, 27 and 28.

1.31 DIGITAL MEDIA AGREEMENT

- A. Computer Aided Drafting (CAD) documents may be available to the contractor for some uses. Contact the engineer prior to bidding to determine what information is available to be transmitted to the contractor in digital form.
- B. When documents are determined to be available, and as requested by the contractor, they will be transmitted upon the completion and execution of the MODUS digital media agreement. A service fee for each document transmitted will be assessed to the contractor. Documents will be transmitted upon payment receipt. Current service fee is \$100.00 per CAD sheet.

1.32 SECURE NETWORKABLE DEVICES

- A. Update network devices to the most current software/firmware.
- B. Change default password of all networkable devices.
 - 1. Passwords shall have at least eight characters.
 - 2. Include uppercase and lowercase letters, numerals, and special characters
- C. Supply MAC address and serial number of all networkable devices.
- D. Work with the Owner's IT department to align to existing IT standards.
- E. Provide to the owner a printed and/or electronic spreadsheet log of all network information including, IP addresses, MAC addresses, logins and password information during system training.

1.33 SYSTEM CONFIGURATION AND PROGRAMMING FILES

- A. Supply system configuration and programming files where export is available.
- B. Supply uncompiled programming for systems applicable.
- C. All configuration and programming shall be property of the owner at conclusion of the project.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

END OF SECTION

**SECTION 26 0090
MINOR ELECTRICAL DEMOLITION FOR REMODELING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. The requirements of the Contract Forms, the Conditions of the Contract, Division 1 - General Requirements and Specification Section 26 0050 - Basic Electrical Requirements "General Provisions" apply to this section.

1.02 SCOPE

- A. This contractor shall be responsible for the demolition and removal of all existing electrical elements within the project area except as follows:
 - 1. Elements shown on the drawings as "existing to remain and/or to be relocated".
 - 2. Elements serving adjacent areas.
 - 3. Elements required for the support of the newly remodeled areas.
- B. Preserve services to the existing facility. Extend, reroute, and reconnect existing systems as required providing for the continued function of these systems.
- C. Demolition shall be accomplished by the proper tools and equipment for the work to be removed. Personnel shall be experienced and qualified in the type of work to be performed.
- D. This electrical contractor shall remove all abandoned equipment, conduit, supports, equipment curbs and bases associated with the remodeled area unless noted otherwise.
- E. This contractor is responsible to provide temporary electrical protection during this project.

1.03 MATERIALS

- A. All elements to be removed are subject to the Owner's Right of Salvage.
- B. All materials removed shall be the property of the removing contractor and shall be removed from the site by them, unless otherwise specified.
- C. The owner may designate and have salvage rights to any material herein demolished by this contractor. It will be the owner's responsibility to designate such salvageable items and remove them prior to the contractor working in that area.

1.04 WORK BY OTHERS

- A. Unless specifically noted under other contracts, the electrical contractor shall assume they will perform all required work. In general, the following will be performed by others:
 - 1. The mechanical contractor shall be responsible for the cutting and capping of all existing gas, water, sewer, and any other utility service.

1.05 EXISTING CONDITIONS

- A. If any existing fixtures or devices that are to remain are disturbed by operations under this contract, the contractor is required to re-establish continuity of such systems.
- B. The electrical contractor shall arrange for the general contractor to repair and patch all construction with material necessary to match surrounding due to removal of equipment and conduit.
- C. The electrical contractor shall furnish all required labor and material, where required, to extend new work to connect to similar work for extension of existing systems.
- D. Demolition plans are based on casual field observations and existing record documents. Report discrepancies to the owner before disturbing existing installation. Beginning of demolition means installer accepts existing conditions.

- E. Floor slabs may contain conduit systems. This Contractor is responsible for taking any measures required to ensure no conduits or other services are damaged. This includes x-ray or similar non-destructive means. Where conduit is in concrete slab, cut conduit flush with floor, pull out conductors, and plug conduit ends.
- F. This Contractor is responsible for all costs incurred in repair, relocations, or replacement of any cables, conduits, or other services if damaged without proper investigation.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify field-circuiting arrangements and reconnect as necessary.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities. Reconnect circuits, as required, to prevent de-energizing of remaining receptacles and lights.
- C. Demolition drawings are based on casual field observation and existing record documents. Report discrepancies to the owner before disturbing existing installation.
- D. Beginning of demolition means installer accepts existing conditions.
- E. Review existing panels to remain in the area of construction. Notify the design team of any damaged circuit breakers or missing closure plates.
- F. Review existing lighting to remain in the area of construction. Notify the design team of any non-functional lamps, ballasts, or electrical parts.

3.02 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal. Disconnect circuits at the source.
- B. Coordinate utility service outage with local utility company.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits use personnel experienced in such operations. This shall include 600 volt or less systems and low voltage signal circuits.
- D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchover connections. Minimize outage duration. Make temporary connections as required.
- E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switch over and connections. Make temporary connections to maintain service within construction areas and in areas adjacent to work area.
- F. Existing Telephone System: Maintain existing system in service.
- G. Existing Paging, Nurse Call, TV Antenna, Ambulance Radio, Intercoms, and ER Scanner Radio Systems:
 - 1. Maintain existing system in service until new systems are accepted.
 - 2. Disable system only to make switch over and connections.
 - 3. Obtain permission from the owner at least 24 hours before partially or completely disabling system.
 - 4. Minimize outage duration.
 - 5. Make temporary connections to maintain service in areas adjacent to work areas.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Demolish and extend existing electrical work under provisions of this section.

- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring to source of supply.
- D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors and patch surfaces.
- E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide a blank cover for abandoned outlets that have not been removed.
- F. Disconnect and remove abandoned panelboards and distribution equipment.
- G. Disconnect and remove electrical devices and equipment serving utilization removed equipment.
- H. Disconnect and remove abandoned luminaires, brackets, stems, hangers, and other accessories. This contractor shall include in their bid, associated fees for disposal of ballasts and lamps.
- I. Repair adjacent construction and finishes damaged during demolition and extension work.
- J. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- K. Extend existing installation using materials and methods compatible with existing electrical installations or as specified.
- L. The electrical contractor is responsible for removal of lamps and ballast from existing fixtures to be demolished. The electrical contractor is to properly dispose of these items in accordance with codes for hazardous materials.

3.04 CLEANING AND REPAIR

- A. Clean and repair existing materials that remain or are to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Provide typed circuit directory showing revised circuiting arrangement.
- C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry.

3.05 INSTALLATION

- A. Install relocated materials and equipment.

END OF SECTION

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**SECTION 26 0519
ELECTRICAL POWER CONDUCTORS AND CABLES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Building wire
- B. Wiring connectors

1.02 RELATED SECTIONS

- A. Specification Section 26 0553 - Identification for Electrical Systems
- B. Specification Section 26 2416 - Panelboards
- C. Specification Section 27 3200 - Area of Refuge Two-Way Communications System
- D. Specification Section 27 5319 - Distributed Antenna System (First Responder)
- E. Specification Section 28 3100 - Fire Detection and Alarm

1.03 REFERENCES

- A. NECA Standard of Installation (National Electrical Contractors Association)
- B. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association)
- C. NFPA 70 - National Electrical Code
- D. Product Data: Provide for each cable assembly type.
- E. Test Reports: Indicate procedures and values obtained.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.
- G. NFPA 92B - Smoke Management for Malls, Atria, and Large Spaces
- H. IBC Section 909 - Smoke Control Systems

1.04 SUBMITTALS

- A. Project Record Documents: Record actual locations of components and circuits.
- B. Project Record Documents: Provide documentation of the manufacturer's recommended lug torque value for aluminum conductors, the date the lugs were torqued, and installed torque readings.

1.05 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.06 REGULATORY REQUIREMENTS

- A. Conform to NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.07 PROJECT CONDITIONS

- A. Verify that field measurements are as indicated.
- B. Wire and cable routing indicated is approximate unless dimensioned. Include wire and cable lengths within 10 foot of length shown.

1.08 COORDINATION

- A. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

2.01 BUILDING WIRE

- A. Manufacturers:
 - 1. Okanite
 - 2. Bell/Hubbell #BICC
 - 3. American Insulated Wire
 - 4. General Cable
 - 5. Southwire
 - 6. Encore Wire Corporation
 - 7. Engineer approved equal.
- B. Description: Insulated conductor wire.
 - 1. All wire shall be stranded. Refer to Section 26 0553 Identification for Electrical Systems for conductor color requirements.
 - 2. Wire sizes #12 AWG and smaller shall be solid. Wire sizes #10 AWG and larger shall be stranded.
 - a. Insulation colors for 120/208V shall be as follows: phase A shall be black, phase B shall be red, and phase C shall be blue.
 - b. For conductors that are too large to be provided in the required color install wire markers per the requirements of Section 26 0553 Identification for Electrical Systems.
 - 3. Provide solid wire pigtails at all wiring devices and lighting control devices.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation: NFPA 70, type #THHN/THWN-2. All cable installation procedures or sizing shall be based on 75 deg C temperature rating.

2.02 WIRING CONNECTORS

- A. Split Bolt Connectors:
 - 1. Burndy
 - 2. Engineer approved equal.
- B. Spring Wire Connectors:
 - 1. Thomas & Betts
 - 2. Engineer approved equal.
- C. Compression Connectors:
 - 1. Burndy
 - 2. Thomas & Betts
 - 3. Engineer approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that mechanical work likely to damage wire and cable has been completed.
- C. Verify that raceway installation is complete and supported.

3.02 PREPARATION

- A. Completely and thoroughly swab raceway over two inch (2") in size or buried below grade before installing wire.

3.03 WIRING METHODS

- A. Concealed Dry Interior Locations: Use only building wire, type #THHN/THWN-2 insulation in raceway. Use type #NMC cable in residential areas where approved for use.

RENOVATION & ADDITION

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- B. Exposed Dry Interior Locations: Use only building wire, type #THHN/THWN-2 insulation in raceway.
- C. Above Accessible Ceilings: Use only building wire, type #THHN/THWN-2 insulation in raceway. Use type #NMC cable in residential areas where approved for use.
- D. Wet or Damp Interior Locations: Use only building wire, type #THHN/THWN-2 insulation in raceway.
- E. Exterior Locations: Use only building wire, type #THHN/THWN-2 insulation, in raceway. Use liquid-tight wiring methods. Use liquid-tight connections.
- F. Underground Installations: Use only building wire, type #THHN/THWN-2 insulation, in raceway. Use liquid-tight wiring methods.
- G. Interior Installations: Use only building wire, type #THHN/THWN-2 insulation, in raceway.
- H. Use wiring methods indicated.

3.04 INSTALLATION

- A. Route wire and cable as required meeting project conditions.
- B. Install cable in accordance with the NECA "Standard of Installation."
- C. Use conductors not smaller than 12 AWG for power and lighting circuits. Only pre-manufactured fixture whips are allowed to be 14 AWG.
- D. Use #10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.
- E. Use #10 AWG conductors for 20 ampere, 208/240 volt branch circuits longer than 200 feet.
- F. Provide minimum #8 AWG wiring for exterior lighting and power circuits leaving building.
- G. It shall be the responsibility of the electrical contractor to verify all voltage drop and size all wire accordingly.
- H. Pull all conductors into raceway at same time.
- I. Use suitable wire pulling lubricant for building wire #4 AWG and larger.
- J. Protect exposed cable from damage.
- K. Use suitable cable fittings and connectors.
- L. Neatly train and lace wiring inside boxes, equipment and panel boards.
- M. Clean conductor surfaces before installing lugs and connectors.
- N. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- O. Use suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.
- P. Use split bolt connectors for copper conductor splices and taps, #6 AWG and larger. Tape non-insulated conductors and connector with electrical tape to 150% of insulation rating of conductor.
- Q. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, #8 AWG and smaller.
- R. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, #10 AWG and smaller. All connections in exterior hand holes shall have liquidtight connections.
- S. Trench and backfill for direct burial cable installation. Install warning tape along entire length of direct burial cable within three inch (3") of grade.

RENOVATION & ADDITION

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- T. Identify and color code wire and cable under provisions of Specification Section 26 0553 - Identification for Electrical Systems. Identify each conductor with its circuit number or other designation indicated.
- U. Terminate aluminum conductors with tin-plated aluminum-bodied compression connectors only. Fill with anti-oxidant compound before installing conductor.
- V. Do not install multi-wire branch circuits. No sharing of neutral shall be permitted.
- W. Install all conductors and make final connections in accordance with all manufacturer's recommendations.
- X. Circuits indicated as 3-pole and having ECM motor loads shall include a neutral conductor.

3.05 FIELD QUALITY CONTROL

- A. Perform field inspection and testing.
- B. Inspect wire and cable for physical damage and proper connection.
- C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
- D. Verify continuity of each branch circuit conductor.

END OF SECTION

**SECTION 26 0526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Rod electrode and conductors
- B. Mechanical connectors
- C. Wire
- D. Grounding well components
- E. Ground enhancement material

1.02 RELATED SECTIONS

- A. Specification Section 27 0526 - Grounding and Bonding for Communication Systems

1.03 SUBMITTALS

- A. Product data and manufacturer's installation instructions for non-approved manufacturers shall be submitted for review prior to the bid date.
- B. Submittals shall include:
 - 1. Dimensional drawing for each planned device.
 - 2. Exothermic Connection Certification for installers.

1.04 SUMMARY

- A. Provide all labor, materials, and equipment necessary to properly install a grounding system conductor in all new branch wiring and feeder installations, which shall be in full compliance with all applicable codes as accepted by the authorities having jurisdiction. The secondary distribution system shall include a grounding conductor in all raceways in addition to the return path of the metallic conduit.
- B. In general, all electrical equipment (metallic conduit, motor frames, panelboards, etc.) shall be bonded together with a green insulated or bare copper system grounding conductor in accordance with specific rules of Article 250 of the NEC and local codes. The bonding conductor through the raceway system shall be continuous from main switch ground bus to panel ground bar of each panelboard, and from panel grounding bar of each panelboard to branch circuit equipment and devices.
- C. All raceways shall have an insulated copper system ground conductor throughout the entire length of circuit installed within conduit in strict accordance with NEC. The grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included or shown on drawings. All grounding conductors that run with feeders in PVC conduit outside of building shall be bare only.
- D. Provide and install all grounding and bonding as required by the National Electrical Code (NEC) including but not limited to Article 800 of the NEC.

1.05 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code
- B. NFPA 99 - Health Care Facilities
- C. The Joint Commission
- D. Iowa Administrative Code, Chapter 61
- E. IEEE 837-2014: Standard for Qualifying Permanent Connections Used in Substation Grounding
- F. IEEE Emerald Book
- G. IEEE Green Book

1.06 PROJECT RECORD DOCUMENTS

- A. Submit record documents to accurately record actual locations of grounding electrodes.
- B. Submit test results of each ground rod.

1.07 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.01 ROD ELECTRODE AND CONDUCTORS

- A. Material: Copper-clad steel.
- B. Diameter: 5/8 inch.
- C. Length: 10 feet (min). Increase number and/or lengths of ground rod electrodes as required to meet and achieve specified resistance.
- D. Maintain separation of not less than eight foot (8') and not more than 20 feet between ground rod electrodes.

2.02 MECHANICAL CONNECTORS

- A. All grounding connectors shall be in accordance with UL 467 and UL listed for use with rods, conductors, reinforcing bars, etc., as appropriate.
- B. Connectors and devices used in the grounding systems shall be fabricated of copper or bronze materials, and properly applied for their intended use. All connectors and devices shall be compatible with the surfaces being bonded and shall not cause galvanic corrosion by dissimilar metals.
- C. Lugs: Substantial construction, of cast copper or bronze with "ground" (micro-flat) surfaces, twin clamp, and two-hole tongue equal to Burndy QQA Series.
- D. Grounding and Bonding Bushings: Malleable iron.
 - 1. Manufacturers:
 - a. Thomas & Betts
 - b. Engineer approved equal.
- E. Piping Clamps: Burndy GAR-TC Series with a two-hole compression terminal.
- F. Grounding Screw and Pigtail: Raco #983.
- G. Building Structural Steel: Thompson #701 Series heavy duty bronze "C" clamp with two-bolt vise-grip cable clamp or equal.
- H. Mechanical lugs or wire terminals shall be used to bond ground wires together or to junction boxes and panel cabinets.

2.03 WIRE

- A. Material: Stranded copper.
- B. Size to meet NFPA 70 requirements as a minimum. Increase size if called for on drawings or in these specifications.
- C. Insulated THWN (or bare as noted elsewhere).

2.04 GROUNDING WELL COMPONENTS

- A. Well: 12"x12"x12" Eritech inspection well, Quazite box, or engineer approved equal.
- B. Well Cover: Bolt attachment, skid resistant with "GROUND" embossed on cover, suitable for designated traffic rating. Verify with engineer.
- C. Material: Polymer concrete with a minimum 10,000lb. load rating.
- D. Increase depth or size as required to provide proper access at installed location.

2.05 GROUNDING ENHANCEMENT MATERIAL

- A. Erico #GEM25A or engineer approved equal.
- B. Product shall meet IEC 62561-7.

PART 3 EXECUTION**3.01 GENERAL**

- A. Install products in accordance with manufacturer's instructions.
- B. Install grounding electrodes conductor, bonding conductors, ground rods, etc. with all required accessories.
- C. Grounding shall meet (or exceed as required to meet these specifications) all the requirements of the N.E.C., the NFPA, and applicable standards of IEEE.
- D. Where there is a conflict between these specifications and the above applicable codes/standards or between this section of these specifications and other sections, then the most stringent or excessive requirement shall govern. Where there is an omission of a code/standard requirement in these specifications then the current code/standard requirements shall comply.
- E. Requirement in these specifications to comply with a specific code/standard article, etc. is not to be construed as deleting of requirements of other applicable codes/standards and their articles, etc.

3.02 GROUNDING ELECTRODES

- A. All connections shall be exothermic welded unless otherwise noted herein. All connections above grade and in accessible locations may be by exothermic clamping with devices UL listed as suitable for use except in locations where exothermic welding is specifically specified in these specifications or called for on drawings.
- B. Each rod shall be die stamped with identification of manufacturer and rod length.
- C. Install rod electrodes at locations indicated and/or as called for in these specifications.
- D. Ground Resistance:
 - 1. Main Electrical Service (to each building) and Generator Locations:
 - a. Grounding resistance measured at each main service electrode system and at each generator electrode system shall not exceed 5 ohms.
 - b. Other Locations:
 - 1) Resistance to ground of all non-current carrying metal parts shall not exceed 5 ohms measured at motors, panels, busses, cabinets, equipment racks, light poles, transformers, and other equipment.
 - 2) Resistance called for above shall be maximum resistance of each ground electrode prior to connection to grounding electrode conductor. Where ground electrode system being measured consists of two or more ground rod electrodes then the resistance specified above shall be the maximum resistance with two or more rods connected together but not connected to the grounding electrode conductor.
- E. Install additional rod electrodes as required to achieve specified resistance to ground (specified ground resistance is for each ground rod location prior to connection to ground electrode conductor).
 - 1. Provide grounding well with cover at each rod location. Install grounding well top flush with finished grade.
 - 2. Verify that final backfill and compaction has been completed before driving rod electrodes.
 - 3. Install ground rods not less than one foot (1') below grade level and not less than two feet (2') from structure foundation.

3.03 GROUNDING ELECTRODE CONDUCTOR

- A. Conductor shall be sized to meet or exceed the requirements of NEC 250 to meet these specifications and/or drawings.

3.04 GROUNDING CONDUCTORS

- A. Grounding conductors shall be provided with every circuit to meet (or exceed as required to meet these specifications and/or drawings) the requirements of NEC 250.
- B. At every voltage level, new portions of the electrical power distribution system shall be grounded with a dedicated copper conductor, which extends from termination back to power source in supply panelboard.
- C. Provide separate, insulated (bare if with feeder in PVC conduit outside of building) conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug.
- D. Except as otherwise indicated, each feeder raceway on the load side of the service entrance shall contain a ground conductor sized as indicated and where not shown shall be sized to meet (or exceed as required) these specifications and/or drawings the requirements of NEC 250. The conductor shall be connected to the equipment grounding bus in switchboards and panelboards, to the grounding bus in all motor control centers, and as specified to lighting fixtures, motors, and other types of equipment and outlets. The ground shall be in addition to the metallic raceway and shall be properly connected thereto, using a lug device located within each item enclosure at the point of electric power connections to permit convenient inspection.
- E. Provide green insulated ground wire for all receptacles and for equipment of all voltages. In addition to grounding strap connection to metallic outlet boxes, a supplemental grounding wire and screw equal to Raco No. 983 shall be provided to connect receptacle ground terminal to the box.
- F. All plug strips and metallic surface raceway shall contain a green insulation ground conductor from supply panel ground bus connected to grounding screw on each receptacle in strip and to strip channel. Conductor shall be continuous.
- G. Where integral grounding conductor is specified elsewhere in bus duct construction, provide equivalent capacity conductor from supply switchboard or panelboard grounding bus to the bus duct grounding conductor. Bond integral conductor to bus duct enclosure at each tap and each termination.
- H. All motors, all heating coil assemblies, and all building equipment requiring flexible connections shall have a green grounding conductor properly connected to the frames and extending continuously inside conduit with circuit conductors to the supply source bus with accepted connectors regardless of conduit size or type. This shall include food service equipment, laundry equipment, and all other "Equipment By Owner" to which an electric conduit is provided under this Division.

3.05 MAIN ELECTRICAL SERVICE

- A. Existing Buildings:
 - 1. The electrical contractor shall verify that each building's electrical service is properly grounded as required by the NEC.
 - 2. Provide and install electrical service grounding at each building as called for herein for all existing services that do not comply with the grounding specified above.
 - 3. Supplement existing electrical service grounding at each building as required to comply with all requirements in these specifications.
 - 4. If exterior ground rod electrode does not exist at each buildings main electrical service, provide and install these ground rods as called for main electrical service, exterior of building.
- B. Complete installation shall meet and exceed the requirements of the NEC 250.

- C. Artificial electrodes shall be provided for the main service in sufficient number and configuration to secure resistance specified.
- D. Bond To All Of The Following When Available On Site:
 - 1. Ground Rods.
 - 2. Metal Water Pipe (Interior and Exterior to Building)
 - 3. Building Metal Frame, Structural Steel and/or Reinforced Structural Concrete
 - 4. All Piping Entering or Leaving All Buildings.
 - 5. Provide a main ground, bare copper conductor, sized per applicable table in NEC 250, but in no case less than #2/0, shall be run in conduit from the main switchgear of each building to the building steel in each respective building.
Reference NEC 250.104 (c). This ground conductor shall also be run individually from the main switchgear and be bonded to the main water service ahead of any union in pipe and must be metal pipe of length as acceptable by authorities having jurisdiction. Provide properly sized bonding shunt around water meter and/or dielectric unions in the water pipe.
- E. Ground/bond neutral per NEC 250.
- F. Provide and install ground bus bar on wall near main service disconnect/switchboard. Connect to ground bar in disconnect/switchboard bonded to switchboard/disconnect enclosure/neutral with copper grounding conductor sized per applicable table in NEC 250.

3.06 EXTERIOR GRADE MOUNTED EQUIPMENT

- A. General:
 - 1. All equipment (including chillers, pumps, disconnects, starters, control panels, panels, etc) mounted exterior to building shall have their enclosures grounded directly to a grounding electrode at the equipment location in addition to the building equipment ground connection.
 - 2. Bond each equipment enclosure, metal rack support, mounting channels, etc. to ground electrode system at each rack with an insulated copper ground conductor sized to match the grounding electrode conductor required by applicable table in NEC 250 based on equipment feeder size, but in no case shall conductor be smaller than #6 copper or larger than #2 copper. This connection is in addition to grounding electrode connections required for services.
- B. Main Electrical Service Rack Mounted Equipment:
 - 1. Ground per "MAIN ELECTRICAL SERVICE".
 - 2. Bond all metal parts as noted above.
- C. Electrical Sub Service Rack Mounted Equipment:
 - 1. Ground per "MAIN ELECTRICAL SERVICE", except do not bond neutral to ground.
 - 2. Bond all metal parts as noted above.
- D. Electrical Equipment Connection Rack Mounted Equipment: Bond all metal parts as noted above.
- E. Grounding Electrodes (Ground Electrodes System) shall be located at each rack location.
- F. Service Equipment: Ground electrode required per "MAIN ELECTRICAL SERVICE".
- G. Equipment Connection: Two or more ten foot (10') ground rods at no less than 30 foot spacing, driven vertical to a minimum depth of one foot (1') below grade. Bond the two or more ground rods together with a size to meet applicable table in NEC 250, but no less than a #2 copper ground conductor. Provide additional rod electrodes as required to achieve specified ground resistance.
- H. Complete installation shall exceed the minimum requirements of NEC 250 and, when applicable, NFPA 78.

3.07 LIGHT FIXTURES

- A. All new and removed/reinstalled fixtures in building interior, and exterior fixtures shall be provided with green grounding conductor, solidly connected to unit. Individual fixture grounds shall be with lug to fixture body, generally located at point of electrical connection to the fixture unit.
- B. All suspended fixtures and those supplied through flexible metallic conduit shall have green ground conductor from outlet box to fixture. Cord connected fixtures shall contain a separate green ground conductor.
- C. Installation shall exceed minimum requirements of NFPA 780.

3.08 MISCELLANEOUS GROUNDING CONNECTIONS

- A. Provide bonding to meet regulatory requirements.
- B. Required connections to building steel shall be with UL accepted non-reversible crimp type ground lugs exothermically welded to bus bar that is either exothermically welded or bolted to steel in locations where weld will affect the structural properties of the steel. Required connections to existing building structural steel purlins/i beams shall be with heavy duty bronze "C" clamp with two bolt vise-grip cable clamp.
- C. Grounding conductors shall be so installed as to permit shortest and most direct path from equipment to ground; be installed in conduit; be bonded to conduit at both ends when conduit is metal; have connections accessible for inspection; and made with accepted solderless connectors brazed or bolted to the equipment or to be grounded; in NO case be a current carrying conductor; have a green jacket unless it is bare copper; be run in conduit with power and branch circuit conductors. The main grounding electrode conductor shall be exothermically welded to ground rods, water pipe, and building steel.
- D. All surfaces to which grounding connections are made shall be thoroughly cleaned to maximum conductive condition immediately before connections are made thereto. Metal rust proofing shall be removed at grounding contact surfaces, for 0 ohms by digital Vm. Exposed bare metal at the termination point shall be painted.
- E. All ground connections that are buried or in otherwise inaccessible locations, shall be welded exothermically. The weld shall provide a connection which shall not corrode or loosen and which shall be equal or larger in size than the conductors joined together. The connection shall have the same current carrying capacity as the largest conductor.
- F. Install ground bushings on all metal conduits entering enclosures where the continuity of grounding is broken between the conduit and enclosure (i.e. metal conduit stub-up into a motor control center enclosure or at ground bus bar). Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.
- G. Install ground bushings on all metal conduits where the continuity of grounding is broken between the conduit and the electrical distribution system (i.e. metal conduit stub-up from wall outlet box to ceiling space. Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.
- H. Each feeder metallic conduit shall be bonded at all discontinuities, including at switchboards and all sub distribution and branch circuit panels with conductors in accordance with applicable table in NEC 250 for parallel return with respective interior grounding conductor.
- I. Grounding provisions shall include double locknuts on all heavy wall conduits.
- J. Bond all metal parts of pole light fixtures to ground rod at base.
- K. Install grounding bus in all existing panelboards of remodeled areas, for connection of new grounding conductors, connected to an accepted ground point.

- L. Bond together reinforcing steel and metal accessories in pool and fountain structures.
- M. Where reinforced concrete is utilized for building grounding system, proper reinforced bonding shall be provided to secure low resistance to earth with "thermite" type devices, and #10AWG wire ties shall be provided to not less than ten full length rebars that contact the connected rebar.

3.09 GROUNDING BAR INSTALLATION

- A. Where indicated on the drawings, provide and install grounding bar/ground bus (bus bar). These bus installations are intended to provide a low-impedance "Earthing" path for surge voltages, which are electrically "clamped" and shunted to earth by variable-impedance surge protective devices. Metal sheaths of underground cables are also to be grounded thereto at points of building entrance.
- B. Mount bolt tapping lugs with hex head bolts to bus bar at two inch (2") on center spacing, one for each ground conductor.
- C. Mount bus bar to wall using two inch (2") polyester molded insulator stand-off.
- D. Extend a #2/0 (minimum size) or larger THWN insulated copper ground conductor (if larger size is called for on drawings or required by N.E.C. for service ground, etc.) in PVC conduit to accepted service ground installation or ground bus/bar in main service equipment enclosure.
- E. Extend #6 insulated copper ground wire from respective bus/bar to each 'local' ground bus/bar in each cabinet for the data and sound systems (if applicable).
- F. 'Systems' grounding bus/bar must be connected with #2/0 insulated copper conductor to grounding electrodes system as defined in NEC "Article 800-40(b).
- G. A separate grounding bar shall be installed in telecommunication rooms. Connect to the main electrical grounding bar with a #4/0 AWG grounding conductor in conduit.

3.10 TESTING AND REPORTS

- A. Raceway Continuity: Metallic raceway system as a component of the facilities ground system shall be tested for electrical continuity. Resistance to ground throughout the system shall not exceed specified limits.
- B. Ground resistance measurements shall be made on each system utilized in the project. The ground resistance measurements shall include building structural steel, driven grounding system, water pipe grounding system and other accepted systems as may be applicable. Ground resistance measurements shall be made in normally dry weather, not less than 24 hours after rainfall, and with the ground under test isolated from other grounds and equipment. Resistances measured shall not exceed specified limits.
- C. Upon completion of testing, the testing conditions and results shall be certified by the electrical contractor and submitted to the engineer.

3.11 INTERFACE WITH OTHER PRODUCTS

- A. Interface with communications system installed under other specification sections.

3.12 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- B. Use suitable test instrument with current certificate of calibration to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method or signal injection method.

END OF SECTION

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**SECTION 26 0529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Product requirements
- B. Formed steel channel
- C. Sleeves

1.02 REFERENCES

- A. NECA Standard of Installation (National Electrical Contractors Association)
- B. NFPA 70 - National Electrical Code

1.03 SUBMITTALS

- A. Product Data: Provide manufacturers catalog data for fastening systems.
- B. Manufacturer's Instructions: Indicate 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 products.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

- A. Materials and Finishes:
 - 1. Corrosion resistant.
 - 2. Select materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit, including weight of wire in conduit.
- B. Anchors and Fasteners:
 - 1. Concrete Structural Elements: Use expansion anchors and preset inserts.
 - 2. Steel Structural Elements: Use beam clamps and welded fasteners.
 - 3. Concrete Surfaces: Use self-drilling anchors and expansion anchors.
 - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
 - 5. Solid Masonry Walls: Use expansion anchors and preset inserts.
 - 6. Sheet Metal: Use sheet metal screws.
 - 7. Wood Elements: Use wood screws.
- C. Staples:
 - 1. Wood Elements: UV resistant polyethylene saddles. For use with non-metallic sheathed cable only.

2.02 FORMED STEEL CHANNEL

- A. Manufacturers:
 - 1. Globe Strut
 - 2. Uni-Strut
 - 3. Kindorf
 - 4. Power-Strut
 - 5. Erico
 - 6. Engineer approved equal.

- B. Description: Galvanized steel.
- C. Provide aluminum supports and hangers in pool area and pool equipment room.

2.03 SLEEVES

- A. For conduits passing through wall, below grade, underground wall sleeves for conduits 4" or larger shall be continuous rigid steel. Seal with Linkseal, or engineer approved equal, at two diameters larger than conduit.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions and utility company regulations where applicable.
- B. Provide anchors, fasteners and supports in accordance with NECA "Standard of Installation".
 - 1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
 - 2. Do not use spring steel clips and clamps.
 - 3. Do not use powder-actuated anchors.
 - 4. Do not drill or cut structural members.
- C. Fabricate supports from structural steel or formed steel members or steel channel. Rigidly weld members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- D. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- E. Use steel channel supports to stand cabinets and panelboards one inch (1") off wall in all wet and damp locations.
- F. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- G. Reinforce outdoor concrete pads with 1/2 inch steel reinforcing bars on 12 inch centers or as shown on the drawings.
- H. All pathways and hangers shall be independently hung.
- I. All pathways shall be routed overhead unless otherwise noted or approved by engineer.

END OF SECTION

**SECTION 26 0533
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Conduit requirements
- B. Conduit types
- C. Box types
- D. Surface metal raceway types

1.02 REFERENCES

- A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated
- B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated
- C. ANSI C80.5 - Rigid Aluminum Conduit
- D. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies
- E. ANSI/NFPA 70 - National Electrical Code
- F. NEMA 250 - Enclosures for Electric Equipment
- G. NEMA WD 6 - Wiring Device Configurations
- H. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
- I. NECA (National Electrical Contractor's Association) Standard of Installation
- J. NEMA WD 6 - Wiring Device Configurations
- K. TIA-569-B - Commercial Building Standard for Telecommunications Pathways and Spaces
- L. NEMA OS 2 – Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2013 (ANSI/NEMA OS2)
- M. UL 514C- Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions

1.03 RELATED SECTIONS

- A. Specification Section 26 0543 - Underfloor Ducts and Raceways for Electrical Systems
- B. Specification Section 27 0526 - Grounding and Bonding for Communications Systems

1.04 PROJECT RECORD DOCUMENTS

- A. Accurately record actual routing of conduits larger than two inches.
- B. Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

1.05 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.06 SUBMITTALS

- A. Product Data: Provide dimensions, knockout sizes and locations, materials, fabrication details, finishes, and accessories.
- B. Manufacturer's Instructions: Indicate 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.

1.07 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to the site.
- B. Accept products on site. Inspect for damage.
- C. Protect products from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.09 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on the drawings.
- B. Verify routing and termination locations of conduit prior to rough in.
- C. Conduit routing is shown on the drawings in approximate locations unless dimensioned. Route as required completing the wiring system.

PART 2 PRODUCTS

2.01 CONDUIT REQUIREMENTS

- A. Minimum Size: 3/4 inch for power wiring and 1 inch for low voltage wiring unless noted otherwise.
- B. Size conduit per ANSI/NFPA 70.
- C. Underground Installations:
 - 1. Within Five Feet (5') from Foundation Wall Including Below Building Slab: Use rigid steel conduit or schedule 80 PVC conduit.
 - 2. More Than Five Feet (5') from Foundation Wall: Use rigid steel conduit or schedule 80 PVC conduit.
 - 3. Where PVC conduit is utilized below slab, provide transition from PVC to rigid steel prior to elbow up and then as continuous rigid conduit through slab. No PVC conduits shall penetrate vertically through concrete slab.
 - 4. Minimum Size: One inch.
 - 5. Provide warning tape.
- D. Above Grade Outdoor Locations: Use rigid steel and aluminum conduit. Aluminum conduit shall not contact concrete mortar or block.
- E. Above Grade In or Under Slab:
 - 1. Use rigid steel conduit or schedule 40 PVC conduit.
 - 2. Maximum Size Conduit in Slab: Total of 50% of pour depth.
 - 3. Minimum Size: One inch.
 - 4. Where PVC conduit is utilized below slab, provide transition from PVC to rigid steel prior to elbow up and then as continuous rigid conduit through slab. No PVC conduits shall penetrate vertically through concrete slab. Unless PVC conduit is stalled below bottom-fed ground mounted equipment. PVC conduits may penetrate the slab as long as a box-out is provided in the slab to allow for conduit to pass through. Backfill box-out with pea gravel once conduits have been installed.
- F. Wet and Damp Locations:
 - 1. Use rigid steel conduit and intermediate metal conduit.
 - 2. Wiring methods for pool and pool equipment rooms as defined in NEC 680.14 shall be listed and identified for use in such areas. Use rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit, or reinforced

thermosetting resin conduit in these areas where subject to a corrosive environment.

- G. Dry Locations:
 - 1. Concealed: Use rigid steel conduit, intermediate metal conduit or electrical metallic tubing.
 - 2. Exposed: Use rigid steel conduit, intermediate metal conduit or electrical metallic tubing.

2.02 CONDUIT TYPES

- A. Metal Conduit:
 - 1. Rigid Steel Conduit: ANSI C80.1
 - 2. Rigid Aluminum Conduit: ANSI C80.5
 - 3. Intermediate Metal Conduit (IMC): Rigid steel
 - 4. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit.
- B. Flexible Metal Conduit:
 - 1. Description: Interlocked steel construction.
 - 2. Fittings: ANSI/NEMA FB 1.
- C. Liquidtight Flexible Metal Conduit:
 - 1. Description: Interlocked steel construction with PVC jacket.
 - 2. Fittings: ANSI/NEMA FB 1.
- D. Electrical Polyvinyl Chloride (PVC):
 - 1. Description: Synthetic Thermoplastic
 - 2. Fittings: NEMA TC3/UL 651
 - 3. Joints: ASTM D2855 solvent weld with ASTM D2564 solvent cement.
- E. Electrical Metallic Tubing (EMT):
 - 1. Description: ANSI C80.3; galvanized tubing.
 - 2. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel setscrew fittings.
- F. PVC-Coated Rigid Steel Conduit
 - 1. Manufacturers
 - a. Atkore - Calbond
 - b. Plasti-bond
 - c. Kor-Kap
 - d. Engineer Approved equal
 - 2. PVC-Coated Conduit shall be listed to UL 6 and manufactured in accordance with ANSI C80.1 and NEMA RN-1.
 - 3. PVC-Coated Conduit shall be hot-dip galvanized covered by a zinc coating on the inside and outside surfaces in trade sizes ½ inch to 6 inches.
 - 4. Exterior PVC Coating Thickness: Nominal value of 40 mils (0.040 inch)
 - 5. Interior Urethane Coating Thickness: Nominal value of 2 mils (0.002 inch)
 - 6. Pass adhesion test and be labeled ETL Verified PVC-001
 - 7. Conduit shall be threaded on both ends. Taper of conduit threads shall be ¾" per foot (1 in 16) per ANSI/ASME B.1.20.1.
- G. Pre-manufactured Fixture Whips:
 - 1. Manufacturers:
 - a. Southwire
 - b. EPCO
 - c. Engineer approved equal.
 - 2. Description: UL listed flexible conduit with conductors and die-cast screw connectors on the end.
 - 3. Size: no longer than 6', 3/8" diameter.
 - 4. Wire: 14 AWG minimum for lighting and required by the load.

5. Install between junction box and light fixture only in concealed and unfinished spaces. Use interior raceway or surface raceway where exposed in finished spaces.
- H. Fittings and Conduit Bodies:
 1. NEMA TC 3
 2. Install offsets at surface boxes.
 3. Install single hole strap connectors on all exposed conduit one inch (1") and smaller.

2.03 BOX TYPES

- A. General Requirements:
 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
 3. Provide a low voltage partition divider plate for applications where low voltage and line voltage circuits share the same outlet box.
- B. Outlet Boxes:
 1. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized steel.
 - a. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported. Include 1/2 inch male fixture studs where required.
 - b. Concrete Ceiling Boxes: Concrete Type.
 2. Sheet Metal Communications Boxes: ANSI/NEMA OS 1, galvanized steel. Minimum of 4-11/16 inch square with a depth of 2-1/8 inch.
 - a. Refer to the drawings for plaster ring size/opening.
 3. PVC Molded Construction box: 2 hour fire rating. Captive nails and bracket support. For use with non-metallic sheathed cable. May be used in wood construction on multi-family residential new construction projects only. UL listed.
 - a. Use nonmetallic boxes when exposed rigid PVC conduit is used.
 - b. Nonmetallic Boxes: Comply with NEMA OS 2; and list and label as complying with UL 514C.
- C. Cast Boxes: NEMA FB 1, type #FD, cast alloy. Provide gasket cover by box manufacturer.
- D. Floor Boxes:
 1. ANSI/NEMA OS 1, semi-adjustable.
 2. Material: Formed steel.
 3. Shape: Rectangular.
 4. Conform to regulatory requirements to concrete tight floor boxes.
- E. Pull and Junction Boxes:
 1. Sheet Metal Boxes: NEMA OS 1 galvanized steel.
 2. Surface Mounted Cast Metal Box: NEMA 250, type #4 and #6, flat-flanged, surface mounted junction box:
 - a. Material: Galvanized cast iron.
 3. Cover: Furnish with ground flange, neoprene gasket and stainless steel cover screws.
 4. Fiberglass Hand Holes:
 - a. Die molded fiberglass hand holes.
 - b. Cable Entrance: Precut 6" x 6" cable entrance at center bottom of each side.
 - c. Cover: Fiberglass weatherproof cover with nonskid finish and light traffic rating.

2.04 SURFACE METAL RACEWAY TYPES

- A. Surface Metal Raceway:

1. Manufacturers:
 - a. Wiremold #V500 or #V700
 - b. Hubbell
 - c. Engineer approved equal.
 2. Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.
 3. Size as required or as indicated on drawings.
 4. Finish is to be ivory enamel.
 5. Color coat to be applied by others.
 6. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories.
 7. Combination Device Box: Furnish Wiremold #V5748 Series.
- B. Surface Single Channel Metal Raceway:
1. Manufacturers:
 - a. Wiremold #3000-access system.
 - b. Engineer approved equal.
 2. Description: Single channel with fitted cover, suitable for use as surface raceway.
 3. Size: 2-3/4" x 1-1/2" deep.
 4. Finish: Ivory scuff coat finish. Architect to verify color.
 5. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories.
 6. Install receptacles as indicated on the drawings. Use Wiremold #V3000 style. Match raceway finish.
- C. Surface Dual Channel Metal Raceway:
1. Manufacturers:
 - a. Wiremold #4000-access system.
 - b. Engineer approved equal.
 2. Description: Dual channel with fitted cover, suitable for use as surface raceway.
 3. Size: 4-3/4" x 1-3/4" deep.
 4. Finish: Ivory scuff coat finish. Architect to verify color.
 5. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories.
 6. Install receptacles as indicated on the drawings. Use Wiremold #4050 style with Wiremold #5507 series power and data devices. Match raceway finish.
- D. Multi-Outlet or Wiring Assembly:
1. Manufacturers:
 - a. Wiremold #2000
 - b. Engineer approved equal.
 2. Assembly: Sheet metal channel with fitted cover suitable for use as multi-outlet or wiring assembly.
 3. Size as indicated on the drawings.
 4. Receptacles: Provide covers and accessories to accept duplex receptacles. Receptacles, where indicated as plug mold, shall be spaced 18 inch on center. Install receptacles as indicated on the drawings. Match raceway finish.
 5. Channel Finish: Ivory scuff coat finish.
 6. Fittings: Furnish manufacturer's standard couplings, elbows, outlet and device boxes, and connectors.

PART 3 EXECUTION

3.01 CONDUIT INSTALLATION

- A. Install conduit in accordance with NECA "Standard of Installation."
- B. Arrange supports to prevent misalignment during wiring installation.

- C. Support conduit using coated steel, malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- D. Group related conduit support using conduit rack. Construct rack using steel channel and provide space on each for 25% additional conduits.
- E. Fasten conduit supports to building structure and surfaces.
- F. Do not support conduit with perforated pipe straps. Remove wire used for temporary supports.
- G. Do not use spring steel clips and clamps for support.
- H. Install compression type fittings in all wet and damp areas.
- I. Do not attach conduit to ceiling support wires.
- J. Arrange conduit to maintain headroom and present neat appearance.
- K. Route exposed conduit parallel and perpendicular to walls.
- L. Route conduit installed above accessible ceilings, parallel and perpendicular to walls.
- M. Route the conduit in and under slab from point-to-point.
- N. Do not cross conduits in slab.
- O. Maintain adequate clearance between conduit and piping.
- P. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degree F.
- Q. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- R. Bring conduit to shoulder of fittings; fasten securely.
- S. Use conduit hubs to fasten conduit to cast boxes.
- T. A run of conduit shall not contain more than the equivalent of four (4) quarter bends (360 degrees), including those bends located immediately at the outlet or body. Use conduit bodies to make sharp changes in direction (as around beams). Use hydraulic one-shot bender to fabricate bends in metal conduit larger than two inch (2") size. All conduit shall be held right to structure.
- U. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- V. Provide suitable fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.
- W. Provide suitable pull string in each empty conduit except sleeves and nipples.
- X. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- Y. Ground and bond all conduits.
- Z. Identify conduit.
- AA. Flexible conduit up to six feet (6') in length can be used to connect mechanical equipment with motors, compressors, light fixtures or unless directed by engineer.
- BB. Install insulated bushings on all conduits and sleeves serving low voltage wiring prior to pulling wire unless otherwise noted.
- CC. Install grounded insulated bushings on all conduits and sleeves serving data wiring prior to pulling wire unless otherwise noted.
- DD. All low voltage conduits shall be sized to have less than 40% fill. Each penetration through a surface of any kind shall have a conduit sleeve with insulated bushings.
- EE. Junction boxes shall not be installed over four foot (4') above accessible ceiling without prior written approval by owner.

- FF. Conduits which enter communications entrance facilities shall extend 4 inches above the finished floor or 3 inches through the wall.
- GG. Minimum bend radius for communications conduits:
 - 1. For conduits 2" or less, maintain a minimum bend radius of (6) times the actual inside diameter of the conduit.
 - 2. For conduits greater than 2", maintain a minimum bend radius of (10) times the actual inside diameter of the conduit.
- HH. Communications conduits shall have no more than two (2) 90 degree bends between pull points and contain no continuous sections longer than 100 feet. Insert pull points or pull boxes for conduits exceeding 100 feet in length.
 - 1. A third bend is acceptable if:
 - a. The total run is not longer than (33) feet.
 - b. The conduit size is increased to the next trade size.
- II. No continuous section of conduit may exceed 100 feet. Utilize pull boxes as necessary. Refer to the pull box execution section for more information.
- JJ. All wiring in the same conduit shall be from the same source and have the same voltage except where approved by the owner.
- KK. Exterior rooftop pathways shall be supported above roofing membrane utilizing rubber type support bases with 12 ga. galvanized channel supports (Copper B-Line Dura-Block or equivalent). Install minimum 7/8" or compliant with current NEC requirements.
- LL. For conduit installed in precast concrete walls or floors, it shall be acceptable to utilize Schedule 40 PVC conduit in lieu of EMT.

3.02 BOX INSTALLATION

- A. Install boxes in accordance with NECA "Standard of Installation."
- B. Install electrical boxes in locations as shown on the drawings and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- C. Set wall mounted boxes at elevations to accommodate mounting heights as indicated.
- D. Electrical boxes are shown on the drawings in approximate locations unless dimensioned. Adjust box location up to ten foot (10') if required to accommodate intended purpose. Verify with architectural drawings and elevations for additional information.
- E. Orient boxes to accommodate wiring device orientation.
- F. Maintain headroom and present neat mechanical appearance.
- G. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only. Junction boxes shall not be installed over four foot (4') above accessible ceilings.
- H. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than six inches (6") from ceiling access panel or from removable recessed luminaire.
- I. Fire-stop boxes to preserve fire resistance rating of partitions and other elements. Boxes may be installed within a minimum of 24 inch separation with written approval prior to installation.
- J. Coordinate mounting heights and locations of outlets mounted above counters, benches, and back splashes.
- K. Locate outlet boxes to allow luminaires positioned as shown on the drawings. If light fixture locations conflict with ceiling plans, the electrical contractor shall document discrepancies and send to the engineer for clarification.
- L. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

- M. Use flush mounting outlet box in finished areas.
- N. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- O. Do not install flush mounting box back-to-back in wall, provide minimum six inch (6") separation.
- P. Provide minimum 24 inch separation for receptacles in acoustic rated walls. Provide sound blocking putty where lighting control devices are located in the same stud cavity.
- Q. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- R. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- S. Use adjustable steel channel fasteners for hung ceiling outlet box.
- T. Do not fasten boxes to ceiling support wires.
- U. Support boxes independently of conduit.
- V. Use gang box where more than one device is mounted together. Do not use sectional box.
- W. Use gang box with plaster ring for single device outlets.
- X. Use cast outlet box in exterior locations exposed to the weather and wet locations.
- Y. Use cast iron floor boxes for installation in slab on-grade, formed steel boxes are acceptable for other installations unless otherwise noted.
- Z. Set floor boxes level.
- AA. Large Pull Boxes: Use set screw enclosure in interior dry locations, surface-mounted cast metal box in other locations.
- BB. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- CC. Group devices associated with each other eight inches (8") on center (i.e. receptacle, data, voice outlet).
- DD. All floor mounted device locations shall have a dimensioned drawing from the Architect prior to installation.

3.03 SURFACE RACEWAY AND WALL DUCT INSTALLATION

- A. Install products in accordance with manufacturer's instructions. Provide all trim and accessories.
- B. Use flat-head screws, clips, and straps to fasten raceway channel to surfaces. Mount plumb and level.
- C. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
- D. Wire Way Supports: Provide steel channel.
- E. Close ends of wire way and unused conduit openings.
- F. Ground and bond raceway and wire way.
- G. Install surface metal raceway in exposed existing finished areas where indicated on the drawing. Coordinate all raceway routing with architect.
- H. Install dual channel metal raceway assemblies in computer areas.
- I. Install insulated bushings on all Wiremold terminated above accessible areas serving low voltage wiring prior to pulling wire unless otherwise noted.

3.04 PULLBOXES

- A. Size communications cabling pull boxes according to the following:

Conduit Trade Size	Width	Length	Depth	Width Increase for Additional Conduit
1"	4"	16"	3"	2"
1-1/4"	6"	20"	3"	3"
1-1/2"	8"	28"	4"	4"
2"	8"	36"	4"	5"
2-1/2"	10"	42"	5"	6"
3"	12"	48"	5"	6"
4"	16"	60"	8"	6"

- B. Directional changes within a pullbox shall not be allowed. Conduit entering the box shall have conduit leaving the box from the opposite side. Do not use a pull box to make 90 degree turns.
- C. Install pullboxes in conveniently accessible locations.
- D. Where identified on drawings as lockable, key all pullboxes the same.
- E. Label all pull boxes. Handwritten labels shall not be accepted.

3.05 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit using materials and method to preserve fire resistance rating of partitions and other elements.
- B. Piping and Ductwork: Route conduits through roof openings or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified.
- C. Coordinate installation of outlet and junction boxes for equipment connection.

3.06 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Install knockout closures in unused box openings.
- C. Adjust floor box flush with finish flooring material.

3.07 CLEANING

- A. Clean interior of boxes to remove dust, debris, and other material.
- B. Clean exposed surfaces and restore finish.

END OF SECTION

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**SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates and labels
- B. Wire markers
- C. Conduit markers
- D. Underground warning tape
- E. Tracer wires
- F. Identification

1.02 REFERENCES

- A. NFPA 70 - National Electrical Code
- B. NFPA 70E - Standard for Electrical Safety in the Workplace

1.03 SUBMITTALS

- A. Product Data: Provide catalog data for nameplates, labels and markers.
- B. Samples: Submit two nameplates 4" x 4" in size illustrating materials and engraving quality.
- C. Manufacturer's Instructions: Indicate 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.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 NAMEPLATES AND LABELS

- A. Nameplates:
 - 1. Normal power: Engraved three-layer laminated plastic white letters on black background.
 - 2. Emergency power: Engraved three-layer laminated plastic white letters on red background.
 - 3. Equipment power: Engraved three-layer laminated plastic black letters on orange background.
- B. Locations:
 - 1. All electrical distribution and control equipment enclosure.
 - a. Switchboards and Panelboards: Line 1 shall state "Panel Name"; Line 2 shall state "Fed by Panel Name" as required by NEC section 408.4(B).
 - 2. Communication cabinets.
 - 3. Single mounted breaker.
 - 4. Fire alarm devices.
- C. Letter Size:
 - 1. Use 1/8 inch letters for identifying individual equipment and loads.
 - 2. Use 1/4 inch letters for identifying grouped equipment and loads.
 - 3. Use 1/4 inch letters for identifying communications cabinets, transfer switches and transformers.

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- D. Labels: Embossed adhesive tape with 3/16 inch white letters on black background.
Use only for identification of individual wall switches and receptacles, control device stations, and communication outlets.

2.02 WIRE MARKERS

- A. Description: Tape feeders to indicate phases.
 - 1. Marker colors for 120/208V shall be as follows: phase A shall be black, phase B shall be red, and phase C shall be blue. Neutral shall be white with tracer matching phase color.
- B. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.
- C. Legend:
 - 1. Power and Lighting Circuits: Branch circuit or feeder number indicated.
 - 2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams.

2.03 CONDUIT MARKERS

- A. Location: Mark conduit longer than 20 feet.
- B. Description: Plastic tape conduit markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings indicating panel and circuit number.
- C. Spacing: 30 feet on center.
- D. Color:
 - 1. 208 Volt System: Black
 - 2. Fire Alarm System: Red
 - 3. Other Systems: Green
- E. Legend:
 - 1. 208 Volt System: L- (name of feeder)
 - 2. Fire Alarm System: FA
 - 3. Telephone System: TS
 - 4. Computer System: CS

2.04 UNDERGROUND WARNING TAPE

- A. Manufacturers:
 - 1. Seaton
 - 2. Engineer approved equal.
- B. Description: Plastic four inch (4") wide tape, detectable type, colored RED with suitable warning legend describing buried electrical lines and inscribed "CAUTION - ELECTRIC LINE BURIED BELOW".
- C. Location: Along length of each underground conduit.

2.05 TRACER WIRES

- A. The electrical contractor shall provide a solid #10 AWG Tracer wire in each below grade conduit serving the electrical and communication systems. Tracer wires shall be labeled at each location of accessibility.

2.06 IDENTIFICATION

- A. Identify All Junction Boxes With Appropriate Marker As Follows:
 - 1. 208 Volt System: Black (circuit name and number)
 - 2. Fire Alarm System: Red
- B. Series rating identification:
 - 1. Upstream devices of series rated components not enclosed in a single NEMA type enclosure shall be identified with a nameplate using 1/8-inch lettering height

- reading "CAUTION - SERIES RATED SYSTEM - IDENTICAL COMPONENT REPLACEMENT REQUIRED".
2. Downstream devices of series rated components not enclosed in a single NEMA type enclosure shall be identified with a nameplate using 1/8-inch lettering height reading "CAUTION - SERIES RATED SYSTEM - ADDITIONAL SERIES COMBINATION RATING: XX,XXX RMS SYMMETRICAL AMPERES" where XX,XXX shall be the series combination rating.
 - C. Write the circuit number of each device inside the device box (not ON the device cover). All receptacles and light switches (new and existing) shall have the final circuit number installed on each device cover with a nylon label. Coordinate exact requirements with the owner prior to installation.
 - D. Write the circuit information for each junction box inside the device box. Write the panel name, panel pm number, circuit number(s), and room number of panel on the outside of each cover plate in unfinished or above ceiling spaces. Do not write on cover plate for junction box with permanent marker in any finished visible spaces. Use a permanent marker. Coordinate exact requirements with the owner prior to installation.
 - E. Temporary label all outlets and switches with circuit numbers.
 - F. All receptacles capable of being powered by an emergency generator shall be identified with a red sticker 3/8 inch diameter with an adhesive back.
 - G. Label all outlets and switches with an adhesive label identifying panel and circuit the device is energized by.
 - H. In a hospital or health care facility receptacle color shall be red if it can be energized by a generator. This shall include all critical, life safety, and essential equipment panels.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

- A. Install nameplate and label parallel to equipment lines.
- B. Secure nameplate to equipment front using screws.
- C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
- D. Identify conduit using field painting.
- E. Paint colored band on each conduit longer than 6 feet.
- F. Paint bands 20 foot on center.
- G. Identify underground conduits or wiring using one underground warning tape per trench at three inch (3") below finished grade.

END OF SECTION

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**SECTION 26 2416
PANELBOARDS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Branch circuit panelboards
- B. Load centers

1.02 RELATED SECTIONS

- A. Specification Section 26 0526 - Grounding and Bonding for Electrical System
- B. Specification Section 26 0553 - Identification for Electrical Systems
- C. Specification Section 26 4313 - Surge Protective Device

1.03 REFERENCES

- A. NECA Standard of Installation (published by the National Electrical Contractors Association)
- B. NEMA AB1 - Molded Case Circuit Breakers
- C. NEMA ICS 2 - Industrial Control Devices, Controllers and Assemblies
- D. NEMA KS1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
- E. NEMA PB 1 - Panelboards
- F. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less
- G. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment (published by the International Electrical Testing Association)
- H. NFPA 70 - National Electrical Code

1.04 SUBMITTALS

- A. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- B. Submit manufacturer's installation instructions. Indicate 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.
- C. Record actual locations of panelboards and record actual circuiting arrangements in project record documents.
- D. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.
- E. It is the electrical contractors and suppliers responsibility to confirm the appropriate size and quantity of circuit breakers in the submitted panelboards with the information shown on the plan sheets, including the panelboard schedule, and the mechanical contractor prior to releasing the panelboards for construction.

1.05 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.06 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.

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- B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.07 RATINGS

- A. Definitions:
 - 1. Fully rated equipment shall be defined as equipment where all devices in that equipment shall carry a minimum of the AIC rating that is specified. The distribution panels, panelboards, and load centers for this project shall be fully rated unless otherwise specifically noted in the Drawings or Specifications.

1.08 MAINTENANCE MATERIALS

- A. Furnish two of each panelboard key.

PART 2 PRODUCTS**2.01 BRANCH CIRCUIT PANELBOARDS**

- A. Manufacturers:
 - 1. Square D. #NQ or NF
 - 2. General Electric
 - 3. Eaton (Cutler-Hammer)
 - 4. Siemens
 - 5. Engineer approved equal.
- B. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.
- C. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.
- D. Minimum Integrated Short Circuit Rating: See schedule on the drawings.
- E. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers with common trip handle for all poles, listed as type #SWD for lighting circuits, type #HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers where scheduled. Provide arc fault circuit breakers in all dwelling units as required by NEC Code. Do NOT use tandem circuit breakers. Handle ties to make multiple pole breakers are NOT permitted.
- F. Current Limiting Molded Case Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let through current and energy level less than permitted for same size Class RK-5 fuse. Handle ties to make multiple pole breakers are NOT permitted.
- G. Enclosure: NEMA PB 1, type #1.
- H. Cabinet box is to be 6" D x 20" W for 240 volt and less panelboards.
- I. Cabinet Front: Flush or surface cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.
- J. Door: Provide hinged door-in-door trim.
- K. Surge Protection Devices shall comply with Specification Section 26 4313.
- L. All panelboards 225 amp or less, are to have either intermediate supports on the bus bars to prevent deflection, or are required to have 800 amp/square inch bus bars if the bus bars are only supported at each end of the bus.
- M. Each section of multi-section panels shall have the same dimensions.
- N. If the system voltage is less than 150V and the equipment is neither grounded nor double insulated, a Class A GFCI with 4 to 6 mA trip current is required per the NEC.

However, if the equipment is considered "specialty" or "special-purpose" and either grounded or double-insulated, a Class C GFCI with 20 mA trip level shall be acceptable.

2.02 LOAD CENTERS

- A. Manufacturers:
 - 1. Square D
 - 2. General Electric
 - 3. Eaton (Cutler Hammer)
 - 4. Siemens
 - 5. Engineer approved equal.
- B. Description: Circuit breaker load center with bus ratings as indicated.
- C. Load Center Bus: Copper, ratings as indicated. Provide copper ground bus in each load center.
- D. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical or as shown on panelboard schedule.
- E. Molded Case Circuit Breakers: NEMA AB 1, plug-on type thermal magnetic trip circuit breakers with common trip handle for all poles, listed as type #SWD for lighting circuits, Class A ground fault interrupter circuit breakers where required by NEC Code, in all wet areas and also where scheduled. Provide arc fault circuit breakers in all dwelling units as required by NEC Code. Do not use tandem circuit breakers. Handle ties to make multiple pole breakers are NOT permitted.
- F. Enclosure: General purpose.
- G. Box:
 - 1. Flush or with lock on door.
 - 2. Finish in manufacturer's standard gray enamel.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1 and the NECA "Standard of Installation."
- B. Install panelboards plumb. Install recessed panelboards flush with wall finishes.
- C. Height is to be six feet (6') to top of the panelboard. Install panelboards taller than six feet (6') with bottom no more than four inch (4") above floor.
- D. Provide filler plates for unused spaces in panelboards.
- E. Provide typed circuit directory for each branch circuit panelboard. Use actual room numbers and not plan room numbers. Coordinate with owner. Revise directory to reflect circuiting changes required to balance phase loads. Typed circuit directories shall be completed in Microsoft Excel. The electrical contractor shall submit a CD with all directories included.
- F. Provide engraved plastic nameplates under the provisions of Specification Section 26 0553 - Identification for Electrical Systems.
- G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling and to the floor below. Minimum spare conduits: Five empty one inch (1") at each recessed panel location. Identify each as SPARE.
- H. Ground and bond the panelboard enclosure.
- I. Any panel field modifications and associated means and methods shall be approved by the Authority Having Jurisdiction and the equipment manufacturer. Any costs associated shall be included in the bid.

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- J. It shall be the responsibility of the electrical contractor to verify all wire sizes with existing and new circuit breakers prior to ordering and installing so that specified wire will properly fit into the corresponding circuit breaker.
- K. Verify lug size of electrical equipment and mechanical equipment is properly sized to receive specified conductor size. Refer to one-line and the conduit/conductor chart for additional information.

3.02 FIELD QUALITY CONTROL

- A. Inspect in accordance with NETA ATS.
- B. Perform inspections listed in NETA ATS.

3.03 ADJUSTING

- A. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20% of each other. Maintain proper phasing for multi-wire branch circuits.

3.04 BREAKER COORDINATION

- A. Manufacturer shall provide all necessary circuit breaker coordination studies to determine required settings of their equipment.
- B. Contractor shall coordinate any breaker settings and adjust per the manufacturers recommended adjustable breaker settings.

END OF SECTION

**SECTION 26 2726
WIRING DEVICES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches
- B. Occupancy sensors
- C. Duplex receptacles
- D. Ground fault circuit interrupting receptacles
- E. Simplex receptacles
- F. Wall plates
- G. Floor boxes and service fittings
- H. General purpose contactor

1.02 RELATED REQUIREMENTS

- A. Specification Section 26 0533 - Raceway and Boxes for Electrical Systems
- B. Specification Section 26 0543 - Underfloor Ducts for Electrical Systems

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2010
- B. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2005)
- C. NEMA WD 6 - Wiring Device -- Dimensional Requirements; National Electrical Manufacturers Association; 2002 (R 2008)
- D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2011
- E. UL Standard 943 - Standard for Safety for Ground-Fault Circuit Interrupters (GFCIs)

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
- C. Manufacturer's Installation Instructions.
 - 1. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.
 - 2. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Wall Plates: One of each style, size, and finish.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Products: Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.01 WALL SWITCHES

- A. Description:
 - 1. Heavy Duty, AC only general-use snap switch, complying with NEMA WD 6 and WD 1.
 - 2. Body and Handle: Impact-resistant plastic with toggle handle. Auto-grounding strap.
 - 3. Ratings: Match branch circuit and load characteristics. Default rating is 20A, 120/277V, 1HP.
 - 4. Wiring: Back and side wire connections. Accepts #14-#10 AWG solid and stranded copper conductors.
 - 5. Provide #12 AWG solid pigtails at each device. Splice to building wire within outlet box.
 - 6. Color: Selected during submittal phase. Provide color chart upon request.
- B. Types:
 - 1. Toggle Switches
 - a. Approved Manufacturers and Models:
 - 1) Pass & Seymour #PS20AC
 - 2) Cooper #2221
 - 3) Hubbell #1221
 - 4) Leviton #1221-2
 - b. Description: Single pole, double pole, 3-way, and 4-way toggle switches as indicated on plans.

2.02 OCCUPANCY SENSORS (LINE VOLTAGE)

- A. Refer to the lighting sequence of operations for additional requirements.
- B. Description
 - 1. Self-configuring, auto-adapting, calibrated wall or ceiling mounted; passive infrared (PIR), ultrasonic or dual technology.
 - 2. Sensors shall be able to self adapt in the field with the ability to adjust the sensitivity and time delay.
 - 3. Sensor shall have adjustable re-trigger time for all manual-on loads.
 - 4. Coverage: 2000 SF minimum, 360 degree view for ceiling type and 180 degree view for wall mount types.
 - 5. Wire all per manufacturer's recommendations.
 - 6. Wire multiple sensors serving the same area to operate as a single unit.
 - 7. Sensors shall be configured to be MANUAL ON/AUTO OFF unless noted otherwise on the drawings and also have the capability to be configured to function AUTO ON/ AUTO OFF.
 - 8. Colors: Verify final color selection during submittal process.
- C. Types:
 - 1. Wall Mount Dual Tech Occupancy Sensor Switch
 - a. Approved Manufacturers and Models:
 - 1) Leviton OSSMT-MDW
 - 2) Approved equivalent.
 - 2. Ceiling Mount Dual Tech Occupancy Sensor Switch
 - a. Approved Manufacturers and Models:
 - 1) Leviton ODC20-MDW
 - 2) Approved equivalent.

2.03 DUPLEX RECEPTACLES

- A. Description
 - 1. Style: Hard use specification grade

2. Device Body: Impact resistant plastic with impact-resistant nylon face. Auto-grounding strap.
 3. Configuration: NEMA WD 6, type as specified and indicated.
 4. Rating: Match branch circuit and load characteristics. Default rating is 5-20R, 125V, 20A.
 5. Standards: Receptacles comply with NEMA WD 6 and WD 1.
 6. Wiring: Back and side wire connections. Accepts #14-#10 AWG solid and stranded copper conductors.
 7. Provide #12 AWG solid pigtails at each device. Splice to building wire within outlet box.
 8. Color: Selected during submittal phase. Provide color chart upon request.
- B. Types
1. Duplex Receptacles
 - a. Manufacturers:
 - 1) Pass & Seymour #5362
 - 2) Cooper #5362C
 - 3) Hubbell #5362
 - 4) Leviton #5362-S
 - b. Description: Traditional style, hard use specification grade duplex receptacle with wraparound grounding/mounting strap.
 2. Weather-Resistant Receptacles
 - a. Manufacturers:
 - 1) Pass & Seymour #2097TRWR
 - 2) Cooper #WRSGF20
 - 3) Hubbell #GFTWRST20
 - 4) Leviton #GFWT2
 - b. Description: UL listed weather-resistant receptacle.
 - c. Provide weather-resistant receptacles for all receptacles located in wet and damp locations as described in NEC Article 406.

2.04 GROUND FAULT CIRCUIT INTERRUPTING RECEPTACLES

- A. Receptacles: Complying with NEMA WD 6 and WD 1. Class A GFCI rated.
1. Style: Hard use specification grade
 2. Device Body: Impact resistant plastic with impact-resistant nylon face. Auto-grounding strap.
 3. Configuration: NEMA WD 6, type as specified and indicated.
 4. Rating: Match branch circuit and load characteristics. Default rating is 5-20R, 125V, 20A.
 5. Standards: Receptacles comply with NEMA WD 6 and WD 1.
 6. Wiring: Back and side wire connections. Accepts #14-#10 AWG solid and stranded copper conductors.
 7. Provide #12 AWG solid pigtails at each device. Splice to building wire within outlet box.
 8. Color: Selected during submittal phase. Provide color chart upon request.
- B. Types
1. GFCI Duplex Receptacles
 - a. Manufacturers:
 - 1) Pass & Seymour #2097
 - 2) Cooper SGF20
 - 3) Hubbell GFRST20
 - 4) Leviton GFNT2
 - b. Description: Specification grade duplex GFCI receptacle.
 - c. Receptacles noted as "GFI" on plans.

2. GFCI Tamper Resistant Receptacles
 - a. Manufacturers:
 - 1) Pass & Seymour 2097TR
 - 2) Cooper TRSGF20
 - 3) Hubbell GFTRST20
 - 4) Leviton GFTR2
 - b. Description: Specification grade tamper-resistant duplex GFCI receptacle.
 - c. Receptacles in all areas as noted in NEC Article 406.
 - d. Receptacles noted as "GFI" on plans.
3. Radiant Dead Front 20A Duplex Self-Test GFCI
 - a. Manufacturers
 - 1) Legrand 2087W
 - 2) Cooper
 - 3) Hubbell
 - 4) Leviton
 - b. Description: Dead front device is a ground fault circuit interrupter designed for use when assess to power is not obtainable.

2.05 SIMPLEX RECEPTACLES

- A. Description
 1. Style: Hard use specification grade
 2. Device Body: Impact resistant plastic with impact-resistant nylon face. Auto-grounding strap.
 3. Configuration: NEMA WD 6, type as specified and indicated.
 4. Rating: Match branch circuit and load characteristics. Default rating is 5-20R, 125V, 20A.
 5. Standards: Receptacles comply with NEMA WD 6 and WD 1.
 6. Wiring: Back and side wire connections. Accepts #14-#10 AWG solid and stranded copper conductors.
 7. Provide #12 AWG solid pigtails at each device. Splice to building wire within outlet box.
 8. Color: Selected during submittal phase. Provide color chart upon request.
- B. 20A, Twist-Lock Single Flush Receptacle w/ Spring Termination
 1. Manufacturers
 - a. Legrand
 - b. Cooper
 - c. Hubbell HBL2310ST
 - d. Leviton
 2. Description: 20A, 125V 2-pole, 3-wire twist-lock single flush receptacle w./ spring termination blocks.

2.06 WALL PLATES

- A. Standard Cover Plates:
 1. Type 302 stainless steel cover plates. Cover plate style to be confirmed during submittal phase.
 2. Basis of Design: Pass & Seymour #SS (Metal), to be confirmed during submittal phase.
 3. Provide coverplate for all devices and provide multiple gang plates where required.
- B. Jumbo Cover Plates:
 1. Type 302 stainless steel oversize cover plates. Cover plate style to be confirmed during submittal phase.

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2. Basis of Design: Pass & Seymour #SSO (Metal) to be confirmed during submittal phase.
 3. Provide coverplate for all devices and provide multiple gang plates where required.
 4. Provide oversize plates on all masonry rough-ins. Verify with architect prior to work being performed.
- C. Weatherproof Box & Cover:
1. Basis of Design: Pass & Seymour #WIUC10.
 - a. Description: Heavy-duty polycarbonate NEMA 3R "While-In-Use" weatherproof box and cover. Installed horizontally.
 - b. Complies with NEC Article 406 requirements for wet location covers.
 - c. Provide with plate kits as required.
 - d. Provide multi-gang or deep cover configurations as required for application.
 - e. Cover shall be capable of accepting a standard size padlock.
 - f. Color shall be gray, to be confirmed during submittal phase.
 - g. Indicated by "WP" on plans.
- D. Provide red plastic faceplates where powered by a redundant power supply, to be confirmed during submittal phase.

2.07 FLOOR BOXES AND SERVICE FITTINGS

- A. See schedule on drawings.

2.08 GENERAL PURPOSE CONTACTOR

- A. Contactors: NEMA ICS 2 and UL 508; electrically held, 30 amps rated.
- B. Coil Operating Voltage: 120 volts, 60 Hertz.
- C. Poles: 6, Normally closed.
- D. Enclosure: ANSI/NEMA ICS 6; NEMA Type 1.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that outlet and switch boxes are installed at proper height.
- B. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- C. Verify that floor boxes are adjusted properly.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.02 PREPARATION

- A. Provide extension rings as needed to bring outlet and switch boxes flush with finished surface.
- B. Clean debris from outlet and switch boxes prior to device installation.

3.03 INSTALLATION

- A. Install securely, in a neat and workmanlike manner, as specified in NECA 1.
- B. Install devices plumb and level.
- C. Install switches with OFF position down.
- D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- E. Install receptacles with grounding pole on top.
- F. Connect wiring device grounding terminal to outlet box with bonding jumper.
- G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

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- H. Connect wiring devices by wrapping conductor around screw terminal.
- I. Use oversize plates for outlets installed in masonry walls.
- J. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- K. The electrical contractor shall verify floor finish and location before ordering floor devices.
- L. The feeding of receptacles downstream of GFI receptacles for protection in lieu of providing multiple GFI receptacles is NOT allowed.
- M. Install boiler emergency pushbutton per CSD-1, located just outside the boiler room door and marked for easy identification. If the boiler room door is on the building exterior, the switch should be located just inside the door. If there is more than one door to the boiler room, there should be a remote shutdown switch located at each door.

3.04 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under Section 26 0533 to obtain mounting heights specified.
- B. In masonry walls, switches and receptacle heights shall be adjusted as required such that outlets are at nearest mortar joint to specified height.
- C. Coordinate the installation of wiring devices with underfloor duct service fittings provided under Section 26 0543.

3.05 FIELD QUALITY CONTROL

- A. Perform field inspection, testing, and adjusting in accordance with Section 01 4000.
- B. Inspect each wiring device for defects.
- C. Operate each wall switch with circuit energized and verify proper operation.
- D. Verify that each receptacle device is energized.
- E. Test each receptacle device for proper polarity.
- F. Test each GFCI receptacle device for proper operation.

3.06 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.07 CLEANING

- A. Clean exposed surfaces to remove splatters and restore finish.

3.08 EXTRA MATERIALS AND LABOR

- A. The electrical contractor shall include in their bid an allowance to install an additional five duplex receptacles including an average 50 feet of raceway, associated wiring, back box and labor, and all accessories required to energize each receptacle requested. Receptacle(s) may be added anytime during the construction process as requested by the owner or design team. Any unused devices shall be turned over to the owner at the final acceptance of building.

END OF SECTION

**SECTION 26 2816
ENCLOSED STARTERS AND SWITCHES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Safety switches
- B. Motor-Rated starters and switches
- C. Automatic Controllers

1.02 RELATED REQUIREMENTS

- A. Specification Section 26 0529 - Hangers and Supports for Electrical Systems
- B. Specification Section 26 0553 - Identification for Electrical Systems
- C. Specification Section 26 2813 - Fuses

1.03 REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association
- B. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association
- C. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association
- D. NFPA 70 - National Electrical Code; National Fire Protection Association
- E. NECA - Standard of Installation (published by the National Electrical Contractors Association)

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide switch ratings and enclosure dimensions.
- C. Project Record Documents: Record actual locations of enclosed switches.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.
- C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 SAFETY SWITCHES

- A. Manufacturers
 - 1. Square D
 - 2. General Electric
 - 3. Eaton
 - 4. Siemens
 - 5. Engineer approved equal.
 - 6. No engineer approved equal.
- B. Heavy duty safety switches shall be used for all motor loads over 1 HP and all non-motor loads 20 amps and greater.
 - 1. Fusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.

- a. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
- b. Handle lockable in OFF position.
- c. Fuse clips: Designed to accommodate NEMA FU1, Class R fuses, with rejection clips designed to permit installation of Class R fuses only.
- d. Indicated as a disconnect switch with a "F" on the drawings.
2. Nonfusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.
 - a. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
 - b. Handle lockable in OFF position.
3. Enclosures: NEMA KS 1.
 - a. Interior Dry Locations: Type 1 .
 - b. Exterior Locations: Type 3R.
 - c. Enclosures shall be provided with a method of opening the cover without opening the switch.
4. Enclosure shall include a grounding bar.

2.02 MOTOR-RATED STARTERS AND SWITCHES

- A. Manufacturers
 1. Square D
 2. General Electric
 3. Cutler-Hammer
 4. Siemens
 5. Cooper-Bussmann
 6. Engineer approved equal.
- B. Motor-rated starters and switches may be used for all motor loads 1 HP and less and all non-motor loads under 20 amps.
 1. Motor-Rated Switch with Fuseholder
 - a. Basis of Design: Cooper-Bussmann "STY".
 - b. Description: Motor-rated toggle switch disconnecting means with plug fuseholder.
 - c. Fuseholder: Designed to accommodate plug fuses. Provide fuse sized per NEC 430.
 - d. For use with single-pole motors only.
 2. Nonfusible Motor-Rated Starter
 - a. Basis of Design: Square D "Type F".
 - b. Description: Fractional horsepower manual starter with melting alloy type thermal overload relay.
 - c. Handle lockable in OFF position.
 - d. Current rating: 16A
 - e. For use with single-phase motors only.
 - f. Provide and install thermal units sized per NEC 430.
 3. Nonfusible Motor-Rated Switch
 - a. Basis of Design: Square D "Type K".
 - b. Description: Fractional horsepower manual switch with melting alloy type thermal overload relay.
 - c. Handle lockable in OFF position.
 - d. Current rating: 30A
 - e. For use with single or three phase motors.

2.03 AUTOMATIC CONTROLLERS

- A. Magnetic Motor Controllers: NEMA ICS 2, AC general-purpose Class A magnetic controller for induction motors rated in horsepower.

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- B. Reversing Controllers: Include electrical interlock and integral time delay transition between FORWARD and REVERSE rotation.
- C. Two-Speed Controllers: Include integral time delay transition between FAST and SLOW speeds.
- D. Coil Operating Voltage: 120 volts, 60 Hertz.
- E. Overload Relay: NEMA ICS; bimetal.
- F. Enclosure: NEMA ICS 6, type as required to meet conditions of installation.
- G. Auxiliary Contacts: NEMA ICS 2, two each normally open contacts in addition to seal-in contact.
- H. Cover Mounted Pilot Devices: NEMA ICS 5, standard duty type.
- I. Pilot Device Contacts: NEMA ICS 5, Form Z, rated A150.
- J. Pushbuttons: Shrouded type.
- K. Indicating Lights: Transformer type.
- L. Selector Switches: Hand off/on/auto selector switch type.
- M. Relays: NEMA ICS 2.
- N. Control Power Transformers: 120 volt secondary in each motor starter. Provide fused secondary, and bond un-fused leg of secondary to enclosure.
- O. Electrical contractor shall provide this style motor starter for integrating into controls/BMS. Coordinate with the mechanical contractor.
- P. Automatic Controllers shall come with lockable disconnecting means.

PART 3 EXECUTION**3.01 INSTALLATION**

- A. Install in accordance with NECA "Standard of Installation."
- B. Install in accordance with manufacturer's instructions.
- C. Install plumb and provide in accordance with Specification Section 26 0529 - Hangers and Supports for Electrical Systems.
- D. Height to be five foot (5') to operating handle.
- E. Install fuses in fusible disconnect switches. Fuses shall not be installed until equipment is ready to be energized.
- F. Provide one set of spare fuses of each size and type.
- G. Provide adhesive label with white letters on black background for associated equipment.
- H. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection in accordance with Section 01 4000.
- B. Inspect and test in accordance with NETA STD ATS, except Section 4.
- C. Perform inspections and tests listed in NETA STD ATS, Section 7.5.1.2.

END OF SECTION

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**SECTION 26 4313
SURGE PROTECTIVE DEVICES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surge Protective Devices - External
- B. Surge Protective Devices - Internal

1.02 REFERENCES

- A. UL 1283 - Electromagnetic Interference Filters
- B. ANSI/IEEE C62.41.1-2002 - IEEE Guide on the Surge Environment in Low Voltage (1000 V and Less) AC Power Circuits
- C. ANSI/IEEE C62.41.2-2002 - IEEE Recommended Practice on Characterization of Surge Voltages in Low Voltage AC Power Circuits
- D. ANSI/IEEE C62.45-2002 - IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits
- E. NFPA 70 - National Electric Code - Article 285

1.03 RELATED SECTIONS

- A. Specification Section 26 0519 - Electrical Power Conductors and Cables
- B. Specification Section 26 0526 - Grounding and Bonding
- C. Specification Section 26 0533 - Raceways and Boxes for Electrical Systems

1.04 SUBMITTALS

- A. Product data and manufacturer's installation instructions for non-approved manufacturers shall be submitted for review prior to the bid date.
- B. Submittals shall include:
 - 1. Dimensional drawing of each SPD type.
 - 2. Dimensional drawing of each SPD enclosure.
 - 3. UL 1449 Current Edition Listing, Standard for Safety, Surge Protective Devices, documentation.
 - 4. UL 1283 Listing, Electromagnetic Interference Filters, documentation.
 - 5. ANSI/IEEE C62.41 and C62.45, Category C3 (20kV-1.2/50, 10kA-8/20microsecond waveform) clamping voltage test results.

PART 2 PRODUCTS

2.01 SURGE PROTECTION DEVICES

- A. For external mount device, the manufacturer shall be from approved list below. Also, the distribution equipment shall be fully tested and certified to the following UL standards:
 - 1. UL 67 = Panelboards.
 - 2. UL 845 = Motor Control Centers.
 - 3. UL 857 = Busway.
 - 4. UL 891 = Switchboards.
 - 5. UL 1558 = Low Voltage Switchgear.
- B. Basis of Design: The system shall be constructed using multiple surge current diversion thermally protected metal oxide varistors (TPMOV). The surge current circuit shall be designed and constructed in a manner that ensures surge current sharing. Use of gas tubes, silicon avalanche diodes or selenium cells are unacceptable unless documentation from a nationally recognized laboratory demonstrates current sharing of all dissimilar components at all surge current levels. The listing of a manufacturer as acceptable does not imply automatic approval .

2.02 SURGE PROTECTION DEVICE MANUFACTURERS

- A. ASCO Power Technologies (APT)
- B. Square D/Schneider Electric
- C. GE
- D. Siemens
- E. Eaton
- F. Liebert

2.03 RATINGS

- A. Minimum Surge Current Capability (single pulse rated) Per Phase Shall Be:
 - 1. Main Service Entrance and Emergency Switchboard: 300 kA per phase/150kA per mode
 - 2. Distribution Panelboards: 200 kA per phase /100kA per mode
 - 3. Branch Panelboards: 100 kA per phase/50kA per mode
- B. UL 1449 clamping voltage must not exceed the following: Voltage Protection Rating (VPR)

VOLTAGE	L-N	L-G	N-G
240/120	1200/800V	800V	800V
208Y/120	700V	700V	700V
480Y/277	1200V	1200V	1200V

- C. UL1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

SYSTEM VOLTAGE	ALLOWABLE SYSTEM VOLTAGE FLUCTUATION (%)	MCOV
208Y/120	25%	150V
480Y/277	15%	320V

- D. SPD shall provide suppression for all modes of protection: L-N, L-G, and N-G in WYE systems. (Minimum 7 Modes)

2.04 DESCRIPTION

- A. SPD shall be listed in accordance with UL 1449 Current Edition Type 2 device and UL 1283, Electromagnetic Interference Filters.
- B. Integrated surge protective devices (SPD) shall be "component recognized" in accordance with UL 1449 Current Edition, Section 37.3.2 and 37.4 at the standards highest short circuit current rating (SCCR) of 200 kA, including intermediate level of fault current testing that will be effective 9/29/2009.
- C. SPD shall be tested with the ANSI/IEEE Category C High exposure waveform (20kV-1.2/50ms, 10kA-8/20ms).
- D. Pulse Life Test: Capable of protecting against and surviving 5000 ANSI/IEEE Category C High transients without failure or degradation of clamping voltage by more than 10%.
- E. Minimum UL 1449 current edition withstand Nominal Discharge Current (In) rating to be 20kA per mode.
- F. SPD shall be designed to withstand a maximum continuous operating voltage (MCOV) of not less than 115% of nominal RMS voltage.
- G. SPD shall be constructed of one self-contained suppression module per phase.
- H. Visible indication of proper SPD connection and operation shall be provided. The indicator lights shall indicate which phase as well as which module is fully operable. The status of each SPD module shall be monitored on the front cover of the enclosure

as well as on the module. A push-to-test button shall be provided to test each phase indicator. Push-to-test button shall activate a state change of dry contacts for testing purposes.

- I. SPD shall be equipped with an audible alarm which shall activate when any one of the surge current modules has reached an end-of-life condition. An alarm on/off switch shall be provided to silence the alarm. The switches and alarm shall be located on the front cover of the enclosure.
- J. A connector shall be provided along with dry contacts (normally open or normally closed) to allow connection to a remote monitor or other system. The output of the dry contacts shall indicate an end-of-life condition for the complete SPD or module.
- K. Terminals shall be provided for necessary power and ground connections.
- L. The SPD shall be Equipped the Following Optional Items:
 - 1. A transient voltage surge counter shall be located on the diagnostic panel on the front cover of the enclosure for the service entrance device . The counter shall be equipped with a manual reset and battery backup to retain memory upon loss of AC power.
 - 2. A remote monitoring device shall be provided to directly connect to the SPD with a dry contact connector for simple installation. The device will have indicator lights and an audible alarm to monitor for normal and fault conditions.
- M. SPD shall have a warranty for a period of ten-years from date of invoice. Warranty shall be the responsibility of the equipment manufacturer and shall be supported by their respective field service division.

PART 3 EXECUTION

3.01 INSTALLATION

- A. For external mount devices, install surge protection devices (SPD's) at the power distribution equipment for use at the utility service entrance to the facility and at each distribution switchboard and branch panelboard to be protected.
- B. The service entrance SPD shall be installed on the load side of a service disconnect overcurrent device per NEC.
- C. The SPD's ground shall be connected to the power system ground.
- D. Before energizing, installer shall verify service and separately derived system Neutral to Ground bonding jumpers per NEC.
- E. Where the SPD is connected to the power system with cables, keep the conductors as short as possible with no sharp bends.
- F. At the service entrance, connect the SPD to a 60 amp circuit breaker. If a 60 amp circuit breaker is not available, a UL-approved disconnect switch shall be provided with the SPD as a means of servicing disconnect.
- G. At distribution switchboards and branch panelboards, connect the SPD to a 30 amp circuit breaker. If a 30 amp circuit breaker is not available, a UL approved disconnect switch shall be provided with the SPD as a means of servicing disconnect.
- H. Installer may reasonably rearrange circuit breaker locations to ensure shortest and straightest possible leads to SPD's.
- I. Provide and install internal or external SPD's with flush mount kits where recessed panelboards are installed in finished spaces.
- J. Provide and install a listed SPD in or on all emergency system switchboards, distribution panels and panelboards per NEC 700.8.

END OF SECTION

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**SECTION 26 5100
INTERIOR LIGHTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. LED Drivers
- B. Light Emitting Diodes (LEDs)

1.02 REFERENCES

- A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; 2006
- B. NECA/IESNA 500 - Recommended Practice for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association
- C. NECA/IESNA 502 - Recommended Practice for Installing Industrial Lighting Systems; National Electrical Contractors Association
- D. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association
- E. NFPA 70 - National Electrical Code; National Fire Protection Association
- F. NFPA 101 - Life Safety Code
- G. IESNA LM-79-08 - Approved Method for the Electrical and Photometric Measurement of Solid-State Lighting Products
- H. IESNA LM-80-08 - Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- I. IESNA TM-21-11 - Projecting Long Term Lumen Maintenance of LED Light Sources
- J. EU Directive 2002/95/EC - Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS), as amended by directive 2005/618/EC

1.03 SUBMITTALS

- A. Provide cut sheet indicating dimensions and components for each luminaire.
- B. Submit manufacturer's installation instructions. Indicate 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.
- C. Submit manufacturer's operation and maintenance instructions for each product.
- D. All lighting submittals must be on Local Authorized Manufacturer Representative's letterhead and contain Project Name and Location.
- E. Closeout: Provide list of Extra Materials for owner to verify and sign for acknowledgement of receiving.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70 and NFPA 101.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.05 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70 and 101
- B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

- C. Products with Light Emitting Diodes:
 - 1. Fixtures shall comply with LM-79-08: Electrical and Photometric Measurements of Solid-State Lighting Products.
 - 2. Interior fixture diode arrays shall maintain +/-100 degrees Kelvin (K); exterior fixture diode arrays shall maintain +/- 500 K color temperature range through the life of the fixture.
 - 3. Diode arrays shall be wired so that if one diode fails, at least 90% of the remaining diodes will operate.

PART 2 PRODUCTS

2.01 LED DRIVERS:

- A. Manufacturers must be in business a minimum of (5) years.
- B. Drivers shall be provided with light emitting diodes as a modular replaceable system. The system shall be fully designed and tested for operation throughout warranted period.
- C. Driver shall be Underwriters Laboratories (UL) listed, Class 2 Outdoor recognized.
- D. Driver shall be suitable for damp locations.
- E. Driver shall operate from -20 to 60 deg C.
- F. Refer to fixture schedule on drawings for additional requirements.
- G. Driver shall operate from 50 to 60 Hz input source of 120 V or 208 V, as required in plans, with sustained variations of +/-10% (voltage and frequency) with no damage to the driver.
- H. Driver output shall be regulated to +/- 5% across published load range.
- I. Driver shall have an "A" sound rating.
- J. Driver shall have a power factor greater than 0.9.
- K. Driver input current shall have Total Harmonic Distortion (THD) of less than +/-20% at all operating voltages.
- L. Driver shall tolerate sustained open circuit and short circuit output conditions without damage and without need for external fuses or trip devices.
- M. Driver shall carry a five-year warranty from the date of manufacture against defects in material or workmanship, including replacement for operation at a maximum case temperature of 90 deg C.
- N. Driver shall have an efficiency greater than or equal to 85%.
- O. Driver shall comply with Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 15, Non-consumer (Class A) for EMI/RFI (conductive and radiated).
- P. Driver shall not contain any Polychlorinated Biphenyl (PCB).

2.02 LIGHT EMITTING DIODES (LEDS):

- A. Manufacturers must be in business for a minimum of (5) years.
- B. Light Emitting Diodes shall be provided with a driver as a modular replaceable system. The system shall be fully designed and tested for operation throughout warranted period.
- C. Diode arrays shall maintain +/-100K color temperature through the life of the fixture.
- D. Diodes shall have a minimum color rendering index of 80.
- E. Diodes and associate circuitry shall be RoHS compliant.
- F. Diodes shall be photometrically tested for compliance with IESNA LM-80-08, with projections calculated in accordance with IESNA TM-21-11.

- G. Diode arrays shall maintain a minimum 70% lumen output through an average operating life of 50,000 hours.
- H. Diodes and associated printed circuit boards shall be RoHS compliant.
- I. Refer to Lighting Fixture Schedule for color temperature requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Furnish products as specified in schedule on the drawings.
- C. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required suspending luminaire at indicated height.
- D. Locate recessed ceiling luminaires as indicated on reflected ceiling drawing and electrical lighting drawings.
- E. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- F. Install recessed luminaires to permit removal from below.
- G. Install recessed luminaires using accessories and fire stopping materials to meet regulatory requirements for fire rating.
- H. Install clips to secure recessed grid-supported luminaires in place.
- I. Install recessed can luminaires to fit in ceiling. Provide all necessary trim ring extenders or other accessories for proper installation of luminaire in ceiling.
- J. Install wall mounted luminaires, emergency lighting units and exit signs at height as scheduled.
- K. Install accessories furnished with each luminaire.
- L. Fixture whips utilizing THHN/THWN-2 wire in flexible metal conduit shall be used to connect all luminaires, emergency lights, and exit signs. Minimum wire size for all fixture whips shall be 14 AWG. Fixture whips shall be wired directly from the luminaire to an accessible junction box. Fixture to fixture whips are not allowed. Maximum length for any fixture whip shall be 6'.
- M. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- N. Bond products and metal accessories to the branch circuit equipment grounding conductor.
- O. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure. Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires.
- P. Support luminaires larger than 2' x 4' size independent of ceiling framing.

3.02 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.03 ADJUSTING

- A. Aim and adjust luminaires as directed.
- B. Position exit sign directional arrows as indicated.

3.04 WARRANTIES

- A. All warranties shall remain as an agreement between the installing contractor and the manufacturer. No third parties shall be involved with warranty repairs or replacements

of installed products without the written consent of the installing contractor and the owner or their representative.

- B. Labor for warranty repairs shall be billed by the contractor directly to the manufacturer or distributor during the duration of the labor warranty on the originally installed products. Labor work required on warranted parts, but outside of the 1-year labor warranty shall be the responsibility of the owner.

3.05 CLEANING

- A. Clean all electrical parts to remove all of the conductive and deleterious materials.
- B. Remove dirt and debris from enclosures.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.

3.06 SCHEDULES

- A. See the drawings.

3.07 EXTRA MATERIAL AND LABOR

- A. The electrical contractor shall include in their bid an allowance to install an additional two exit signs of each type and two emergency battery pack fixtures of each type as scheduled including an average 50 feet of raceway, associated wiring, back box and labor, and all accessories required to energize each device requested. Fixture(s) may be added anytime during the construction process as requested by the owner or design team. See schedule on drawings for types. Any materials that are not used during construction shall be turned over to the owner at the final acceptance of the building.
- B. Drivers:
 - 1. The electrical contractor shall include in their bid, two (2) additional drivers for all wattages, voltages, and configurations required on the project.
 - 2. Extra materials shall be turned over to the owner at substantial completion in their original unopened packaging.
 - 3. All drivers shall be clearly marked for the fixture types that they are compatible with based on the drawings, fixture schedule and submittals received.
 - 4. Extra drivers included in this requirement shall not be used for warranty replacements without replacing this extra stock in the owner's inventory.
 - 5. No labor should be added to the project over the standard warranties already required in previous sections.

END OF SECTION

**SECTION 27 0050
BASIC COMMUNICATIONS REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Basic Communications Requirements specifically applicable to Electrical Division Specification Sections.
- B. Division 27 Specification requirements also include, by reference, all Division 00 and 01 specification sections. This contractor is responsible to review these specification sections. Requirements of these specification sections are included as a part of this contract.

1.02 WORK BY OWNER

- A. The Following Work or Sub Contracts Will Be Furnished and Installed (OFOI) By The Owner:
 - 1. Telephone system equipment and installation.
 - 2. Computer network equipment and installation.
 - 3. Computer workstation equipment and installation.
 - 4. Television/Monitor/Mounts.
 - 5. Wireless access point (WAP) hardware
 - 6. Structured (network) cabling. Electrical contractor shall provide rough-in only.
- B. Owner's Responsibility:
 - 1. Arrange for and deliver owner reviewed shop drawings, and product data to contractor.
 - 2. Arrange and pay for product delivery to site.
 - 3. On delivery, inspect products jointly with contractor.
 - 4. Submit claims for transportation damage and replace damaged, defective or deficient items.
- C. Contractor's Responsibility:
 - 1. Review owner reviewed shop drawings, and product data.
 - 2. Review and unload owner purchased materials at site, inspect for completeness and/or damage jointly with the owner.
 - 3. Handle, store, install and finish products. Install electrical wiring and devices.
 - 4. Repair and/or replace items damaged after receipt.

1.03 OWNER OCCUPANCY

- A. The owner will occupy the premises during the construction period.
- B. Limit use of site and premises to allow owner occupancy.
- C. Cooperate with the owner to minimize conflict and to facilitate owner's operations.
- D. Schedule the work to accommodate this requirement.

1.04 REGULATORY REQUIREMENTS

- A. This contractor shall give proper authorities all requisite notices relating to work in their charge, obtain official permits, licenses for temporary construction and pay proper fees for it.
- B. This contractor is to be solely answerable for and shall promptly make good all damage, injury or delay to other contractors, to neighboring premises or to persons or property of the public by themselves, by their employees or through any operation under their charge, whether in the contract or extra work.
- C. No attempt has been made to reproduce in these specifications any of the rules or regulations contained in city, state or federal ordinances and codes pertaining to the

work covered by these specifications that the contractor be thoroughly familiar with all such ordinances and codes.

- D. The fact that said various rules, regulations and ordinances are not repeated in this specification does not relieve the contractor of the responsibility of making the entire installation in accordance with the requirement of those authorities having jurisdiction.
- E. All work shall comply with the applicable recommendations of:
 - 1. National Board of Fire Underwriters
 - 2. ANSI-NFPA 70 National Electrical Code
 - 3. National Fire Protection Association (NFPA)
 - 4. Occupations Safety and Health Act (OSHA)
 - 5. IBC Building Code (current) and any current applicable city building and or electrical codes.
 - 6. Fire Protection: Conform to International Fire Code (IFC) and NFPA
 - 7. International Energy Conservation Code (IECC)
 - 8. The Joint Commission
 - 9. Iowa Administrative Code, Chapter 61
- F. Obtain permits and request inspections from authority having jurisdiction.
- G. Conform to latest approved versions of codes.

1.05 PROJECT/SITE CONDITIONS

- A. Install work in locations shown on drawings unless prevented by project conditions.
- B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other sections. Obtain permission of owner and architect/engineer before proceeding.
- C. This contractor shall, before submitting their bid, visit the site of the project to familiarize themselves with locations and conditions affecting their work.
- D. It is the intent of this specification that the contractor furnishes all labor and material required to complete the installation as outlined in the drawings and specifications. No additions to the contract price shall be allowed due to the failure of this contractor to properly evaluate the effect of existing conditions on the work to be done under this contract.
- E. Whenever renovation or remodeling or relocation of existing equipment is included in the contract, it is imperative that all locations of existing wiring conduits, electrical panels, equipment, services and grades be noted on the job site before bid is submitted and that all elevations and grades be verified before roughing in new work.
- F. This contractor shall provide holes as necessary for the installation of their work and in accordance with materials other than the structure.

1.06 SEQUENCING AND SCHEDULING

- A. This contractor shall arrange their work in order that it progresses along with the general construction of the building.
- B. This contractor shall be kept informed as to the work of other trades engaged in this project and shall execute their work in such a manner so as not to delay or interfere with progress of other contractors.
- C. Where space for electrical lines and conduit is limited, it is imperative that all such trades coordinate their work so as to ensure concealment in space provided. Where conflict exists, the design team shall decide priority of space. If work is not properly coordinated, the design team may require removal and relocation of work without additional compensation.

1.07 GUARANTEE

- A. This contractor shall guarantee all of the apparatus, materials, equipment furnished and labor installed under this contract for a period of one year after date of final acceptance, unless a longer period is specified.
- B. Neither final certificate of payment nor any provisions in the contract documents nor partial or complete occupancy of premises by owner shall constitute an acceptance for work not done in accordance with contract documents or relieve the contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship.
- C. Should any defects arise as the result of defective workmanship or material within the guarantee period set forth, this contractor shall make the necessary correction at their own expense.

1.08 ENGINEER APPROVED EQUAL PRODUCTS

- A. When the engineer, at the request of the interested parties, including the contractor, supplier and manufacturer approved "engineer approved equal" products for this project, such products are approved on the assumption that they will equal or exceed the performance of the products specified.
- B. If such products do not do so after being installed on this project, this contractor shall replace or modify the particular product as necessary to equal the performance of the products specified at no expense to the owner, architect or engineer.
- C. Request for "engineer approved equal" products shall be received by the architect/engineer prior to the last addendum being issued. Requests for substitutions received after this date will not be considered. Substitution requests shall clearly state which products are being considered for substitution. Substitution requests shall include all pertinent product information needed to evaluate the substitution as an "equal".
- D. Similar products shall be all of the same manufacturer and style. There is no exception to this unless prior approval has been granted from engineer.

1.09 OWNER'S RIGHT OF SALVAGE

- A. Before beginning construction, the contractor shall check and verify with the owner each item of existing equipment that must be removed.
- B. The owner will designate which items of material or equipment not reused that he may wish to keep. The contractor shall then remove these items with care and store in a location designated by the owner for the owner's disposal.
- C. All other items of equipment to be removed and not specified for reuse in new construction or reserved by the owner for their use shall become the property of the contractor and shall be removed from the site.

1.10 TELECOMMUNICATIONS UTILITY COMPANY

- A. The contractor is required to assist in coordination of final telecommunications utility locations that will serve the building with telephone, internet and cable television services. See 26 0050 for additional information.

1.11 PROTECTION AND MAINTENANCE

- A. The work covered by these drawings and specifications involves all work in the existing building and expansion.
- B. Where necessary to connect to any existing utility service, this electrical contractor shall contact the owner and shall coordinate any building service connection with the owner so that normal operation to the building is disrupted as little as possible.

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- C. Any work to be done in existing structures shall be coordinated with the owner and arrangements made so that traffic flow may be maintained and areas finished where possible before other areas are begun.
- D. This contractor shall protect existing equipment in finished areas from dirt, dust, and damage as a result of their work.
- E. Coordinate protection requirements with department heads before beginning construction.
- F. Protect any building openings from unauthorized entry. Coordinate with owner where building entry must be controlled.

1.12 DEMOLITION

- A. This contractor shall be responsible for the demolition and removal of all existing system elements within the project area except as follows:
 - 1. Elements shown on the drawings as "existing to remain and/or to be reused".
 - 2. Elements serving adjacent areas.
 - 3. Elements required for the support of the newly remodeled areas.
 - 4. All elements to be removed are subject to the Owner's Right of Salvage.
- B. Preserve services to the existing facility. Extend/reroute/reconnect the existing systems as required providing for the continued function of these systems.

1.13 CUTTING AND PATCHING

- A. This contractor shall do all cutting and patching necessary for the installation of their work in all existing and new buildings unless otherwise noted.
- B. In areas where the integrity of fire separation assembly/wall is compromised by the work, this contractor shall be responsible to patch and/or seal openings as necessary to maintain and/or return fire separation to rating as required by applicable codes.
- C. This contractor shall do all cutting and patching required for their work beyond the remodeled areas unless otherwise noted. All finish work shall include patching to match existing adjacent surfaces. Painting shall be by others.

1.14 CLEANING AND RUBBISH

- A. This contractor, upon completion of their work, shall remove all rubbish and debris resulting from their operation and shall remove it from site at their own expense.
- B. As far as their work is concerned, all equipment shall be cleaned and the premises left in first class condition.
- C. This contractor shall maintain the work area each day to prevent hazardous accumulation of debris from their work.

1.15 SEALING AND PENETRATION

- A. Clearance around the piping passing through fire or smoke rated construction shall be sealed to maintain the rated integrity of the construction (1 hr. 2 hrs. etc.). One and two-hour rated assemblies are to be patched on both sides of the assembly.
- B. This contractor shall verify rating and location of all such construction with the architectural drawings and seal all penetrations.
- C. Manufacturer offering products to comply with the requirements include the following:
 - 1. Dow Corning "Silicone RTV Foam"
 - 2. 3-M Corporation "Fire Barrier Caulk and Putty"
 - 3. Thomas and Betts "Flame Safe Fire Stop System"
 - 4. Specified Technologies "EZ-Path"
- D. Installation of these products are to be in strict accordance with the manufacturer's recommendations and architectural specifications, details or equivalent fire stopping general specification section.

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- E. This contractor shall submit shop drawings showing approved sealing assemblies to be utilized on this project.

1.16 HAZARDOUS MATERIALS

- A. If the contractor stores any hazardous solvents or other materials on the site, they shall obtain copies of the safety data sheets for the materials and post them at the site. The contractor shall inform the owner and all employed of any potential exposure to this material.
- B. At no time shall any product containing asbestos be incorporated into the work.
 - 1. If asbestos materials are encountered, report to the owner. The owner will be responsible for asbestos removal.

1.17 SUBMITTALS / RECORD DOCUMENTS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years.
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents.
 - 4. Have options clearly indicated as applicable to each submittal.
 - 5. Refer to Architectural Specification Sections for additional requirements.

1.18 ALTERNATES

- A. Refer to description of alternate bids under General Specification Sections.

1.19 REVIEW OF MATERIALS

- A. This contractor shall submit to the engineer, for review one (1) electronic copy giving a complete list of materials, fixtures, devices and panels he proposes to furnish. The brochure shall contain complete information as to the model of equipment, type, size, capacities, dimensions, and illustration. An electronic copy shall be kept on the job at all times.
- B. Checking of submittal drawings by the engineer does not relieve the contractor of the responsibility for the accuracy of such drawings and for their conformity to drawings and specifications unless he notifies engineer, in writing, of such deviation at time such drawings are furnished.
- C. All submittals shall have the date marked on them when the contractor receives them from the supplier. Submittals shall be submitted through the contractor and shall not come direct from the supplier to the architect or engineer.
- D. This contractor shall mark the date and sign each set signifying that the contractor has checked each of them in their entirety before submitting to the engineer. Submittals that are not dated and signed by the contractor will not be accepted, or checked and will be marked "resubmit" and sent back to the contractor.

1.20 TEST OF SYSTEMS

- A. This contractor, before concealed, shall test all systems installed under this contract as called for in these specifications and as required by local codes. Tests shall be made in the presence of the engineer, local authorities or their duly authorized representative. Any defects discovered in testing shall be corrected and the tests repeated until all defects are eliminated.
- B. This contractor shall coordinate all testing of systems within Division 27 specification section. Follow manufacturer's recommended testing procedures as a minimum unless the following related specification section has further detail of testing procedures. The more stringent testing procedure shall be used.

1.21 SCOPE OF WORK

- A. This contractor shall furnish all the labor and material to install a complete communication system in the existing building and expansion.. The system shall include all items of work as outlined in these specifications and on the drawings.
- B. All work shall be performed by a well-qualified, licensed or certified technician with a thorough knowledge of the various systems involved in this building. It shall be this contractor's responsibility to see that their technicians are familiar with all the various codes, installation procedures and tests applicable to this work.
- C. All equipment shall be new and of the type specified by the engineer unless otherwise noted in these specifications or on the drawings to remain and or be reused.
- D. The intent of the specifications and drawings is for complete installation of the systems outlined in the specifications and drawings so that at the conclusion of construction the system will be turned over to the owner complete and ready for safe and efficient operation.
- E. This contractor is required to furnish and install all such items normally included on systems of this type, which, while not mentioned directly herein or on the drawings are obviously essential to the installation and operation of the system and which are normally furnished on quality installation of this type. The specifications and drawings cannot deal individually with the many minute items that may be eventually required by the nature of the systems.
- F. This contractor, shall before proceeding with any work, review the architectural drawings and specifications. Any conflict between the technology and architectural drawings and specifications shall be reported to the engineer for clarification.
- G. If there is a discrepancy between the drawings and the specifications or within either document, the more stringent requirement shall be estimated unless brought to the engineer's attention and an addendum is issued for clarification.
- H. The Communications Contractor shall establish system elevations prior to fabrication and installation. The Communications Contractor shall coordinate elevations with other trades. All elevations shall be coordinated with all trades in the field prior to installation. When a conflict between trades arises, the design team shall be notified immediately prior to further installation however priority shall be as follows:
 - 1. Lighting Fixtures
 - 2. Gravity flow piping, including steam and condensate.
 - 3. Electrical bus duct.
 - 4. Sheet metal.
 - 5. Cable trays, including access space.
 - 6. Other piping.
 - 7. Conduits and wireway.
- I. Low Voltage Cable Installation
 - 1. This contractor is to install if they are licensed to, or contract with a licensed electrician to install conduit serving low voltage cables located in all mechanical rooms and non-accessible areas and exposed structural areas. Use J-hooks equal to Cablofil or Caddy Cable CAT. No cable shall be allowed to lie on accessible ceilings tiles. Provide sleeves between walls and accessible clouds. Provide hooks with closure holes. Mount hooks 3 feet on center.
 - 2. All vertical riser and telecommunication room cabling shall be properly supported and bundled by approved velcro straps every 3 feet. Cable ties (zip ties), or other tie systems that cause compression, crushing, or pinching of cabling shall not be allowed.

1.22 TRENCHING AND BACKFILLING

- A. Each contractor is responsible for their own individual trenching and backfilling unless otherwise noted in the drawings or addendum.
- B. All underground utilities, telephone conduit, parking lot lighting, tunnels, etc shall be exactly located prior to digging. This contractor shall be held responsible for all damages caused by failure to do so.
- C. Any backfill shall be tamped and compacted to prevent future settling. The backfill shall be installed to a smooth and level grade and installed in accordance with local codes.
- D. All excess dirt shall be cleared from the area and disposed of as directed by the owner.
- E. Refer to architectural specification sections for additional information.

1.23 DAILY HOUSEKEEPING AND CLEANING

- A. At the end of each workday, the contractor shall remove all of their debris, rubbish, tools, and surplus materials from the project work area. The work area shall be broom cleaned and left in a neat and orderly condition. The contractor, for the removal of debris from the project, shall not use the owner's waste disposal facility.
- B. At end of construction, all equipment shall be cleaned and the premises left in first class condition as far as this contractor's work is concerned.

1.24 WALL CONTINUITY (1 HR.)

- A. All items mounted in 1 hr. rated walls requiring an opening larger than a four inch (4") square (16 sq. inches) require the 1 hr. rating not be degraded.
- B. Any system panels in a 1 hr. wall will require the exterior of the recessed panel be covered with 5/8 inch fire rated gypsum board. This is true for any device requiring more than a 16 sq. inch opening.

1.25 DIGITAL MEDIA AGREEMENT

- A. Computer Aided Drafting (CAD) documents may be available to the contractor for some uses. Contact the engineer prior to bidding to determine what information is available to be transmitted to the contractor in digital form.
- B. When documents are determined to be available, and as requested by the contractor, they will be transmitted upon the completion and execution of the MODUS digital media agreement. A service fee for each document transmitted will be assessed to the contractor. Documents will be transmitted upon payment receipt. Current service fee is \$100.00 per CAD sheet.

1.26 SECURE NETWORKABLE DEVICES

- A. Update network devices to the most current software/firmware.
- B. Change default password of all networkable devices.
 - 1. Passwords shall have at least eight characters.
 - 2. Include uppercase and lowercase letters, numerals, and special characters
- C. Supply MAC address and serial number of all networkable devices.
- D. Work with the Owner's IT department to align to existing IT standards.
- E. Provide to the owner a printed and/or electronic spreadsheet log of all network information including, IP addresses, MAC addresses, logins and password information during system training.

1.27 SYSTEM CONFIGURATION AND PROGRAMMING FILES

- A. Supply system configuration and programming files where export is available.
- B. Supply uncompiled programming for systems applicable.

- C. All configuration and programming shall be property of the owner at conclusion of the project.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

END OF SECTION

**SECTION 27 0090
MINOR COMMUNICATION DEMOLITION FOR REMODELING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. The requirements of the Contract Forms, the Conditions of the Contract, Division 1 - General Requirements and Specification Section 26 0050 - Basic Electrical Requirements "General Provisions" apply to this section.

1.02 SCOPE

- A. This contractor shall be responsible for the demolition and removal of all existing communication elements within the project area except as follows:
 - 1. Elements shown on the drawings as "existing to remain and/or to be relocated".
 - 2. Elements serving adjacent areas.
 - 3. Elements required for the support of the newly remodeled areas.
- B. Preserve services to the existing facility. Extend, reroute, and reconnect existing systems as required providing for the continued function of these systems.
- C. Demolition shall be accomplished by the proper tools and equipment for the work to be removed. Personnel shall be experienced and qualified in the type of work to be performed.
- D. This contractor shall remove all abandoned equipment, cabling and boxes associated with the remodeled area unless noted otherwise.
- E. This contractor is responsible for providing communication cabling protection for all existing systems to remain during this project.

1.03 MATERIALS

- A. All elements to be removed are subject to the Owner's Right of Salvage.
- B. All materials removed shall be the property of the removing contractor and shall be removed from the site by them, unless otherwise specified.
- C. The owner may designate and have salvage rights to any material herein demolished by this contractor. It will be the owner's responsibility to designate such salvageable items and remove them prior to the contractor working in that area.

1.04 EXISTING CONDITIONS

- A. Demolition plans are based on casual field observations and existing record documents. Report discrepancies to the owner before disturbing existing installation. Beginning of demolition means installer accepts existing conditions.
- B. If any existing equipment, cabling or devices that are to remain are disturbed by operations under this contract, this contractor is required to re-establish continuity of such systems according to owner approved standards and methods.
- C. This contractor shall arrange for the general contractor to repair and patch all construction with material necessary to match surrounding due to removal of equipment and conduit.
- D. This contractor shall furnish all required labor and material for extension of existing systems.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

- A. Beginning of demolition means installer accepts existing conditions.

- B. Verify existing structured cabling, special systems wiring topology, and reconnect as necessary.
- C. Verify that abandoned cabling being removed is disconnected from the source and is not actively serving other areas of the existing building. Reconnect as required to prevent any system downtime.
- D. Demolition drawings are based on casual field observation and existing record documents. Report discrepancies to the owner before disturbing existing installation.

3.02 PREPARATION

- A. Disconnect structured cabling and special systems components in walls, floors, and ceilings scheduled for removal. Disconnect circuits at the source.
- B. Coordinate any service outage with all of the owner's existing telecommunications service providers.
- C. Existing Communication Network: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchover connections. Obtain permission from the owner, at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections as required.
- D. Existing Telephone System: Maintain existing system in service.
- E. Existing Paging, TV Antenna, Ambulance Radio, Intercoms, and ER Scanner Radio Systems:
 - 1. Maintain existing system in service until new systems are accepted.
 - 2. Disable system only to make switch over and connections.
 - 3. Obtain permission from the owner at least 48 hours before partially or completely disabling system.
 - 4. Minimize outage duration.
 - 5. Make temporary connections to maintain service in areas adjacent to work areas.
- F. Maintain all existing communication lines to the building fire alarm system, and intrusion system.

3.03 DEMOLITION AND EXTENSION OF EXISTING COMMUNICATIONS WORK

- A. Demolish and extend existing communications work under provisions of this section.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring to source of supply.
- D. Disconnect abandoned cable and remove devices. Provide a blank cover for abandoned devices that have not been removed.
- E. Disconnect and remove abandoned patch panels, cross connect fields and special systems distribution equipment.
- F. Disconnect and remove devices and equipment serving abandoned special systems.
- G. Repair adjacent construction and finishes damaged during demolition and extension work.
- H. Extend existing installation using materials and methods compatible with existing communications installations or as specified.
- I. Cable to remain shall be installed in retrofit sleeve/grommet for a clean installation.

3.04 CLEANING AND REPAIR

- A. Clean and repair existing materials that remain or are to be reused.

3.05 INSTALLATION

- A. Install relocated materials and equipment.

END OF SECTION

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**SECTION 27 0526
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding clamps
- B. Splice
- C. Grounding lugs
- D. Communications grounding rods
- E. Telecommunications bonding backbone
- F. Wall-mount busbars
- G. Rack mount grounding strip

1.02 RELATED SECTIONS

- A. Specification Section 26 0526 - Grounding and Bonding for Electrical System
- B. Specification Section 27 0528 - Pathways for Communication Systems

1.03 REFERENCES

- A. ANSI/NFPA-70 2021 National Electrical Code (NEC)
- B. ANSI/IEEE Std. 1100-as adopted - Recommended Practice for Powering and Grounding Electronic Equipment
- C. TIA-607-B Telecommunications Grounding (Earthing) and Bonding for Customer Premises
- D. ANSI/TIA-606-B Administration Standard for Telecommunications Infrastructure
- E. NECA/BICSI 607-as adopted, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

1.04 SUMMARY

- A. Provide a communications bonding and grounding system as described within this specification and drawings. System shall be in compliance with the above cited Codes, Standards and Agencies.
- B. Comply with the requirement for Section 26 0526 - Grounding and Bonding for Electrical System.
- C. Bond the following items within the telecommunications grounding system:
 - 1. All communications system active equipment.
 - 2. All PDU and surge protection equipment.
 - 3. Metallic raceway systems, including metallic cable trays.
 - 4. Communications equipment enclosures (cabinets) or cross-connect frames.
 - 5. Broadband passive devices.
 - 6. Metallic splice cases.
 - 7. Metallic cable screens, armor or shields.
 - 8. All metal cable conduit.
 - 9. Electrical service panels in entrance facilities, telecommunications and equipment rooms.
 - 10. Wall and rack mounted grounding busbars.
 - 11. Exposed building steel that is within 6 feet of equipment racking systems.
 - 12. Building steel extending to earth in outside-plant.
 - 13. All related bonding accessories.

1.05 QUALITY ASSURANCE

- A. Qualifications:

1. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
2. Grounding to conform to applicable building codes.
3. Methods of construction that are not specifically described or indicated in the contract documents to be subject to the control and approval of the owner or their official representatives.
4. Equipment and materials specified shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed.
5. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to written approval by the owner per the substitution policy listed within these specifications.
6. Materials and methods shall comply in every way with above cited Standards and Codes.

1.06 SUBMITTALS

- A. All submitted documents shall be:
 1. Digital (scanned documents are not acceptable)
 2. Current, within last 5 years.
 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents.
 4. Have options clearly indicated as applicable to each submittal.
- B. Construction submittal
 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings. Include electrical characteristics and connection requirements.

1.07 REGULATORY REQUIREMENTS

- A. Conform to applicable building code for requirements applicable to work specified herein.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Deliver items in their original factory shipping cartons.
- B. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

1.09 APPROVED MANUFACTURERS

- A. Panduit
- B. Chatsworth Products, Inc.
- C. Hoffman
- D. Engineer approved equal.

PART 2 PRODUCTS

2.01 GROUNDING CLAMPS

- A. Pipe Clamps:
 1. Used to ground copper code conductor to water pipe or copper tubing.
 2. Cast from high strength, electrolytic bronze to provide reliable grounding connections.
 3. Plated steel screws provide high strength and inhibit corrosion.
 4. Accommodates a wide range of pipe, tube, rod and conductor sizes.

5. UL 467 Listed for grounding and bonding with AWG conductor.
- B. Bronze Grounding Clamps for Conduit:
 1. Used to ground copper code conductor parallel to, or at a right angle to a rod, tube, or pipe.
 2. Made from high strength, electrolytic cast bronze.
 3. Accommodates a wide range of pipe, tube, rod and conductor sizes.
 4. UL 467 Listed for grounding and bonding with AWG conductor and suitable for direct burial in earth or concrete.
- C. Bronze Grounding Clamps with Lay-in Feature:
 1. Bonds water pipe to continuous copper grounding conductors.
 2. Made from high strength, electrolytic cast bronze.
 3. Bronze hardware provides long term reliable assembly.
 4. UL 467 Listed for grounding and bonding with AWG conductor and suitable for direct burial in earth or concrete.
- D. Zinc Ground Clamp:
 1. Bonds steel and aluminum pipe to aluminum conductors.
 2. Made from die cast zinc.
 3. Zinc plated steel hardware.
 4. UL 467 Listed for grounding and bonding.
- E. Universal Beam Grounding Clamp:
 1. For bonding structural steel such as I-Beams into bonding network.
 2. Universal, fits on a wide range of standard (angled) and wide flange (parallel) structural steel beams.
 3. Provide a mounting pad suitable for a two-whole compression lug.
 4. Installs quickly and easily with standard 1/4" key hex wrench tooling.
 5. UL 467 Listed and CSA 22.2 Certified for grounding and bonding suitable for direct burial in earth or concrete.
 6. Comply with vibration tests per MIL-STD-202G.

2.02 SPLICE

- A. Compression-type Aluminum-to-Copper Reducing Splice:
 1. Dual rated for use with aluminum or copper conductors.
 2. Factory pre-filled with joint compound and sealed with easy pull-out end plug to inhibit corrosion.
 3. Color-coded end plug and die index numbers marked on barrel for proper crimp die selection.
 4. Tin-plated to inhibit corrosion.
 5. For use up to 35KV and temperature rated 90 degree C when crimped with manufacturer rated crimping tools and dies.
- B. Code/Flex Conductor H-TAPs:
 1. Used as a splice, or to tap smaller conductors into larger continuous conductors.
 2. Each HTAP terminates a wide range of conductor sizes and combinations of code and flex conductors Class G, H, and I to suit a variety of applications.
 3. Tap grooves are separated from one another, allowing them to function independently so HTAP can be used with single or multiple conductors, providing maximum design and installation flexibility.
 4. Color coded and marked with manufacturer die index numbers for proper crimp die selection.
 5. UL Listed and CSA Certified, with wide size range of conductor sizes and rated for applications up to 600V when crimped with manufacturer rated tools and dies.
 6. Tin plated to inhibit corrosion.
- C. Code Conductor, Thin Wall, Tin -plated C-TAP:

1. For copper-to-copper splicing or pigtail tap splicing.
2. Wide wire range-taking capability minimizes inventory requirements.
3. Color-coded for proper crimp die selection.
4. Ribbed design provides high strength.
5. Made from high conductivity wrought copper.
6. Tin-plated to inhibit corrosion and oxidation.
7. UL Listed and CSA Certified, with wide size range of conductor sizes and rated for applications up to 600V when crimped with manufacturer rated tools and dies.

2.03 GROUNDING LUGS

- A. Copper and Aluminum One-Hole Grounding Lay-in Lug for Bonding Ladder Rack:
 1. Used for quick installation of a continuous grounding conductor.
 2. UL 467 Listed for grounding and bonding, copper lugs. UL Listed for direct burial in earth or concrete.
 3. UL 467 Listed for use up to 600V and temperature rated 90 degree C.
- B. Two-hole, Long-barrel Copper Compression Lugs for Grounding Conductors:
 1. Meets TIA-607-B requirements for network systems grounding applications.
 2. Tested by Telcordia - meets NEBS Level 3 with AWG conductor.
 3. For use up to 35KV and temperature rated 90 degree C when crimped with manufacturer rated crimping tools and dies.
 4. Color-coded barrels marked with manufacturer's die index numbers for proper crimp die selection.
 5. Have long barrel to maximize number of crimps and provides premium wire pull-out strength and electrical performance.
 6. Have "inspection window" over tongue to visually assure full conductor insertion.
 7. Be tin-plated to inhibit corrosion.
 8. Available with NEMA and BISC hole-sizes and spacing.

2.04 COMMUNICATIONS GROUNDING RODS

- A. Standard Grounding Rod:
 1. Material: Copper-clad steel.
 2. Size: 3/4 -inch by 8 feet long.
 3. Standards: Meet requirements of ANSI/UL 467-1984, CSA and ANSI/NEMA GR-1.
 - a. Used for quick installation of a continuous grounding conductor.
 - b. UL 467 Listed for grounding and bonding, copper lugs. UL Listed for direct burial in earth or concrete.
 - c. UL 467 Listed for use up to 600V and temperature rated 90 degree C.
- B. Electrolytic Grounding Rod:
 1. Where standard ground rods do not have acceptable levels of conductivity (typically greater than 5 ohms resistance) to earth due to local soil conditions, electrolytic systems may be considered.
 2. Such systems shall meet the following:
 - a. Be comprised of a hollow stainless steel or copper tube 10 feet or longer and filled with a mixture of hygroscopic electrolytic salts.
 - b. Function as an active grounding system by absorbing moisture out of the air and constantly leaching an electrolytic solution into the surrounding soil to maintain high conductivity.
 - c. Rod shall be encased in a conductive, non-corrosive carbon based back fill material.
 - d. Provide low resistance to ground.
 - e. Provide season to season stability.
 - f. Be maintenance-free for 30 years.
 - g. Contain no hazardous materials or chemicals.

2.05 TELECOMMUNICATIONS BONDING BACKBONE (TBB) GROUNDING CONDUCTORS

- A. To be bare or insulated copper, of minimum conductor size #6 AWG and sized at 2 kcmil per linear foot up to a maximum of 750 kcmil. For details on TBB sizing see "Execution" section at end of this document.
- B. Where un-insulated, to be identified with green tape at termination location.
- C. Labeled in accordance with recommendations set forth in ANSI/TIA-606-B Administration for Telecommunications Infrastructure.

2.06 WALL MOUNT BUSBARS (TMGB/TGB)

- A. Meet BICSI and TIA-607-B requirements for network systems grounding applications.
- B. Employ BICSI hole spacing to 2-hole lugs.
- C. Be made of high conductivity copper and tin-plated to inhibit corrosion.
- D. Come pre-assembled with brackets and insulators attached for quick installation.
- E. Use labels to identify busbars to meet TIA/EIA-606-A.

2.07 RACK MOUNT GROUNDING STRIP

- A. Provide clean bond to any rack mounted equipment regardless of whether or not equipment has an integrated grounding terminal.
- B. EIA Universal hole pattern.
- C. Provide length required to bond up to 20 RU per rack.

PART 3 EXECUTION

3.01 GENERAL

- A. It shall be the responsibility of this contractor to adapt the following general guidelines and principles for the requirements of the actual environments where the grounding and bonding systems are to be implemented.
- B. System shall provide equipment ground connections (bonds) from the premises entrance facility and outside-plant earthing system to each telecommunication room ground busbar, through the racking systems to bond the network equipment.
- C. Entire grounding link from equipment to earth should be visually verifiable except where hidden by walls, conduit or pathways.
- D. Installing contractor shall label all elements of the communications bonding network according to guidelines defined in TIA-607-B and ANSI/TIA 606-B.
- E. It is the responsibility of the installer to be knowledgeable of all previously cited Standards and Codes and to bring to the attention of the engineer any conflicts discrepancies to achieve a fully functioning, standards-compliant earthing system.

3.02 TELECOMMUNICATIONS BONDING BACKBONE (TBB)

- A. Bonding and grounding conductors may be insulated or un-insulated and shall not decrease in size as the grounding path moves closer to earth.
- B. Connections (bonds) between the telecommunications grounding network and associated electrical panels shall be done by a qualified electrician in accordance with guidelines in TIA 607-B and applicable electrical codes.
- C. Bonding Conductors should be continuous and routed in the shortest possible straight line path, avoiding changes in elevation and sharp bends.
- D. TBB conductors shall be protected from mechanical damage and built so as to minimize splicing. Where splicing is unavoidable they shall be done using irreversible compression splices (C-TAPS) built to that purpose. See the Materials section of this document for appropriate compression splices.

- E. TBB in multi-story buildings with multiple risers shall employ a grounding equalizer (GE) between vertical grounding backbones at the top floor of the building and minimally at every third floor in between to the lowest floor level. The GE shall be no smaller than the largest sized TBB.
- F. Routing grounding conductors through ferrous metal conduit should be avoided, but if it is necessary due to building constraints, any grounding conductor running through ferrous conduit longer than 3 feet shall be bonded at the end using appropriately sized HTAP.
- G. Conductors used to bond TBB to conduit ends shall be of #6 AWG size or larger.
- H. Provide appropriately sized TBB conductor using the pathway distances and the chart found in TIA 607-B.

3.03 ENTRANCE FACILITIES AND TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

- A. TMGB shall be located in the entrance facility, near the electrical panel to which it will be bonded but installed to maintain clearances required by applicable electrical codes.
- B. TMGB shall be sized according to the anticipated number of bonded connections needed.
- C. TMGB shall have tinned surface to restrain oxidation and be cleaned and antioxidant paste applied prior to fastening conductors.
- D. Connectors on TBB which attach to TMGB shall be of two-hole, long-barrel compression lugs as specified in the Materials section of this document.
- E. Building steel within six feet of the communications grounding system should be bonded into the system with appropriate hardware.
- F. All cables containing a metallic shield or armor shall have that shield properly bonded into the communications grounding system using appropriately sized grounding kits from the approved manufacturers.

3.04 BONDING WITHIN RACKS AND CABINETS

- A. Racks and cabinets shall be bonded into the communications bonding network with conductors of #6 AWG or larger.
- B. Depending on size of the telecommunications room, rack bonding conductors (RBC) may tap into underfloor or overhead grounding conductors, or for smaller TRs (3-5 racks or cabinets), may go directly from the rack to the wall mounted busbar.
- C. Racks, cabinets and similar enclosures shall not be attached serially but must have individual RBC into the grounding system.
- D. Newly installed racks and cabinets shall have vertical grounding busbars installed along one rail to provide clean bonding landing point for all rack mounted equipment. Grounding busbars shall not be isolated from the rack or cabinet.
- E. All painted components of racks/cabinets shall be assembled using serrated grounding washers and thread-forming screws to ensure electrical continuity between the different structural components of the rack/cabinet.
- F. Larger equipment with integral grounding terminals or pads shall be bonded to the vertical busbar with equipment grounding kits attached to those terminals and bonding them to the rack-mounted busbars.
- G. Anywhere two metallic surfaces are to be bonded, contractor shall clean the contact areas of paint or oxidation using abrasive pads, and apply film of anti-oxidation compound between surfaces prior to bonding.
- H. All cable fittings shall be of two-hole compression-type. Mechanical screw-lugs on racking systems will not be accepted and must be removed and replaced at contractor's expense.

- I. All screws used to affix compression lugs to rack-mounted vertical busbars shall be of the thread forming type made specifically for electrical bonding.
- J. Smaller equipment not having integral grounding pads must be bonded to the rack through the equipment mounting flanges using green thread-forming grounding screws with serrations under the head to cut through paint, coatings and oxidation that may be present on the equipment flange. Such equipment shall have minimally one grounding screw per piece of equipment.

3.05 FIELD QUALITY CONTROL

- A. On installations confined to a single telecommunications room, the installing contractor shall visually verify continuity of communications bonding system from equipment, through racking systems, to overhead underfloor backbone to the wall mounted busbar in that telecommunications room.
- B. Contractor shall further verify the use of all appropriate bonding accessories in the racking systems such as grounding washers and thread-forming grounding screws.
- C. Installation of a building-wide telecommunications backbone, installing contractor is further responsible for visually verifying sizing and sound installation of the telecommunications bonding backbone including presence of properly sized and installed grounding equalizer conductors between backbones contained in separate risers.
- D. Inspecting contractor shall verify that any conduit larger than 3 feet through which a grounding conductor passes is properly bonded to the grounding conductor as described in this document.
- E. During inspections contractor shall verify compliance with all stipulations specified in this document and compliance with all regulatory references cited.
- F. All openings or gaps in the bonding system during inspections will be recorded in the inspection report and remedied.
- G. During inspections, contractor shall check all grounding and bonding system conductors and connections for tightness and proper installation, including checking proper dies were used on compression taps and fittings by checking embossed die numbers on those connections.

END OF SECTION

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**SECTION 27 0528
PATHWAYS FOR COMMUNICATION SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Termination backboards
- B. Thru-Wall Fire Stop Fitting

1.02 RELATED SECTIONS

- A. Specification Section 26 0529 - Hangers and Supports for Electrical Systems
- B. Specification Section 26 0533 - Raceway And Boxes for Electrical Systems
- C. Specification Section 27 0526 - Grounding and Bonding for Communications Systems

1.03 REFERENCES

- A. EIA/TIA-568B - Commercial Building Wiring Standard
- B. EIA/TIA-569B - Commercial Building Standard for Telecommunication Pathways and Spaces
- C. NFPA 70 - National Electrical Code

1.04 SUBMITTALS

- A. All submitted documents shall be:
 - 1. Digital (scanned documents are not acceptable)
 - 2. Current, within last 5 years.
 - 3. Complete and in sufficient detail to allow ready determination of compliance with contract documents.
 - 4. Have options clearly indicated as applicable to each submittal.
- B. Construction submittal
 - 1. Provide (1) submittal including all products listed in this specification section. Provide the following for each product.
 - a. Product Data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings. Include electrical characteristics and connection requirements.

1.05 SYSTEM DESCRIPTION

- A. Pathway: Conform to EIA/TIA 569B, using raceway as indicated.

1.06 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.01 TERMINATION BACKBOARDS

- A. Material: Plywood.
- B. Size: 4' x 8', 3/4 inch thick.
- C. Grade: Fire-retardant, AC grade with "C" grade applied to wall.
- D. Painted on all sides and edges with fire resistant paint, (Sherwin Williams MIL-PRF-24596B).
- E. Apply at location as shown on drawings.

2.02 THRU-WALL FIRE STOP FITTING

- A. Manufacturers:

1. Specified Technologies EZ-Path
 2. Engineer approved equal.
- B. Thru-wall fire stop device for use in through-penetration fire stop system, examined and tested by Underwriters Laboratories Inc. to UL1479 and bears U.S. UL Classification Mark. Device shall be classified for use in one, two, three, and four hour rated gypsum, concrete, and block walls and provided with a maximum "L" rating of 6 CFM.
- C. Box is to be constructed of 16 AWG G90 steel. Provide with adjustable doors.
- D. Provide with grounding lug. Maintain ground continually through all devices.
- E. See plans for sizes, quantities and placements.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

- A. Support raceways, backboards and cabinets.
- B. Install termination backboards and cabinets plumb, and attach securely to building wall at each corner.
- C. Install polyethylene pulling string in each empty conduit over ten feet (10') in length or containing a bend.
- D. This contractor shall provide blank cover plates for all indicated telephone and computer outlets.
- E. All conduit sizes shall be verified with the owner prior to installation.
- F. Provide conduit with box from each outlet location to above nearest accessible ceiling.
- G. Conduit serving mechanical equipment low voltage cabling shall be 3/4" or larger.
- H. Conduit serving category network cabling shall be 1" or larger.
- I. This contractor is to install if they are licensed to, or contract with a licensed electrician to install conduit serving low voltage cables located in all mechanical rooms and non-accessible areas and exposed structural areas. Use J-hooks equal to Cablofil or Caddy Cable CAT. No cable shall be allowed to lie on accessible ceilings tiles.
- J. Provide sleeves between walls and accessible clouds. Provide hooks with closure holes. Mount hooks 3 feet on center.

END OF SECTION

**SECTION 27 1116
COMMUNICATIONS RACKS, FRAMES AND ENCLOSURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall mounted racks
- B. Cable management

1.02 SUMMARY

- A. Provide all labor, materials, and equipment for the complete installation of each rack.

1.03 GENERAL REQUIREMENTS

- A. The drawings and specifications indicate the intent and direction of the installation. Items and their location are shown diagrammatic and are to be field verified by the contractor prior to completing work associated with the item.
- B. All work shall be performed in strict accordance with all applicable laws, ordinances, codes of local, state and federal government, or other authorities having lawful jurisdiction. The contractor is required to verify all requirements.
- C. The contractor shall furnish all required labor, material, and associated tools to facilitate the installation of all the equipment racks, cabinets, frames and associated items specified herein and with respect to the infrastructure design drawings without damage to the cables, associated items, and/or facilities.
- D. Qualified personnel, utilizing state-of-the-art equipment and techniques shall complete all installation work.
- E. All materials shall be installed in accordance with the manufacturer's specified recommendations and practices.

1.04 QUALITY ASSURANCE

- A. Standards: All equipment, devices, and other associated items and work shall conform to the most recent requirements of the following codes, standards, and organizations where applicable:
 - 1. TIA - 569-B Commercial Building Standard for Telecommunications Pathways and Spaces
 - 2. ANSI/TIA - 568-C Commercial Building Telecommunications Cabling Standard
 - 3. ANSI/NECA/BICSI 568-as adopted - Standard for Installing Commercial Building Telecommunications Cabling
 - 4. TIA - 606-A Administration Standard for Commercial Telecommunications Infrastructure
 - 5. ANSI-J-STD - 607-A Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
 - 6. ANSI/TIA-942 Telecommunications Infrastructure Standard for Data Centers
 - 7. NFPA 70 - National Electric Code
- B. 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 the contract documents shall be subject to the control and approval of the Owner or Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

1.05 SUBMITTALS

- A. The contractor is to provide material cut-sheet for all products listed in this specification, and any other material not listed but required for proper installation.

- B. Provide both the manufacturer's certification for all installers and technicians that will have a role in this project

1.06 DELIVERY, STORAGE, AND HANDLING

- A. The contractor shall coordinate all delivery, storage and handling concerns with the general contractor.
- B. Provide protection from weather, moisture, extreme heat and cold, dirt, dust, and other contaminants for equipment placed in storage.

1.07 APPROVED EQUIPMENT VENDORS

- A. All cabling and conductivity products provided by the structured cabling contractor shall be part of the following complete end-to-end systems:
 - 1. Chatsworth Products, Inc.
 - 2. Middle Atlantic Products
 - 3. Legrand
 - 4. Hoffman
 - 5. Great Lakes
 - 6. Panduit
 - 7. Engineer approved equal.

PART 2 PRODUCTS

2.01 WALL MOUNTED RACKS

- A. Standard Swing Gate Wall Rack
 - 1. Wall mounted cabinets shall be manufactured from steel sheet.
 - 2. Dual hinges open to right or left, stopping in 90° position
 - 3. EIA-310-E compliant
 - 4. Universal 5/8"-5/8"-1/2" (15.9 mm -15.9mm -12.7 mm) alternating hole pattern
 - 5. Rack-mount spaces are marked and numbered
 - 6. Includes (50) #12-24 mounting screws.
 - 7. Supports 100 lb (45.4 kg) of equipment in the open and closed position when securely mounted
 - 8. Load capacity can be increased to 150 lb (68 kg) with optional Heavy Duty Swing Gate Kit
 - 9. Supports single-sided and double-side shelves
 - 10. Refer to drawings for quantities.
- B. Standard Swing Gate Wall Rack Approved Manufacturers
 - 1. Chatsworth Products Inc #11791-718 (Black, 20 RU, 19"EIA, 18" Deep)
 - 2. Engineer Approved equal

2.02 CABLE MANAGEMENT

- A. Horizontal Cable Management for Racks/Frames
 - 1. Place horizontal cable managers above and below each patch panel on/in each rack/frame/cabinet. The horizontal cable manager will guide patch/equipment cords between the vertical cable manager and individual network port connections.
 - 2. The cable manager will be sized to match cabling requirements. Provide 1U of horizontal cable management for every 2U of connectivity. Cables must be able to access the cable manager so that no ports are blocked by the cables.
 - 3. The manufacturer will state estimated cable fills for the cable manager in the product data sheet.
 - 4. The horizontal cable manager will match the rack-mount width of the rack(s)/frame(s)/cabinet(s).
 - 5. The horizontal manager will attach to the front or rear of the rack/frame/cabinet with screws and will be sized to fit within standard EIA-310-D rack mount spacing.

The manufacturer of the horizontal cable manager will sell compatible racks/frames/cabinets.

6. The horizontal cable manager will be a single-sided C-shaped trough with a cover. The single-sided trough will have a slot or holes at the rear to facilitate front-to-rear cabling through the horizontal manager. The front of the cable manager will have T-shaped cable guides along the top and bottom surfaces of the cable manager. Evenly spaced cable openings in between the T-shaped cable guides allow cables to enter/exit the cable manager into the rack-mount space. The openings will have rounded edges to protect the cables. The cover will be removable, hinged to open up or down and will snap on to secure the cover in the closed position.
7. The horizontal cable manager shall be a matched solution from the rack/frame manufacturer and be manufactured from sheet aluminum and composite material.
8. Refer to drawings for quantities.

PART 3 EXECUTION

3.01 GENERAL

- A. Cable Management
 1. When more than one cable manager is used on a rack/frame or group of racks/frames, use the same make, style and size of vertical cable manager on the rack/frame or in between racks/frames.
 2. The color of the rack(s)/frame(s) and cable manager(s) must match.
 3. Door shall be attached to the cable manager and in the closed position after cabling is complete.
- B. Wall-mounted cabinets and open frame swing racks
 1. Provide all components of the cabinet/frame system (cabinet, mounting rails, cable managers, power strips, and accessories).
 2. Attach the cabinet to the wall so that the front door and cabinet body can be opened fully without obstruction by other building, storage or architectural components. Follow the manufacturer's installation instructions when securing the cabinet to the wall and backboard. When not attached to the wall, the floor, shelf or tabletop surface on which the cabinet is placed must be able to hold the combined weight of the cabinet and the equipment within the cabinet. The cabinet should not be attached to sheet rock. The cabinet must be attached directly into studs through a $\frac{3}{4}$ " plywood backboard. The cabinet may be attached to a masonry wall when the installer provides hardware. Use included hardware or the appropriate hardware as defined by local code or the authority having jurisdiction. The top of the cabinet when installed should not exceed 84" above the finished floor.
 3. Cables shall enter/exit the cabinet through conduit knockouts in the top and/or bottom of the rear panel of the cabinet or through the rectangular cut out in the back of the rear panel of the cabinet. Use edge-protection grommets on conduit knockouts when cables pass through a conduit knockout but are not enclosed in conduit.
 4. Install and adjust to position all accessories including power strips, equipment-mounting rails, fan and filter kits and lights, prior to installing equipment into the cabinet. Verify that fans, light and power strips work prior to installing equipment into the cabinet. Shelves, if used, may be installed with equipment.
 5. Provide a telecommunications ground for equipment within the cabinet. Attach a 19" EIA busbar to the equipment mounting rails so that the mounting rails are bonded together. Attach a bonding conductor sized as defined in J-STD-607-A and as defined by local code or the authority having jurisdiction between the Telecommunications Grounding Busbar and the 19" EIA bus bar within the cabinet using two-hole compression lugs to connect the bonding conductor to each busbar. The installer will provide the 19" EIA bus bar, antioxidant compound,

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the bonding conductor and other necessary hardware required to make the connections between the cabinet and the Telecommunications Grounding Busbar.

END OF SECTION

**SECTION 28 0050
BASIC ELECTRONIC SAFETY AND SECURITY REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Basic Electronic Safety and Security Requirements specifically applicable to Electrical Division Specification Sections.
- B. Division 28 Specification requirements also include, by reference, all Division 00 and 01 specification sections. This contractor is responsible to review these specification sections. Requirements of these specification sections are included as a part of this contract.
- C. Division 28 Specification requirements also include, by reference, Specification Section 08 7100 - Door Hardware. Review and inclusion of the electrical requirements of this specification section are included as a part of this contract.

1.02 WORK BY OWNER

- A. The Following Work or Sub Contracts Will Be Furnished and Installed By The Owner:
 - 1. Security camera system shall be provided by owner including all cameras, mounts, and cabling. Electrical contractor shall provide rough-in only.
 - 2. Card access system shall be provided by owner including all cabling. Electrical contractor shall provide rough-in only.
 - 3. Emergency response system shall be provided by owner including all cabling. Electrical contractor shall provide rough-in only.
- B. Owner's Responsibility:
 - 1. Arrange for and deliver owner reviewed shop drawings, and product data to contractor.
 - 2. Arrange and pay for product delivery to site.
 - 3. On delivery, inspect products jointly with contractor.
 - 4. Submit claims for transportation damage and replace damaged, defective or deficient items.
- C. Contractor's Responsibility:
 - 1. Review owner reviewed shop drawings, and product data.
 - 2. Review and unload owner purchased materials at site, inspect for completeness and/or damage jointly with the owner.
 - 3. Handle, store, install and finish products. Install electrical wiring and devices.
 - 4. Repair and/or replace items damaged after receipt.

1.03 OWNER OCCUPANCY

- A. The owner will occupy the premises during the construction period.
- B. Limit use of site and premises to allow owner occupancy.
- C. Cooperate with the owner to minimize conflict and to facilitate owner's operations.
- D. Schedule the work to accommodate this requirement.

1.04 REGULATORY REQUIREMENTS

- A. This contractor shall give proper authorities all requisite notices relating to work in their charge, obtain official permits, licenses for temporary construction and pay proper fees for it.
- B. This contractor is to be solely answerable for and shall promptly make good all damage, injury or delay to other contractors, to neighboring premises or to persons or property of the public by themselves, by their employees or through any operation under their charge, whether in the contract or extra work.

- C. No attempt has been made to reproduce in these specifications any of the rules or regulations contained in city, state or federal ordinances and codes pertaining to the work covered by these specifications that the contractor be thoroughly familiar with all such ordinances and codes.
- D. The fact that said various rules, regulations and ordinances are not repeated in this specification does not relieve the contractor of the responsibility of making the entire installation in accordance with the requirement of those authorities having jurisdiction.
- E. All work shall comply with the applicable recommendations of:
 - 1. National Board of Fire Underwriters
 - 2. ANSI-NFPA 70 National Electrical Code
 - 3. National Fire Protection Association (NFPA)
 - 4. Occupations Safety and Health Act (OSHA)
 - 5. IBC Building Code (current) and any current applicable city building and or electrical codes.
 - 6. Fire Protection: Conform to UFC and NFPA
 - 7. The Joint Commission
 - 8. Iowa Administrative Code, Chapter 61
- F. Obtain permits and request inspections from authority having jurisdiction.
- G. Conform to latest approved versions of codes.

1.05 PROJECT/SITE CONDITIONS

- A. Install work in locations shown on drawings unless prevented by project conditions.
- B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other sections. Obtain permission of owner and architect/engineer before proceeding.
- C. This contractor shall, before submitting their bid, visit the site of the project to familiarize themselves with locations and conditions affecting their work.
- D. It is the intent of this specification that the contractor furnishes all labor and material required to complete the installation as outlined in the drawings and specifications. No additions to the contract price shall be allowed due to the failure of this contractor to properly evaluate the effect of existing conditions on the work to be done under this contract.
- E. Whenever renovation or remodeling or relocation of existing equipment is included in the contract, it is imperative that all locations of existing wiring conduits, electrical panels, equipment, services and grades be noted on the job site before bid is submitted and that all elevations and grades be verified before roughing in new work.
- F. This contractor shall provide holes as necessary for the installation of their work and in accordance with materials other than the structure.

1.06 SEQUENCING AND SCHEDULING

- A. This contractor shall arrange their work in order that it progresses along with the general construction of the building.
- B. This contractor shall be kept informed as to the work of other trades engaged in this project and shall execute their work in such a manner so as not to delay or interfere with progress of other contractors.
- C. Where space for electrical lines and conduit is limited, it is imperative that all such trades coordinate their work so as to Ensure concealment in space provided. Where conflict exists, the design team shall decide priority of space. If work is not properly coordinated, the design team may require removal and relocation of work without additional compensation.

1.07 GUARANTEE

- A. This contractor shall guarantee all of the apparatus, materials, equipment furnished and labor installed under this contract for a period of one year after date of final acceptance, unless a longer period is specified.
- B. Neither final certificate of payment nor any provisions in the contract documents nor partial or complete occupancy of premises by owner shall constitute an acceptance for work not done in accordance with contract documents or relieve the contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship.
- C. Should any defects arise as the result of defective workmanship or material within the guarantee period set forth, this contractor shall make the necessary correction at their own expense.

1.08 ENGINEER APPROVED EQUAL PRODUCTS

- A. When the engineer, at the request of the interested parties, including the contractor, supplier and manufacturer approved "engineer approved equal" products for this project, such products are approved on the assumption that they will equal or exceed the performance of the products specified.
- B. If such products do not do so after being installed on this project, this contractor shall replace or modify the particular product as necessary to equal the performance of the products specified at no expense to the owner, architect or engineer.
- C. Request for "engineer approved equal" products shall be received by the architect/engineer prior to the last addendum being issued. Requests for substitutions received after this date will not be considered. Substitution requests shall clearly state which products are being considered for substitution. Substitution requests shall include all pertinent product information needed to evaluate the substitution as an "equal".
- D. Similar products shall be all of the same manufacturer and style. There is no exception to this unless prior approval has been granted from engineer.

1.09 OWNER'S RIGHT OF SALVAGE

- A. Before beginning construction the contractor shall check and verify with the owner each item of existing equipment that must be removed.
- B. The owner will designate which items of material or equipment not reused that they may wish to keep. This contractor shall then remove these items with care and store in a location designated by the owner for the owner's disposal.
- C. All other items of equipment to be removed and not specified for reuse in new construction or reserved by the owner for their use shall become the property of the contractor and shall be removed from the site.

1.10 PROTECTION AND MAINTENANCE

- A. The work covered by these drawings and specifications involves all work in the existing building and expansion.
- B. Where necessary to connect to any existing utility service, this contractor shall contact the owner and shall coordinate any building service connection with the owner so that normal operation to the building is disrupted as little as possible.
- C. Any work to be done in existing structures shall be coordinated with the owner and arrangements made so that traffic flow may be maintained and areas finished where possible before other areas are begun.
- D. This contractor shall protect existing equipment in finished areas from dirt, dust and damage as a result of their work.

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- E. Coordinate protection requirements with department heads before beginning construction.
- F. Protect any building openings from unauthorized entry. Coordinate with owner where building entry must be controlled.

1.11 DEMOLITION

- A. This contractor shall be responsible for the demolition and removal of all existing electrical elements within the project area except as follows:
 - 1. Elements shown on the drawings as "existing to remain and/or to be reused".
 - 2. Elements serving adjacent areas.
 - 3. Elements required for the support of the newly remodeled areas.
 - 4. All elements to be removed are subject to the Owner's Right of Salvage.
- B. Preserve services to the existing facility. Extend/reroute/reconnect the existing systems as required providing for the continued function of these systems.

1.12 CUTTING AND PATCHING

- A. This contractor shall do all cutting and patching necessary for the installation of their work in all existing and new buildings unless otherwise noted.
- B. In areas where the integrity of fire separation assembly/wall is compromised by the work, this contractor shall be responsible to patch and/or seal openings as necessary to maintain and/or return fire separation to rating as required by applicable codes.
- C. This contractor shall do all cutting and patching required for their work beyond the remodeled areas unless otherwise noted. All finish work shall include patching to match existing adjacent surfaces. Painting shall be by others.

1.13 CLEANING AND RUBBISH

- A. This contractor, upon completion of their work, shall remove all rubbish and debris resulting from their operation and shall remove it from site at their own expense.
- B. As far as their work is concerned, all equipment shall be cleaned and the premises left in first class condition.
- C. This contractor shall maintain the work area each day to prevent hazardous accumulation of debris from their work.

1.14 SEALING AND PENETRATION

- A. Clearance around the piping passing through fire or smoke rated construction shall be sealed to maintain the rated integrity of the construction (1 hr. 2 hrs. etc.). One and two-hour rated assemblies are to be patched on both sides of the assembly.
- B. This contractor shall verify rating and location of all such construction with the architectural drawings and seal all penetrations.
- C. Manufacturer offering products to comply with the requirements include the following:
 - 1. Dow Corning "Silicone RTV Foam"
 - 2. 3-M Corporation "Fire Barrier Caulk and Putty"
 - 3. Thomas & Betts "Flame Safe Fire Stop System"
- D. Installation of these products are to be in strict accordance with the manufacturer's recommendations and architectural specifications, details or equivalent fire stopping general specification section.
- E. This contractor shall submit shop drawings showing approved sealing assemblies to be utilized on this project.

1.15 HAZARDOUS MATERIALS

- A. If this contractor stores any hazardous solvents or other materials on the site, they shall obtain copies of the safety data sheets for the materials and post them at the site. The

contractor shall inform the owner and all employed of any potential exposure to this material.

- B. At no time shall any product containing asbestos be incorporated into the work.
 - 1. If asbestos materials are encountered, report to the owner. The owner will be responsible for asbestos removal.

1.16 RECORD DRAWINGS

- A. This contractor shall provide (at the conclusion of the project) one clean, non-torn, neat and legible "as-built" set of drawings to the owner. These drawings shall show the routing of conduit, wiring and equipment drawn in at scaled locations. All cabling, devices, and endpoints shall be labeled and conform to head end programming and system drawings. All dimensions indicated shall be referenced to a column line. A set of construction blueprints will be furnished for this work.
- B. All electrical panels and electrical installed equipment shall be shown on the "as-built" drawings.
- C. Refer to Architectural Specification Sections for additional requirements.
- D. This contractor shall update these drawings during the project at least every week.

1.17 ALTERNATES

- A. Refer to description of alternate bids under General Specification Sections.

1.18 REVIEW OF MATERIALS

- A. This contractor shall submit to the engineer for review one (1) electronic copy giving a complete list of materials, fixtures, devices and panels they propose to furnish. The brochure shall contain complete information as to the model of equipment, type, size, capacities, dimensions, and illustration. An electronic copy shall be kept on the job at all times.
- B. Checking of submittal drawings by the engineer does not relieve the contractor of the responsibility for the accuracy of such drawings and for their conformity to drawings and specifications unless the contractor notifies engineer, in writing, of such deviation at time such drawings are furnished.
- C. All submittals shall have the date marked on them when the contractor receives them from the supplier. Submittals shall be submitted through the contractor and shall not come direct from the supplier to the architect or engineer.
- D. This contractor shall mark the date and sign each set signifying that the contractor has checked that each of them in their entirety before submitting to the engineer. Submittals that are not dated and signed by the contractor will not be accepted, or checked and will be marked "resubmit" and sent back to the contractor.

1.19 TEST OF SYSTEMS

- A. This contractor, before concealed, shall test all systems installed under this contract as called for in these specifications and as required by local codes. Tests shall be made in the presence of the engineer, local authorities or their duly authorized representative. Any defects discovered in testing shall be corrected and the tests repeated until all defects are eliminated.
- B. This contractor shall be held responsible for all damage resulting from defects in the system.
- C. Each individual feeder circuit shall be tested at the panel and in testing for insulation resistance to ground; the power equipment shall be connected for proper operation. In no case shall the insulation resistance to ground be less than that required by the National Electrical Code (NEC).

1.20 SCOPE OF WORK

- A. This contractor shall furnish all the labor and material to install a complete safety and security system in the existing building and expansion. The system shall include all items of work as outlined in these specifications and on the drawings.
- B. All work shall be performed by a well-qualified and licensed technician with a thorough knowledge of the various systems involved in this building. It shall be this contractor's responsibility to see that their electricians are familiar with all the various codes and tests applicable to this work.
- C. All equipment shall be new and of the type specified by the engineer unless otherwise noted in these specifications or on the drawings to remain and or be reused.
- D. The intent of the specifications and drawings is for complete installation of the systems outlined in the specifications and drawings so that at the conclusion of construction the system will be turned over to the owner complete and ready for safe and efficient operation.
- E. This contractor is required to furnish and install all such items normally included on systems of this type, which, while not mentioned directly herein or on the drawings are obviously essential to the installation and operation of the system and which are normally furnished on quality installation of this type. The specifications and drawings cannot deal individually with the many minute items that may be eventually required by the nature of the systems.
- F. This contractor, shall before proceeding with any work, review the architectural drawings. Any conflict between the technology and architectural drawings shall be reported to the engineer for clarification.
- G. If there is a discrepancy between the drawings and the specifications or within either document, the more stringent requirement shall be estimated unless brought to the engineer's attention and an addendum is issued for clarification.
- H. The Safety and Security Contractor shall establish system elevations prior to fabrication and installation. The Safety and Security Contractor shall coordinate elevations with other trades. All elevations shall be coordinated with all trades in the field prior to installation. When a conflict between trades arises, the design team shall be notified immediately prior to further installation however priority shall be as follows:
 - 1. Lighting Fixtures
 - 2. Gravity flow piping, including steam and condensate.
 - 3. Electrical bus duct.
 - 4. Sheet metal.
 - 5. Cable trays, including access space.
 - 6. Other piping.
 - 7. Conduits and wireway.
- I. Low Voltage Cable Installation
 - 1. This contractor is to install if they are licensed to, or contract with a licensed electrician to install conduit serving low voltage cables located in all mechanical rooms and non-accessible areas and exposed structural areas. Use J-hooks equal to Cablofil or Caddy Cable CAT. No cable shall be allowed to lie on accessible ceilings tiles. Provide sleeves between walls and accessible clouds. Provide hooks with closure holes and cable ties. Mount hooks 3 feet on center.

1.21 TRENCHING AND BACKFILLING

- A. Each contractor is responsible for their own individual trenching and backfilling unless otherwise noted in the drawings or addendum.
- B. All underground utilities, telephone conduit, parking lot lighting, tunnels, etc shall be exactly located prior to digging. This contractor shall be held responsible for all damages caused by failure to do so.

- C. Any backfill shall be tamped and compacted to prevent future settling. The backfill shall be installed to a smooth and level grade and installed in accordance with local codes.
- D. All excess dirt shall be cleared from the area and disposed of as directed by the owner.
- E. Refer to architectural specification sections for additional information.

1.22 DAILY HOUSEKEEPING AND CLEANING

- A. At the end of each workday, the contractor shall remove all of their debris, rubbish, tools, and surplus materials from the project work area. The work area shall be broom cleaned and left in a neat and orderly condition. The contractor, for the removal of debris from the project, shall not use the owner's waste disposal facility.
- B. At end of construction, all equipment shall be cleaned and the premises left in first class condition as far as this contractor's work is concerned.

1.23 WALL CONTINUITY (1 HR.)

- A. All items mounted in 1 hr. rated walls requiring an opening larger than a four inch (4") square (16 sq. inches) require the 1 hr. rating not be degraded.
- B. Any branch panel in a 1 hr. wall will require the exterior of the recessed panel be covered with 5/8 inch fire rated gypsum board. This is true for any device requiring more than a 16 sq. inch opening.

1.24 CABLE

- A. The fire alarm system manufacturer shall approve low voltage cable. All low voltage electrical cable, installed as part of a new fire alarm system, shall be plenum rated cable.
- B. Cable installed without using raceway shall be neatly routed and supported every 3 feet by no less than a nylon wire tie or supported in bridle rings. All wiring in mechanical rooms shall be in conduit. All exposed wiring shall be in raceways. No cable shall be allowed to lie on the accessible ceiling tile.

1.25 DIGITAL MEDIA AGREEMENT

- A. Computer Aided Drafting (CAD) Documents may be available to the contractor for some uses. Contact the engineer prior to bidding to determine what information is available to be transmitted to the contractor in digital form.
- B. When documents are determined to be available, and as requested by the contractor, they will be transmitted upon the completion and execution of the MODUS digital media agreement. A service fee for each document transmitted will be assessed to the contractor. Documents will be transmitted upon payment receipt. Current service fee is \$100.00 per CAD sheet.

1.26 SECURE NETWORKABLE DEVICES

- A. Update network devices to the most current software/firmware.
- B. Change default password of all networkable devices.
 - 1. Passwords shall have at least eight characters.
 - 2. Include uppercase and lowercase letters, numerals, and special characters
- C. Supply MAC address and serial number of all networkable devices.
- D. Work with the Owner's IT department to align to existing IT standards.
- E. Provide to the owner a printed and/or electronic spreadsheet log of all network information including, IP addresses, MAC addresses, logins and password information during system training.

1.27 SYSTEM CONFIGURATION AND PROGRAMMING FILES

- A. Supply system configuration and programming files where export is available.

- B. Supply uncompiled programming for systems applicable.
- C. All configuration and programming shall be property of the owner at conclusion of the project.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 28 0090

MINOR ELECTRONIC SAFETY AND SECURITY DEMOLITION FOR REMODELING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. The requirements of the Contract Forms, the Conditions of the Contract, Division 1 - General Requirements and Specification Section 26 0050 - Basic Electrical Requirements "General Provisions" apply to this section.

1.02 SCOPE

- A. This contractor shall be responsible for the demolition and removal of all existing electrical elements within the project area except as follows:
 - 1. Elements shown on the drawings as "existing to remain and/or to be relocated".
 - 2. Elements serving adjacent areas.
 - 3. Elements required for the support of the newly remodeled areas.
- B. Preserve services to the existing facility. Extend, reroute, and reconnect existing systems as required providing for the continued function of these systems.
- C. Demolition shall be accomplished by the proper tools and equipment for the work to be removed. Personnel shall be experienced and qualified in the type of work to be performed.
- D. This contractor shall remove all abandoned equipment, conduit, and supports associated with the remodeled area unless noted otherwise.
- E. This contractor is responsible to provide temporary electronic safety and security protection during this project.

1.03 MATERIALS

- A. All elements to be removed are subject to the Owner's Right of Salvage.
- B. All materials removed shall be the property of the removing contractor and shall be removed from the site by them, unless otherwise specified.
- C. The owner may designate and have salvage rights to any material herein demolished by this contractor. It will be the owner's responsibility to designate such salvageable items and remove them prior to the contractor working in that area.

1.04 EXISTING CONDITIONS

- A. If any existing devices that are to remain are disturbed by operations under this contract, the contractor is required to re-establish continuity of such systems.
- B. This contractor shall arrange for the general contractor to repair and patch all construction with material necessary to match surrounding due to removal of equipment and conduit.
- C. This contractor shall furnish all required labor and material, where required, to extend new work to connect to similar work for extension of existing systems.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

- A. **Beginning of demolition means installer accepts existing conditions.**
- B. Demolition drawings are based on casual field observation and existing record documents. Report discrepancies to the owner before disturbing the existing installation.

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- C. Verify field-circuiting arrangements and reconnect as necessary.
- D. Verify that abandoned wiring and devices serve only abandoned facilities. Reconnect circuits, as required, to prevent de-energizing of remaining receptacles of lights.

3.02 PREPARATION

- A. Disconnect safety & security in walls, floors, and ceilings scheduled for removal.
- B. Coordinate service outage with local utility company, inspectors, owners, and design team.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction.
- D. Existing safety and security services: Maintain existing system in service until new systems are complete and ready for deployment. Disable systems only to make switchover connections. Obtain permission from the owner, at least 48 hours before partially or completely disabling any system. To minimize outage, duration, make temporary connections as required.
- E. Existing Telephone system: maintain existing system in service.
- F. Existing Building Security System, Video Surveillance, Door Access, and Fire Alarm Systems:
 - 1. Maintain existing system in service until new systems are accepted.
 - 2. Disable system only to make switch over and connections
 - 3. Obtain permission from the owner at least 48 hours before partially or completely disabling system.
 - 4. Minimize outage duration.
 - 5. Make temporary connections to maintain service in areas adjacent to work areas.

3.03 DEMOLITION AND EXTENSION OF EXISTING SAFETY AND SECURITY

- A. Demolish and extend existing safety and security work under provisions of this section.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring to source of supply.
- D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors and patch surfaces.
- E. Disconnect abandoned cable and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide a blank cove for abandoned devices that have not been removed.
- F. Disconnect and remove abandoned control panels and head end equipment.
- G. Disconnect and remove devices and equipment service abandoned safety and security system.
- H. Repair adjacent construction and finishes damaged during demolition and extension work.
- I. Maintain access to existing safety and security installations that remain active. Modify installation or provide access panel as appropriate.
- J. Extend existing installation using materials and methods compatible with existing electrical installations or as specified.

3.04 CLEANING AND REPAIR

- A. Clean and repair existing materials that remain or are to be reused.
- B. Control Panels: Clean exposed surfaces and check tightness of all connections. replace damaged items and equipment. Provide typed directory showing revised changes or programming.

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RENOVATION & ADDITION

3.05 INSTALLATION

- A. Install relocated materials and equipment.

END OF SECTION

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**SECTION 28 3100
FIRE DETECTION AND ALARM**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire alarm and smoke detection control panel
- B. Peripheral devices
- C. Fire alarm wire and cable
- D. Fire/smoke dampers
- E. Sprinkler flow and tamper switch

1.02 RELATED SECTIONS

- A. Section 08 7100 - Door Hardware
- B. Section 21 1300 - Fire Suppression Sprinkler System
- C. Section 21 2000 - Fire Extinguishing System
- D. Section 26 0533 - Raceways and Boxes for Electrical Systems

1.03 REFERENCES

- A. NFPA 70 - National Electrical Code
- B. NFPA 72 - National Fire Alarm Code
- C. NFPA 101 - Life Safety Code
- D. International Building Code
- E. International Fire Code
- F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems

1.04 SYSTEM DESCRIPTION

- A. Provide and install a manual and automatic fire alarm system that shall meet or exceed current IBC/IFC code requirements in accordance with NFPA 72.
- B. Fire alarm system shall include the system wiring, raceways, pull boxes, terminal cabinets, outlet and mounting boxes, control equipment, alarm and supervisory signal initiating devices, alarm notification appliances and other accessories required for a complete operating system.

1.05 SUBMITTALS

- A. Shop Drawings: Provide a scaled building layout showing each device and wiring connection required.
- B. Product Data: Provide electrical characteristics and connection requirements.
- C. Test Reports: Indicate satisfactory completion of required tests and inspections.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation and starting of products.
- E. Contractor shall submit software logic, flow diagrams, battery calculations and one line diagrams illustrating device loops.
- F. Contractor shall be responsible for submitting a copy of these documents to the local Authority having jurisdiction or state for required review.
- G. Submit copies of NICET certifications as described in this specification section.

1.06 PROJECT RECORD DOCUMENTS

- A. Record actual locations of all initiating devices, signaling appliances, shut down relays, power supplies, and end-of-line devices. Illustrate each SLC loop that is planned.
- B. Indicate device addresses on the drawings.
- C. Deliver to owner as both hard copy and electronic file.

1.07 OPERATION AND MAINTENANCE DATA

- A. Operation Data: Operating instructions.
- B. Maintenance Data: Maintenance and repair procedures.
- C. Configuration Data: Printouts of configuration settings for all devices.
- D. Routine Maintenance Checklist.

1.08 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum ten years experience.
- B. Contractor: The contractor shall have a fully equipped, factory trained, and manufacturer certified service and installation organization.
- C. Supervisor: The job supervisor shall be a NICET Level II (or higher) technician and be a full-time employee of the certified reseller. Supervisor shall be responsible for programming and testing.
- D. Technician: A fire alarm technician shall have a minimum of four years experience terminating and installing fire alarm systems. The technician shall also be factory trained in the installation, adjustment, testing and operation of the equipment specified. The technician shall be capable of answering trouble calls from a permanently maintained location less than 100 miles from project site.
- E. Installer: The installer shall be a company specializing in installing the products specified in this section with minimum three years experience, a NICET certified installer and/or licensed electrician shall be allowed to install wire, cable, conduit and back boxes for the fire alarm system.
- F. A list of technicians with any level of responsibility with this project shall be submitted for review and acceptance during the submittal process. A copy of their NICET Certification(s) shall be included.

1.09 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 72 and NFPA 101.
- B. Furnish products listed and classified by UL, FM approved for purpose specified and indicated.

1.10 MAINTENANCE SERVICE

- A. A maintenance program shall be offered to the owner at the end of the warranted period to meet NFPA requirements.

1.11 EXTRA MATERIALS AND LABOR

- A. Provide 2 installed automatic smoke detectors including 40 feet of wiring each per device to be positioned by the owner or engineer.
- B. Provide 2 installed audible/visual alarms including 40 feet of wiring each per device to be positioned by the owner or engineer.
- C. Provide 1 installed visual alarms including 40 feet of wiring each per device to be positioned by the owner or engineer.
- D. Provide a minimum of six keys of each type.

- E. Devices shall be installed at the direction of the owner or design team.
- F. Any materials that are not used during construction shall be turned over to the owner at the final acceptance of the building.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Notifier (Basis of Design)
- B. Farenhyt
- C. Gamewell FGI
- D. Seimens
- E. Simplex
- F. Edwards
- G. Engineer approved equal.

2.02 FIRE ALARM AND SMOKE DETECTION CONTROL PANEL

- A. The main FACP Central Console shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, control circuits, and notification appliance circuits, local and remote operator terminals, printers, annunciators, and other system controlled devices.
- B. The Notifier FIREWARDEN-50X control panel shall be the basis of design.
- C. In conjunction with intelligent Loop Control Modules and Loop Expander Modules, the main FACP shall perform the following functions:
 - 1. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
 - 2. Supervise all initiating signaling and notification circuits throughout the facility by way of connection to addressable monitor and control modules.
 - 3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed. In the event of CPU failure, all SLC loop modules shall fallback to degrade mode. Such degrade mode shall treat the corresponding SLC loop control modules and associated detection devices as conventional two-wire operation. Any activation of a detector in this mode shall automatically activate associated Notification Appliance Circuits.
 - 4. Visually and audibly annunciate any trouble, supervisory, security or alarm condition on operator's terminals, panel display, and annunciators.
 - 5. When a fire alarm, trouble or supervisory condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
 - a. The system alarm LED shall flash.
 - b. A local piezoelectric audible device in the control panel shall sound a distinctive signal.
 - c. The 640-character backlit LCD display shall indicate all information associated with the condition, including the type of alarm point and its location within the protected premises.
 - d. All system outputs assigned via preprogrammed equations for a particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
- D. The control panel shall be capable of expansion via up to 1 SLC modules. Each module shall support a maximum of 50 analog/addressable devices for a maximum

system capacity of 50 points. The system shall be capable of 8 annunciator points per system regardless of the number of addressable devices.

- E. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit 640-character liquid crystal display, individual, color coded system status LEDs, and a QWERTY style alphanumeric keypad for the field programming and control of the fire alarm system. Said LCD shall also support graphic bit maps capable of displaying the company name and logo of either the owner or installing company.
- F. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
- G. The door shall provide a key lock and include a transparent opening for viewing all indicators. For convenience, the door shall have the ability to be hinged on either the right or left-hand side.
- H. The control unit shall be modular in structure for ease of installation, maintenance, and future expansion.
- I. Communicator:
 - 1. Universal Digital Alarm Communicator Transmitter
 - a. The UDACT-2 is capable of transmitting the status of software zones (Alarm and Trouble), System Trouble, Panel Off-Normal, Supervisory, Bell Trouble, Low Battery, and AC Fail.
 - b. Dual phone lines with line voltage detect.

2.03 PERIPHERAL DEVICES

- A. Fire Sensors:
 - 1. All fire sensors shall mount on a common base to facilitate the changing of sensor type if building conditions change.
 - 2. Each sensor shall have the capability to be tested for alarm from the sensor location.
 - 3. Each sensor shall be capable of being tested for alarm via command from the transponder.
 - 4. Each sensor shall respond to transponder scan for information with its type identification to preclude inadvertent substitution of another sensor type.
 - 5. The transponder shall operate with the installed type but shall initiate mismatch (trouble) condition until the proper type is installed or programmed sensor type changed.
 - 6. Each sensor shall respond to transponder scan for information. Such response proves end-to-end sensor response including the operation of the sensor electronics.
 - 7. Provide an addressable relay to control a 110-volt solenoid valve, which holds water off. See detail on the drawings. This is for sprinkler flow switches at elevator.
- B. Manual Fire Alarm Stations:
 - 1. Design based on Notifier NOT-BG12LX or equal.
 - 2. Fire alarm pull station with red Lexan body, semi-flush mounted.
- C. Automatic Smoke Detectors:
 - 1. Design based on Notifier NP-200 or equal.
 - 2. Photo-electric smoke sensors.
- D. Photoelectric Smoke Detector with low frequency sounder base:
 - 1. Design based on Notifier #NH-200 with base Notifier B200S.
 - 2. Contractor shall coordinate colors with design team.
- E. Thermo-Detectors:

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1. Design based on Notifier NH-100 or equal.
 2. Area thermo-detectors shall be 135 degree rate-of-rise fixed type and shall cover 2500 sq. ft.
- F. Monitor Modules:
1. Design based on Notifier NMM-100P or equal.
 2. The monitor module shall provide an addressable input for N.O. or N.C. contact devices such as manual stations, water flow switches, sprinkler supervisory devices, etc.
 3. The monitor module shall provide a supervised initiating circuit. An open circuit fault shall be annunciated at the transponder. Subsequent alarms shall be reported.
- G. Relay Modules:
1. Design based on Notifier NC-100R.
 2. The control module shall provide an addressable output for a separately powered alarm indicating circuit for a control relay.
 3. The control module shall provide a supervised indication circuit where indicated on the drawings. An open circuit fault shall be annunciated at the transponder. Subsequent alarm signaling shall occur in spite of the fault condition.
- H. Horn/Strobe Indicators:
1. Design based on Notifier P(A)2(B)L or equal.
 - a. P2RL - Wall mount, red.
 - b. P2WL - Wall mount, white.
 - c. PC2RL - Ceiling mount, red.
 - d. PC2WL - Ceiling mount, white
 - e. PC2RHL - Ceiling mount, red, high candela
 - f. PC3WHL - Ceiling mount, white, high candela
 2. Contractor shall coordinate color with design team.
 3. Mounted to comply with Americans with Disabilities Act.
 4. Flush mounted unit shall have thermoplastic faceplate, trim shall have the word "FIRE".
 5. Visual Alarm Light: LED Light.
- I. Strobes:
1. Design based on Notifier S(A)R(B) or equal.
 - a. SRL - Wall mount, red.
 - b. SWL - Wall mount, white.
 - c. SCRL - Ceiling mount, red.
 - d. SCWL - Ceiling mount, white.
 - e. SCRHL - Ceiling mount, red, high candela.
 - f. SCWHL - Ceiling mount, white, high candela.
 2. Contractor shall coordinate color with design team.
 3. Mounted to comply with Americans with Disabilities Act.
 4. Flush mounted unit shall have thermoplastic faceplate, trim shall have the word "FIRE".
- J. Duct Smoke Detectors:
1. Design based on Notifier XXX or equal.
 - a. Notifier DNR - Housing.
 - b. Notifier NP-100R - Detector.
 - c. Notifier DSTS - Sampling Tube.
 - d. Notifier RTS151 - Remote Test Station.
 2. Furnish and install duct smoke detectors in supply and return air ducts for all the air handling units with fan shutdown relays.

3. **Provide remote key resets for these detectors. Coordinate installation location with design team prior to rough-in.**
- K. Sprinkler System Post Indicating Valve (PIV):
 1. The post indicating valve tamper switch is provided and installed by the sprinkler contractor. This contractor is to monitor this valve.

2.04 FIRE ALARM WIRE AND CABLE

- A. Fire Alarm Power Branch Circuits: Building wire as specified by the manufacturer.
- B. Initiating Device and Indicating Appliance Circuits: All fire alarm wiring shall be in metallic conduit or open raceway system concealed in finished areas as specified. Wiring shall be as specified by the manufacturer.

2.05 FIRE/SMOKE DAMPERS

- A. When duct smoke detection is furnished by mechanical contractor. Electrical contractor shall provide and install 120 volt wiring for smoke dampers. Fire alarm contractor shall provide and install Monitor Module at each fire/smoke damper or smoke damper. Fire alarm contractor shall coordinate signal from Fire Alarm panel to HVAC control system to shut down associated units.
- B. Where a damper is installed within an un-ducted opening in a wall, a smoke detector shall be installed within 5 feet of the damper.
- C. Dampers shall be controlled/monitored by the fire alarm system via addressable relays and monitor modules that interrupt power to the damper. Dampers shall close when power is removed. Direct control from duct detector relays is not allowed. One fire alarm addressable relay may control multiple dampers but shall only be grouped for the same air handling unit equipment. Damper power circuit shall be on the same electrical branch as the associated air handling equipment, when on emergency power, the same transfer switch shall serve the air handling equipment and associated dampers
- D. Dampers shall close when associated air handling equipment is shut down. A relay provided by the T.C.C. shall initiate damper closure through a dedicated fire alarm monitor module. Fire alarm programming shall associate monitor module(s) with respective damper operation.
- E. Dampers that close more than 80% of air from an air handling unit (AHU) shall be interlocked with AHU shutdown programming and shall provide an appropriate delay to allow sufficient time (usually 120 seconds) to allow AHU fans to slow down prior to damper closure to prevent high-static pressure trips. Delays shall be initiated by the building automation system, provide additional control relays to achieve delays and inhibit signals.
- F. All smoke damper circuits shall be dedicated.
- G. See the mechanical and electrical drawings for damper locations.
- H. Furnish and install a momentary test switch at each fire/smoke and smoke damper to allow proof of damper operation.

2.06 SPRINKLER FLOW AND TAMPER SWITCH

- A. This contractor is responsible to wire all flow and tamper switches on all valves provided by the sprinkler contractor.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install manual station with operating handle 48 inches on center above finished floor. Install audible and visual signal devices 90 inches above floor or six inches (6") below ceiling, whichever is lower in accordance with ADA Guidelines.

- C. Automatic Detector Installation: Conform to NFPA 72.
- D. Provide and install monitor modules required to successfully monitor all planned Ansul, pre-action sprinkler and/or clean agent suppression systems.
- E. This contractor shall be responsible for installing an indication system that meets or exceeds the required strobe intensity per NFPA 72.
- F. This contractor shall be responsible for installing an indication system that results in a tone reaching 15 dB over ambient or louder. Horns shall not reach a volume that is greater than 105dB in any room.
- G. This contractor is responsible to provide all necessary components and wiring for service to approved HVAC equipment 2000 cfm (and larger), approved kitchen hoods and approved fire suppression services. Coordinate exact requirements with HVAC, kitchen equipment, and fire suppression contractors.
- H. This contractor is responsible to provide all necessary components and wiring for service to mute Sound Masking, Audio and Paging Systems:
 - 1. Connect Fire Alarm Control Unit (FACU) to the audio system utilizing a supervised line and addressable relays, per NFPA 72, to shut down and effectively mute all sound masking, audio and paging systems.
 - 2. The FACU and associated supervised lines to meet UL 2572 ensuring the shutdown mechanism is properly supervised and is reliable and will in no way damage the FACU or audio system.
 - 3. The FACU and associated relays must not introduce any noise into the sound masking, audio or paging system.
 - 4. Muting ambient sound during an emergency is necessary to meet ADA suggested guidelines and NFPA acoustic requirements.

3.02 ELECTRICAL REQUIREMENTS

- A. All wiring shall be concealed within walls. No exposed raceways except areas with exposed structure. Coordinate conduit routing with the architect. Provide conduit for wiring located in non-accessible areas. In areas with accessible ceilings, use j-hooks as specified. Provide sleeves through walls and floors (3/4 inch minimum). Do not exceed a 40% pipe fill.
- B. Minimum 3/4 inch conduit size.
- C. Fire alarm cable installed in conduit shall not be shared by any other low voltage system cable.
- D. All cable terminations shall be located within the device itself or in a junction box. Exposed splices are not acceptable.
- E. Make conduit and wiring connections to door release devices, sprinkler flow switches, and sprinkler valve tamper switches. This contractor is responsible for all wiring and conduit to the sprinkler system post indicating valve, when this valve is provided. See drawings for location.
- F. Provide and Install insulated bushing on end of raceways.
- G. All fire alarm devices, junction and pull boxes shall be installed so they are easily accessible without removing light fixtures, equipment, conduits, junction boxes or other items.
- H. Provide locking breaker on 120 VAC power source and label "Fire Alarm." Locking breaker shall be painted red. Any power source to FACP or devices shall be labeled with location of Power source for room number, panel and circuit number.
- I. Fire alarm control and remote power panel's power shall be supplied by a surge protected dedicated circuit(s).
- J. Auxiliary functions that are powered from a remote source must be monitored for power if they do not go to the operational mode for fire protection. (i.e. A power opener purge

door that must open to purge air through building or a stairway air pressurization fan that must be monitored for power in case the breaker is shut off.)

3.03 FIELD QUALITY CONTROL

- A. Test in accordance with NFPA 72.
- B. Upon completion of the fire alarm system installation, the contractor shall provide a written statement advising the architect of completion and to be in compliance with fire and electrical codes, and in accordance with wiring diagrams, instructions and directions provided by the manufacturer.
- C. Representative of the manufacturer shall certify the system complete and that the owner has received adequate instructions in system operation.

3.04 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems.
- B. Include services of certified technician to supervise installation, adjustments, final connections and system testing.

3.05 DEMONSTRATION

- A. Demonstrate normal and abnormal modes of operation and required responses to each.

3.06 CABLE

- A. The fire alarm system manufacturer shall approve the low voltage cable and cable size. All low voltage electrical cable, which is installed as part of the new fire alarm system shall be plenum rated.
- B. The cable that is installed without using raceway shall be neatly routed and supported every three feet (3'). All wiring in mechanical rooms shall be in conduit. All exposed wiring shall be in raceway. No cable shall be allowed to lie on the accessible ceiling tile.
- C. Cable associated with smoke control or stairwell pressurization systems shall be installed in continuous raceway.

3.07 CERTIFICATION

- A. The fire alarm system shall be installed and operating within the manufacturers defined parameters and be certified by the manufacturer's representative's signature.
- B. Certification shall be turned over to the owner prior to closing of this project.

END OF SECTION

**SECTION 31 1000
SITE CLEARING**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Protecting existing vegetation to remain.
 - 2. Removing existing vegetation.
 - 3. Clearing and grubbing.
 - 4. Stripping and stockpiling topsoil.
 - 5. Removing above- and below-grade site improvements and existing features.
 - 6. Disconnecting, capping or sealing site utilities.

1.02 MATERIAL OWNERSHIP

- A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.03 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- C. During site clearing, contact the Architect, Engineer, and Owner should any contaminated soils or foreign fills be encountered.
- D. Utility Locator Service: Notify Iowa One Call forty-eight (48) hours prior to site clearing.
- E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.
- F. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Foot traffic.
 - 4. Erection of sheds or structures.
 - 5. Impoundment of water.
 - 6. Excavation or other digging unless otherwise indicated.
 - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- G. Geotechnical Report and Soil Borings: Chosen Valley Testing (CVT) has performed soil borings in the area and the contractor shall refer to these reports prior to bidding and beginning construction.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 Section "Earth Moving."
 - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.
- B. Unsuitable Soil Material: Any material which is considered foreign fill materials, Contractor shall notify the Architect, Owner and Geotechnical Engineer prior to proceeding with remediation, over excavation or replacement with suitable material. Should unsuitable material or suspected unsuitable material be encountered, contractor shall contact Owner, Architect, and Geotechnical Engineer for confirmation of removal, disposal, and haul in of suitable material.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner. Damage outside of the work limits shall be repaired at the contractor's expense.

3.02 TREE AND PLANT PROTECTION

- A. General: Protect trees and plants remaining on-site.
- B. The contractor shall remove trees within construction limits or as specified on the plans.
- C. Erect and maintain temporary fencing around trees to remain before starting site clearing. Install mulch around tree for protection during construction. Remove fence when construction is complete.
- D. Repair or replace trees, shrubs, and other vegetation indicated to remain that are damaged by construction operations, in a manner approved by Engineer.

3.03 EXISTING UTILITIES

- A. Existing utilities have been identified on the drawings from available surveys, records and deeds. Therefore, their locations must be considered approximate only. There may be others, the existence of which is presently not known. It is the contractor's responsibility to verify the location and depth of these utilities.
- B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
 - 1. Arrange with utility companies to shut off indicated utilities.
- C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
 - 2. Notify Architect not less than two days in advance of proposed utility interruptions from contaminated soils.
 - 3. Do not proceed with utility interruptions without Owner's written permission.
- D. Removal of underground utilities is included in Division 22 Sections.

3.04 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil. Mow all weeds, grass, and growing crops or other herbaceous vegetation close to the ground and remove from the site. Shred sod by shallow plowing or blading and thorough disking. Thoroughly shred to allow the soil to be easily spread in a thin layer over areas to be covered. If allowed by the Engineer, herbicides may be applied, and vegetation may be incorporated into the topsoil.
- B. Strip topsoil to a minimum depth of eight (8) inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water. Place silt fence around all stockpiles to prevent sediment from running offsite.
- D. Refer to Section 312000 "Earth Moving" for topsoil spreading.

3.05 SITE IMPROVEMENTS

- A. Remove existing above and below grade improvements as indicated and necessary to facilitate new construction per the plans.
- B. Pavement Removal
 - 1. Cut surface pavement to full depth as required in straight lines, and at designated removal lines.
 - 2. Remove all items without damage to adjacent property, trees, utilities, or pavement that are to remain in place.
 - 3. Salvage and stockpile all items removed if indicated on the plans.
 - 4. Grind or saw existing curbs at locations specified in the contract documents to install pavement, curb & gutter and sidewalks.
 - 5. Remove all pavement materials.
 - a. If specified in the contract documents or allowed by the Engineer, process for re-use.
 - b. Dispose of excess material as follows:
 - 1) Use as unsuitable soil according to Section 312000.
 - 2) If specified in the contract documents, deliver and stockpile at a site designated by the Engineer.
 - 3) Otherwise, properly dispose of off-site in accordance with local, state, and federal guidelines.
 - 6. Remove pavement material broken or damaged by the Contractor beyond designated removal lines to new line designated by the Architect or Owner, and replaced at the Contractor's expense.
 - 7. Protect subgrade beneath existing pavement removal areas.

3.06 DISPOSAL OF SURPLUS, UNSUITABLE, AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, unsuitable soil, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. During site clearing, contact the Architect, Engineer, and Owner should any foreign fills be encountered. Foreign fill shall be disposed of properly with local, state, and federal regulations. Proper soil mitigation shall be utilized in these areas at the direction of the Geotechnical Engineer.

END OF SECTION

**SECTION 31 2000
EARTH MOVING**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Preparing subgrades for slabs-on-grade, walks, pavements, lawn grasses, and plants.
 - 2. Subbase course for concrete pavements
 - 3. Excavating, bedding material, and backfilling for utility trenches.
 - 4. Stripping, stockpiling, and placing Topsoil

1.2 DEFINITIONS

- A. Backfill: Soil material used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- D. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.
- F. Fill: Soil materials used to raise existing grades
- G. RAP: Recycled Asphalt Pavement
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.
- L. Unsuitable Materials: Any soils with contaminants, rubble, buried foundations, or materials deemed to not be suitable or native fill materials by the Owner and Geotechnical Engineer.

1.3 PROJECT CONDITIONS

- A. Utility Locator Service: Notify Iowa One Call forty-eight (48) hours prior to beginning earth moving operations.
- B. Conflict Avoidance:
 - 1. Expose possible conflicts in advance of construction, such as utility lines and drainage structures. Verify elevations and locations of each and verify clearance for proposed construction.
 - 2. Complete other elements of the work which can affect line and grade in advance of other open cut construction unless noted on plans.
- C. Stop Work: Stop work and notify Architect, Engineer, and Owner immediately if contaminated soils, foreign fill materials, historical artifacts, or other environmentally hazardous or historic items are encountered. Contaminated soils or soils with foreign fill may require additional soil mitigations at the direction of the Geotechnical Engineer.
- D. Conform to Local, State, and Federal requirements.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: All grading shall be completed with soil that is present on the existing site as much as possible.
- B. Topsoil: Use suitable topsoil of uniform quality, free from hard clods, roots, sod, stiff clay, hard pan, stones larger than 1 inch (1/2 inch for turfgrass seeding), lime cement, ash, slag, concrete, tar residue, tarred paper, boards, chips, sticks, or any undesirable material. Use on-site topsoil, unless compost-amended or off-site topsoil is specified.
 - 1. On-site Topsoil: On-site topsoil material is material excavated from the top 12 inches of the site. Use of on-site topsoil material is subject to the Engineer's approval.
 - 2. Compost-amended On-site Topsoil: Amend low-quality on-site topsoil, not meeting the requirements specified for off-site topsoil, with a minimum of 1 inch of compost for every 3 inches of topsoil. Use compost meeting the following requirements:
 - a. Derived from a well-decomposed source of organic matter.
 - b. Produced using an aerobic composting process, meeting Code of Federal Regulations (CFR) 503 for time, temperature, and heavy metal concentrations.
 - c. No visible admixture of refuse or other physical contaminants, nor any material toxic to plant growth.
 - d. Certified by the U.S. Composting Council's Seal of Testing Assurance (STA) program.
 - e. Conforms to chemical, physical, and biological parameters of AASHTO MP 10-03, with the following additional requirements:
 - 1) Follow U.S. Composting Council's TMECC guidelines for all testing.
 - 2) Organic Matter Content: 30% minimum.
 - 3) pH: between 6.0 and 8.0.
 - 4) Maturity (growth screening): Minimum 90% emergence for all compost to be vegetated.
 - 5) Particle Size:

Sieve Size	Percent Passing*
2"	100
1"	90-100

3/4"	65-100
3/8"	0-75
*6 inch maximum particle length	

3. Off-site Topsoil: Contains at least 3% organic matter, according to ASTM D 2974, has a high degree of fertility, is free of herbicides that prohibit plant growth, has a pH level between 6.0 and 8.0, and meets the following mechanical analysis requirements:

Sieve Size	Percent Passing*
1"	100
1/2"	95*-97*
1/4"	40-60
No. 100	40-60
No. 200	10-30
*100% for turf grass	

- C. The Engineer will approve the source of off-site topsoil. Surface soils from ditch bottoms, drained ponds, and eroded areas, or soils that are supporting growth of noxious weeds or other undesirable vegetation, will not be accepted. The Engineer will determine if testing is necessary. The Contractor will be responsible for payment of the testing if the off-site topsoil does not meet the above requirements.
- D. Satisfactory Soils: Meet the following requirements:
1. ASTM D2487 soil classification groups CL, CL-ML, SC, GW, GP, GM, SW, SP, SM or a combination of these group symbols
 2. Density of 95 pcf or greater according to ASTM D 698 or AASHTO T 99 (Standard Proctor Density)
 3. Be free of rock, gravel, or concrete chunks larger than 3 inches in any dimension
 4. Be free of debris, waste, frozen materials, vegetation, and other deleterious materials.
 5. Have a liquid limit less than or equal to 45 and a plasticity index of less than or equal to 23.
 6. Be approved by the Special Inspection Agency.
 7. Soils not meeting these requirements are considered unsuitable soils.
 8. For soils to be placed below water, use clean granular material.
- E. Unsatisfactory Soils:
1. ASTM D2487 soil classification groups CL-CH, GC, MH, CH, OL, OH, PT or a combination of these group symbols.
 2. Material encountered during excavation above or below grade that does not meet the suitable soil requirements in this section under "Satisfactory Soils". Should contaminated soils or soils with foreign fill materials be encountered, the contractor shall notify the Architect, Engineer, and Owner. Soil mitigation may be required at the discretion of the Geotechnical Engineer.
 3. Contractor shall fill below-grade voids from unsuitable material excavation with satisfactory soils defined below per the cross section defined in the proposed plans.
 4. Satisfactory Soils not maintained as follows:

- a. Cohesive soils: moisture content within a range of -1 to +4 percent of the material's optimum moisture content.
- b. Cohesionless sands: moisture content within a range of ± 3 percent of optimum moisture content.
- 5. Rubbish and debris, including trees, stumps, waste construction materials, scrap metals, and other materials that cannot be buried or used for backfill or topsoil.
- 6. Moisture content does not determine suitability of materials.

F. Select Subgrade Materials

- 1. All soils required for select subgrade materials must be approved by the Engineer. Approval of materials and their use will be based on AASHTO M 145.
 - a. Cohesive soils must meet all of the following requirements:
 - 1) 45% or less silt size fraction.
 - 2) Density of 110 pcf or greater according to ASTM D 698 or AASHTO T 99 (Standard Proctor Density).
 - 3) Plasticity index greater than 10.
 - 4) A-6 or A-7-6 soils of glacial origin.
 - b. Granular soils must meet all of the following requirements:
 - 1) Density of 110 pcf or greater according to ASTM D 698 or AASHTO T 99 (Standard Proctor Density).
 - 2) 15% or less silt and clay.
 - 3) Plasticity index of 3 or less.
 - 4) A-1, A-2, or A-3 (0).
- 2. Crushed stone, crushed PCC, crushed composite pavement, or RAP; mixtures of gravel, sand, and soil; or uniformly-blended combinations of the above; as approved by the Engineer.
- 3. The Engineer may authorize a change in select subgrade materials subject to materials available locally at time of construction.

G. Granular Stabilization Materials:

- 1. Clean, crushed stone or crushed concrete, with the following gradation:

Sieve Size	Percent Passing*
2 1/2"	100
2"	90-100
1 1/2"	35-70
1"	0-20
1/2"	0-5

- 2. The Engineer may authorize a change in gradation, subject to materials available locally at time of construction.

H. Subgrade Treatment:

- 1. Cement: Meet the requirements of AASHTO M 85 for portland cement.

2. Asphalt: Meet the requirements of AASHTO M 140.
3. Fly ash:
 - a. Meet requirements of ASTM C 618 or AASHTO M 295.
 - b. Class C, the pozzolanic activity test with lime will not be required.
 - c. Approval of source required.
4. Lime: Hydrated lime should meet requirements of ASTM C 207, Type N or AASHTO M 216, and others.

Geogrid: Use an integrally-formed grid structure manufactured of a stress-resistant polypropylene material. Use Type 1 geogrid, unless Type 2 is specified. Meet the following minimum physical properties:

Property	Test Method	Units	Type 1 ¹	Type 2
Aperture stability modulus at 20 cm-kG	Kinney ² – 01	cm-kG/deg	3.2	6.5
Minimum true initial modulus in use				
Machine direction (MD)	ASTM	lb/ft	15,080	32,890
Cross Machine direction (CMD)	D 6637-01		20,560	44,725
Tensile strength, 2% strain				
MD	ASTM	lb/ft	270	410
CMD	D 6637-01		380	590
Junction efficiency	ASTM D 13388-96	%	93	93
Flexural rigidity	ASTM D 1388-96	mg-cm	250,000	750,000
Aperture size				
Minimum		in.	0.5	0.5
Maximum		in.	2.0	2.0
¹ Geogrids meeting the requirements of Iowa DOT Article 4196.01, E and Materials I.M. 496.01 will be acceptable.				
² Dr. Thomas C. Kinney, P.E. and US Army Corps of Engineers.				

- I. Stabilized Construction Entrance
 1. Comply with Iowa DOT Section 4122, Gradation 13, Macadam crushed stone.
- J. Subbase Material:
 1. Special Backfill shall meet the following requirements:
 - a. Crushed stone, crushed PCC, crushed composite pavement, or reclaimed HMA (Class C Subbase)
 - b. Mixtures of gravel, sand, and soil
 - c. Or uniformly blended combinations of the above meeting the following gradations:

Class A Subbase

Material	% Passing Standard Sieve Size					
	1 1/2"	1.0"	3/4"	1/2"	8	200
Crushed Stone Crushed PCC Crushed Composite Pavement	100				10-40	0-10
Gravel or Gravel Blends with Crushed Stone, PCC or Composite		100	90-100	75-90	30-55	3-7

Class C Subbase	
IDOT TABLE 4132.02 – 2	
Material	Gradation
Reclaimed HMA	Nominal top size of 2 inches (50 mm)

- d. For gravel mixture do not exceed the following:

IDOT TABLE 4132.03		
Maximum Permissible Amounts of Objectionable Materials	Maximum Percent Allowed	Test Method
Plasticity Index	10	Iowa DOT Materials Laboratory Test Method 109
Carbon	1.0	Iowa DOT Materials Laboratory Test Method 111

2. Granular Subbase (Class B Subbase) shall meet the following requirements:

- Crushed stone
- Gravels of which 30% or more of the particles retained on the 3/8 inch (9.5 mm) sieve have at least one fractured face as defined in IDOT Materials I.M. 305
- Crushed PCC pavement meeting the requirements of IDOT Materials I.M. 210
- Or uniformly blended combinations of the above materials.
- Crushed Material shall meet the requirements of the following gradation:

Sieve Size	Percent Passing*

1 1/2"	100
3/8"	40-80
8	5-25
200	0-6

- f. Gravel Material shall meet the requirement of the following gradation:

Sieve Size	Percent Passing*
1 1/2"	100
1/2"	50-80
8	10-30
50	5-15
200	3-7

The following requirements apply to the individual virgin aggregates before combining:

IDOT TABLE 4121.03		
Coarse Aggregate Quality	Maximum Percent Allowed	Test Method
Abrasion	50	AASHTO T 96
Alumina ^(a)	1.5	Iowa DOT Materials Laboratory Test Method 222
A Freeze	25	Iowa DOT Materials Test Laboratory Test Method 211, Method A
^(a) If the Alumina value fails, the A Freeze value shall be determined for specification compliance. Iowa DOT Materials Laboratory Test Method 222 does not apply to gravel.		

K. Engineered Fill:

1. Granular

- a. Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

2. Soil

- a. Low plasticity cohesive or cohesionless soil
- b. Liquid Limit of 45 or less and Plasticity Index of 23 or less

- c. Free of rubble and organics
- d. Moisture content of -1 to +4% of optimum moisture

L. Bedding Course:

1. Class I Granular Bedding and Backfill Material
2. Use gravel or crushed stone for granular bedding, complying with the following gradation:

Sieve	Percent Passing
1-1/2"	100
1"	95 to 100
1/2"	25 to 60
No. 4	0 to 10
No. 8	0 to 5

- a. Engineer may allow the use of gravel or authorize a change in gradation subject to materials available locally at time of construction
- b. Engineer may authorize the use of crushed PCC, for pipe sizes up to 12 inches.
- c. Use aggregates having a percentage of wear, Grading A or B, not exceeding 50%, determined according to AASHTO T 96.

3. Class II Backfill Material:

- a. Class II material is manufactured and non-manufactured open graded (clean) or dense graded (clean) processed aggregate, clean sand, or coarse-grained natural soils (clean) with little or no fines.
- b. Class II material is non-plastic soil less than 1-1/2 inches in size and consists of the following:

Class	Type	Soil Group Symbol D 2487	Description	1 1/2 in. (40 mm)	No. 4 (4.75 mm)	No. 200 (0.075 mm)	LL	PI	Uniformity C _u	Curvature C _c
II	Course-Grained Soils, clean	GW	Well-graded gravels and gravel-sand mixtures, little or no fines.	100 %	< 50% of "Course Friction"	< 5%	Non Plastic		>4	1 to 3
		GP	Poorly graded gravels and gravel sand mixtures, little or no fines.						>4	<1 or >3
		SW	Well-graded sands and gravelly sands, little or no fines.		> 50% of "Course Friction"				>6	1 to 3
		SP	Poorly graded sands and gravelly sands, little or no fines.						>6	<1 or >3
	Course-Grained Soils, borderlin	e.g. GW-GC,	Sands and gravels which are borderline between clean and with fines.	100 %	Varies	5% to 12%	Non Plastic		Same as for GW, GP, SW, and SP	

	e clean to with fines	SP- SM							

4. Class III Backfill Material

- Class III material is natural coarse-grained soils with fines.
- Do not use where water condition in trench may cause instability.
- Class III material consists of the following:

Class	Type	Soil Group Symbol D 2487	Description	1 ½ in. (40 mm)	No. 4 (4.75 mm)	No. 200 (0.075 mm)	LL	PI	Unifor mity C _u	Cur vat ure C _c
III	Course-Grained Soils, with fines	GM	Silty gravels, gravel-sand-silt mixtures.	100%	< 50% of “Cour se Frictio n”	12% to 50%	N/A		>4 or <”A” Line	1 to 3
		GC	Clayey gravels, gravel-sand-clay mixtures.		<7 and >”A” Line				<1 or >3	
		SM	Silty sands, sand-silt mixtures.		>4 or <”A” Line				1 to 3	
		SC	Clayey sands, sand-clay mixtures.		>7 and >”A” Line				<1 or >3	

5. Class IVA Material:

- The Engineer will determine if material is not suitable for use as backfill material under deep fills, surface applied wheel loads, heavy vibratory compactors, tampers, or other conditions.
- Do not use where water conditions in trench may cause instability.
- Material is suitable for use in dry trench conditions only.
- Natural fine-grained inorganic soils consists of the following:

Class	Type	Soil Group Symbol D 2487	Description	1 ½ in. (40 mm)	No. 4 (4.75 mm)	No. 200 (0.075 mm)	LL	PI	Uniformity C _u	Curvature C _c
IVA	Fine-Grained Soils (inorganic)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, silts with slight plasticity.	100%	100%	> 50%	<50	<4 or <"A" Line	N/A	N/A
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clay, lean clay					>7 and >"A" Line		

6. Class IVB Material:

- When approved by the Engineer, material may be used as final trench backfill in a dry trench.
- Do not use in pipe embedment zone.

Natural fine-grained inorganic (high elastic silts and plastic clays – fat clay) with a liquid limit greater than 50% meeting the following:

Class	Type	Soil Group Symbol D 2487	Description	1 ½ in. (40 mm)	No. 4 (4.75 mm)	No. 200 (0.075 mm)	LL	PI	Uniformity C _u	Curvature C _c
IVB	Fine-Grained Soils (inorganic)	MH	Inorganic silts or micaceous or diatomaceous fine sandy or silty soils, elastic silts.	100%	100%	> 50%	>50	<"A" Line	N/A	N/A
		CH	Inorganic clays of high plasticity, fat clays.					>"A" Line		

7. Unsuitable Material: Remove unsuitable materials from the site, including, but not limited to, the following:

- Soils not classified as suitable backfill material, as defined in this section.
- Rock with gradation not meeting the stated gradation for stabilization material.
- Individual stones or concrete chunks larger than 6 inches, and averaging more than one per each cubic foot of soil.
- Frozen materials.

- e. Stumps, logs, branches, and brush.
 - f. Trash, metal, or construction waste.
 - g. Soil in clumps or clods larger than 6 inches, and without sufficient fine materials to fill voids during placement.
 - h. Environmentally-contaminated soils.
 - i. Materials removed as rock excavation or over-excavation.
8. Special Pipe Embedment and Encasement Material
- a. Concrete Cradle, Arch, or Encasement: Use Iowa DOT Class C concrete.
 - b. Flowable Mortar: Comply with Iowa DOT Article 2506.02
 - c. CLSM:
 - 1) Approximate quantities per cubic yard:
 - a) Cement: 50 pounds
 - b) Fly ash: 250 pounds
 - c) Fine aggregate: 2, 910 pounds
 - d) Water: 60 gallons
 - 2) A compressive strength of at least 50 psi compressive strength at 28 calendar days can be expected.
 - 3) Comply with material requirements of Iowa DOT Article 2506.02

M. Drainage Course:

1. Crushed stone or Processed Gravel shall conform with the following gradation:

Sieve	Percent Passing
3/4"	100
1/2"	95 to 100
3/8"	50 to 100
No. 4	0 to 50
No. 8	0 to 8

2. Pea gravel shall conform with the following gradation (may not be used under pavement):

Sieve	Percent Passing
3/4"	100
1/2"	95 to 100
3/8"	40 to 80
No. 4	0 to 15
No. 8	0 to 7

2.2 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored to comply with local practice or requirements of authorities having jurisdiction.

- B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene 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 the 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 to comply with local practice or requirements of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.
- D. Remove all ground cover from the area.
- E. All grading around existing buildings to remain shall be shaped in a manner to create positive drainage away from all structures.
- F. Strip topsoil to the depth encountered (1.0'-1.5') below proposed building and pavement slabs and to a minimum of 8" in all other areas.

3.2 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.
- B. Any buried foundation encountered shall be cut and removed to a minimum of 2-feet below the proposed subbase. This work shall be considered extra beyond the base bid and shall be paid for by the unit price listed in the bid documents.

3.3 EXCAVATION AND BACKFILL FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. Protect existing facilities, trees, and shrubs during trench excavation.
 - 2. Place excavated material away from trench.
 - 3. Grade spoil piles to drain. Do not allow spoil piles to obstruct drainage.
- B. Unsuitable Backfill Material:
 - 1. If unsuitable backfill material or foreign fill is encountered, notify the Architect as well as the Owner prior to remediating, backfilling, or replacing with suitable material.
 - 2. Remove rock, rubbish, boulders, debris, and other unsuitable backfill materials at least 6 inches below and on each side of the pipe.
 - 3. Keep unsuitable backfill material separated from suitable backfill material and topsoil.
 - 4. Restore trench to design dimensions using bedding or stabilization material.
- C. Rock or Unstable Soils in Trench Bottom:
 - 1. Notify the Architect prior to over-excavation.
 - 2. The Engineer will determine the need for over-excavation and trench foundation stabilization prior to installation of pipes and structures.
- D. Trench Protection:
 - 1. Install adequate trench protection (sheeting, shoring, and bracing) to prevent ground movement or damage to adjacent structures, pipelines, and utilities.
 - 2. Move trench boxes carefully to avoid disturbing pipe, bedding, or trench wall.

E. Dewatering:

1. Maintain water levels below the bottom of trench excavation.
2. Perform the dewatering operation according to the dewatering plan approved by the Engineer. The dewatering plan may be modified to meet actual field conditions, with approval of the Engineer.
3. Ensure operation of the dewatering system does not damage adjoining structures and facilities. Cease dewatering operations and notify the Engineer if damage is observed.
4. Discharged Water:
 - a. Do not discharge water into sanitary sewers.
 - b. Discharging water into storm sewers requires Engineer's approval.
 - c. Obtain permission of adjacent property owner prior to discharging water onto their property.
 - d. Maintain and control water discharge as necessary to prevent a safety hazard for vehicular and pedestrian traffic.
 - e. Direct water discharge away from electrical facilities or equipment.
 - f. Use dewatering equipment that will minimize disturbance from noise and fumes.
 - g. Protect discharge points from erosion. Provide sediment control for sediment contaminated water discharged directly from trench.

F. Pipe Bedding and Backfill:

1. General:
 - a. Comply with Details in the Contract Documents.
 - b. Bedding and backfill used for pipe installation will depend on:
 - 1) Type of installation (water main, sanitary sewer gravity main, sanitary sewer force main, or storm sewer).
 - 2) Pipe material.
 - 3) Depth of bury.
 - 4) Pipe diameter.
 - c. After pipe installation, place remaining bedding material and immediately place backfill in trench.
 - d. Adjust the moisture content of excessively wet, but otherwise suitable, backfill material by spreading, turning, aerating, and otherwise working material as necessary to achieve required moisture range.
 - e. Adjust the moisture content of excessively dry, but otherwise suitable, backfill material by adding water, then turning, mixing, and otherwise blending the water uniformly throughout the material until the required moisture range is achieved.
 - f. Hydraulic compaction (flooding with water) is not allowed unless authorized by the Engineer.
2. Pipe Bedding:
 - a. Granular Material:
 - 1) Class I granular bedding material is required for all gravity mains. Use when specified for pressure pipes.
 - 2) Comply with Details in Contract Documents.
 - 3) Place bedding material in the bottom of the trench in lifts no greater than 9 inches thick. Consolidate and moderately compact bedding material.

- 4) Shape bedding material to evenly support pipe at the proper line and grade, with full contact under the bottom of the pipe. Excavate for pipe bells.
- 5) Install pipe and system components.
- 6) Place, consolidate, and moderately compact additional bedding material adjacent to the pipe to a depth equal to 1/6 the outside diameter of the pipe.
- b. Suitable Backfill Material:
 - 1) Only use with pressure pipe. Comply with Details in Contract Documents.
 - 2) Use suitable backfill material to shape trench bottom to evenly support pipe at the proper line and grade, with full contact under the bottom of the pipe. Excavate for pipe bells.
- c. Special Pipe Embedment and Encasement Materials:
 - 1) If specified in the contract documents, use concrete, flowable mortar, or CLSM in lieu of other bedding materials.
 - 2) Secure pipe against displacement or flotation prior to placing concrete, flowable mortar, or CLSM.
3. Haunch Support: Place from the top of the pipe bedding to the springline of the pipe.
 - a. Granular Material:
 - 1) Place Class I material in lifts no greater than 9 inches thick.
 - 2) Consolidate and moderately compact by slicing with a shovel or using other approved techniques.
 - b. Suitable Backfill Material:
 - 1) Place in lifts no greater than 9 inches thick.
 - 2) For Class II backfill material, consolidate and moderately compact by slicing with a shovel or using other approved techniques.
 - 3) For Class III and Class IVA backfill materials, compact to at least 90% of Standard Proctor Density. Obtain required compaction within a soil moisture range of optimum moisture to 4% above optimum moisture content.
 - c. Special Pipe Embedment and Encasement Materials:
 - 1) If specified in the contract documents, use concrete, flowable mortar, or CLSM in lieu of other haunch materials.
 - 2) Secure pipe against displacement or flotation prior to placing concrete, flowable mortar, or CLSM.
4. Primary and Secondary Backfill:
 - a. General:
 - 1) For primary backfill, place from the spring line of the pipe to the top of the pipe.
 - 2) For secondary backfill, place from the top of the pipe to 1 foot above the top of the pipe.
 - b. Granular Material:
 - 1) Place in lifts no greater than 9 inches thick.
 - 2) Compact to at least 65% relative density.
 - c. Suitable Backfill Material:
 - 1) Place in lifts no greater than 9 inches thick.
 - 2) For Class II backfill material, compact to at least 65% relative density.

- 3) For Class III and Class IVA backfill materials, compact to at least 95% of Standard Proctor Density. Obtain required compaction within a soil moisture range of optimum moisture to 4% above optimum moisture content.
- d. Special Pipe Embedment and Encasement Materials:
 - 1) If specified in the contract documents, use concrete, flowable mortar, or CLSM in lieu of other primary and secondary backfill materials.
 - 2) Secure pipe against displacement or flotation prior to placing concrete, flowable mortar, or CLSM.
5. Final Trench Backfill:
 - a. Place suitable backfill material from 1 foot above the top of the pipe to the top of the trench.
 - 1) Use no more than 9-inch-thick lifts for backfill areas more than 3 feet below the bottom of pavement.
 - 2) Use no more than 9-inch-thick lifts for backfill areas less than or equal to 3 feet below the bottom of pavement.
 - b. Place backfill material after recording locations of connections and appurtenances or at the Engineer's direction.
 - c. Class I and Class II Backfill Material:
 - 1) Compact to at least 65% relative density within city right-of-way and under pavements.
 - 2) Compact to at least 50% relative density under vegetative areas.
 - d. Class III and Class IVA Backfill Material:
 - 1) Compact to at least 95% of Standard Proctor Density within city right-of-way and under pavements
 - 2) Compact to at least 90% of Standard Proctor Density under vegetative areas.
 - 3) Obtain required compaction within a soil moisture range of optimum moisture to 4% above optimum moisture content.
 - e. In areas to remain unpaved, terminate backfill material 8 inches below finished grade. Use topsoil for the final 8 inches above trench backfill material.
 - f. Terminate backfill material at subgrade elevation in areas to be paved.
- G. Trenches in Tree and Plant Protection Zones:
 1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
 2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
 3. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

3.4 EXCAVATION AND HAUL OFF OF UNSUITABLE MATERIALS

- A. Contractor shall notify Architect, Owner, and Geotechnical Engineer should unsuitable materials be encountered on-site including but not limited to foreign fill or rubble fill.
- B. All below grade voids created from unsuitable material excavations shall be backfilled with satisfactory material per this specification section per the proposed cross section in the proposed plans.

3.5 SOIL FILL FOR EXTERIOR SLABS ON GRADE

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under future grass and planted areas, use satisfactory soil material or Topsoil (Soil Classification Group CL-CH).
 - 2. Under future building, walks, and pavements use satisfactory soil material as outlined in the geotechnical report.

3.6 COMPACTION OF SOIL FILLS

- A. Place fill soil materials in layers not more than 9 inches (200 mm) in loose depth for material compacted by heavy compaction equipment.
- B. Compact soil materials to not less than the following percentages of Standard Proctor Density according to ASTM D 698:
 - 1. Under future structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material as follows:
 - a. 98% Standard Proctor Density for Cohesive Soil (ASTM D698)
 - b. 98% Standard Proctor Density for Cohesionless Soil (ASTM D698)
 - c. 70% Relative Density for Cohesionless Soil (ASTM D4253& D4254) where Standard Proctor technique (ASTM D698) does not result in a definable maximum dry density and optimum moisture content
 - 2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 98 percent SPD.
 - 3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent SPD.
- C. Compact granular soils with vibratory compaction equipment.
- D. Compact cohesive soils with sheepsfoot or pneumatic type compactors.

3.7 SUBGRADE PREPARATION FOR EXTERIOR SLABS-ON-GRADE

- A. Shape and consolidate subgrade in preparation for the placement of pavement and/or building foundations.
- B. Uniform Composition: Provide uniform composition of at least 12 inches below top of subgrade under buildings, pavement, or subbase and of at least 6 inches below top of subgrade under walkways, plus 2 feet on each side. Use select subgrade materials unless granular stabilization materials or subgrade treatment is specified.
 - 1. Subgrade Compaction in Fill Sections:
 - a. See "COMPACTION OF SOIL BACKFILLS AND FILLS" in this section
 - 2. Subgrade Compaction in Cut Sections:
 - a. Excavate and stockpile the top 6 inches of subgrade.
 - b. Scarify, mix with subbase treatment, and re-compact the next 6 inches of subgrade.
 - c. Replace, mix with subbase treatment, and compact the top 6 inches of subgrade.
 - d. Remove stones over 3 inches from subgrade.
 - e. Construct to elevation and cross-section such that, after rolling, surface will be above required subgrade elevation.

3. Final Subgrade: Complete final subgrade by excavation to grade by use of steel-shod template supported on side forms, support rollers, or by use of an automatically-controlled subgrade excavating machine.
- C. Subgrade Check:
 1. Proof-roll all subgrades prior to placing subbase rock or pavement with fully loaded dump truck. If soft spots appear, rework area and/or add more treatment material.
 2. Check subgrade elevations and grades prior to paving.
- D. Ruts: If ruts or other objectionable irregularities form in subgrade during construction, reshape and re-roll subgrade before placing pavement. Fill ruts or other depressions with material similar to other subgrade material, and compact.
- E. Sprinkling or wetting of the finished subgrade will be required, as necessary; to insure reasonable moisture content at the time pavement or base is placed upon it.

3.8 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
 1. Shape subbase course and base course to required crown elevations and cross-slope grades to the specified depth, plus 2 feet outside the pavement area.
 2. Place subbase course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
 3. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
- C. Ensure that the top 1 inch of the subbase is uniformly moist prior to paving.
- D. Do not allow hauling equipment and other traffic on completed subbase.

3.9 SUBGRADE TREATMENT FOR EXTERIOR SLABS ON GRADE (AS NECESSARY)

- A. Lime, Cement, Fly Ash, or Asphalt:
 1. Incorporate the subgrade treatment material uniformly during subgrade preparation to the depth and rate specified in the contract documents.
 2. Place subgrade treatment in the areas specified in the contract documents for the width of the pavement, plus 2 feet on each side.
- B. Geogrid or Geotextiles:
 1. Install according to manufacturer's recommendations, on top of the prepared subgrade.
 2. Place in the areas specified in the contract documents for the width of the pavement, plus 2 feet on each side.

3.10 SUBGRADE AND FOOTING INSPECTION

- A. Footing Excavations shall be kept free of water accumulation.
- B. Test Probing shall be done by a Geotechnical Engineer in all foundation and slab subgrades.
- C. Subgrade Stability for Slabs-On-Grade:
 1. Perform proof rolling of subgrade below the building slabs and pavements with a truck loaded to the maximum single legal axle gross weight of 20,000 pounds or the maximum tandem axle gross weight of 34,000 pounds. Operate trucks at less than 10 mph. Make multiple passes. The subgrade will be considered to be unstable if, under the operation of the loaded truck, the surface shows yielding (soil wave in front of the loaded tires) or

rutting of more than 2 inches, measured from the top to the bottom of the rut at the outside edges. Do not proof-roll wet or saturated subgrades.

2. If soft or yielding areas are located, remove unstable materials and replace with suitable foundation materials as approved by the Engineer. Compact subgrade materials in cut sections as required by the Geotechnical Engineer. If stabilization material is used, place and compact as required for subbase.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Geotechnical Engineer, without additional compensation.

3.11 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Geotechnical Engineer.
 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer.

3.12 STORAGE OF SOIL MATERIALS

- A. Maintain erosion control around stockpiles following the requirements of the Pollution Prevention Plan.

3.13 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction as follows:
 1. Cohesive soils: moisture content within a range of -1 to +4 percent of the material's optimum moisture content.
 2. Cohesionless sands: moisture content within a range of ± 3 percent of optimum moisture content.
- B. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
- C. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content as defined above and is too wet to compact to specified dry unit weight.

3.14 SPREADING TOPSOIL

- A. Preparation for Topsoil Placement:
 1. Finish excavation and embankment work according to the specified grades and cross-sections; grade and slope all surfaces to drain away from buildings and prevent ponding. Conform to the grading plan within ± 2 inches.
 2. Loosen surface to a minimum depth of 4 inches to reduce compaction.
- B. Topsoil Spreading and Finish Grading:
 1. Place the topsoil after all grading and trenching activities in the area have been completed.
 2. Place topsoil at least 8 inches deep; smooth and finished grade according to the contract documents. If topsoil is being amended with compost, thoroughly blend compost with on-site topsoil at the rate specified.
 3. After finish grading the topsoil, remove clods, lumps, roots, litter, other undesirable material, or stones larger than 1 inch (1/2 inch for turfgrass).

3.15 DRAINAGE

- A. Provide temporary drainage facilities to prevent damage to public or private interests when necessary to interrupt natural drainage or flow of artificial drains.
- B. Restore original drainage as soon as work allows.
- C. The Contractor is responsible for damage resulting from their neglect to provide erosion control or artificial drainage.
- D. Partially grade two future ponds (one wet, one dry) to be used as silt basins during construction. Install temporary cmp culverts as indicated in the plans.

3.16 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- C. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.17 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.
- D. Maintain stabilized construction entrance tracking pad as indicated on the drawings and as per Section 311000
- E. Seed all disturbed areas with Temporary stabilizing seeding as per Section 311000.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove trash, and debris, and legally dispose of them off Owner's property in accordance with all state, local, and federal guidelines.

END OF SECTION

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**SECTION 32 1313
CONCRETE PAVING**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Driveways
 2. Parking Lots
 3. Curbs and Gutters
 4. Walks
 5. Wheel Stops

1.2 SUBMITTALS

- A. Two weeks prior to commencing any portland concrete placement, the Contractor shall submit a paving mix design for each different source of aggregate to be used for review and approval by the Architect or Engineer. Mixes or mix designs approved by the Iowa Department of Transportation or an independent testing laboratory shall be submitted.
- B. Prior to ordering materials, Contractor shall submit material certifications for wheel stops.
- C. Submit all testing and certifications in accordance with this Section.
- D. The Contractor will provide Material Certifications to the Architect or Engineer.

1.3 DELIVERY, STORAGE, HANDLING, AND SALVAGING

- A. Aggregate Storage: Prevent contamination and frequent variations in specific gravity, gradation, or moisture content; Iowa DOT 2301.
- B. Concrete transported without continuous agitation shall not be used if the period elapsed between the time the concrete is mixed and the time it is placed is greater than 30 minutes; Iowa DOT 2301. With the approval of the Engineer or Engineer, an approved retarding admixture may be used at the rate prescribed in Materials IM 403 and the mixed-to-placed time may be extended by an additional 30 minutes.
- C. Concrete transported with agitation shall not be used when the cement has been in contact with the aggregate more than 90 minutes before it is placed; Iowa DOT 2301. With the approval of the Engineer or Engineer, an approved retarding admixture may be used at the rate prescribed in Materials IM 403.

Concrete containing Type III cement and transported with agitation shall be delivered and placed within the following time limits:

Concrete Temperature (at time of mixing, degrees F)	Maximum Time (from mixing to placement, in min.)
75 or less	60
76 to 85	45
above 85	30

- D. The methods of delivering and handling the concrete shall be such that objectionable segregation or damage to the concrete will not occur, and that which will facilitate placing with a minimum of rehandling; Iowa DOT 2301.

- E. The compartment in which concrete is transported to the work shall be thoroughly cleaned and flushed with water to ensure that hardened concrete will not accumulate. Flushing water shall be discharged from the compartment before it is charged with the next batch; Iowa DOT 2301.
- F. Cement and Fly Ash: Store in suitable weatherproof enclosures; Iowa DOT 2301.
- G. Admixtures: Store in suitable weather tight enclosures which will preserve quality.
- H. Reinforcing Steel: Store off ground on timbers or other supports.

1.4 SCHEDULING AND CONFLICTS

- A. Construction Sequence:
 - 1. Attend a preconstruction meeting unless not required by Architect or Engineer.
 - 2. Submit plan for construction sequence and schedule prior to commencing construction.
- B. Conflict Avoidance:
 - 1. Expose possible conflicts in advance of construction, such as utility lines and drainage structures. Verify elevations and locations of each and verify clearance for proposed construction.
 - 2. Complete elements of the work which can affect line and grade in advance of other open cut construction unless noted on plans.
 - 3. Notify Engineer or Engineer of conflicts discovered or changes needed to accommodate unknown or changed conditions.
- C. Traffic Control Plan: The Contractor shall develop a traffic control plan based on the Manual on Uniform Traffic Control Devices (MUTCD). Traffic control plans that are provided in the contract documents shall be reviewed by the Contractor and all traffic control devices used shall be in accordance with the MUTCD.
- D. Stop Work: Stop work and notify Engineer or Engineer immediately if contaminated soils, historical artifacts, or other environmental or historic items are encountered.
- E. Conform to Local, State, and Federal Requirements.

1.5 RESTRICTIONS ON OPERATIONS

- A. Weather Conditions:
 - 1. Do not place concrete when stormy or inclement weather or temperature prevents good workmanship. Aggregates containing frozen lumps shall not be placed, and concrete shall not be placed on a frozen subgrade or subbase. The contractor will take all necessary actions to prevent the pavement from freezing.
 - a. Concrete placement may commence if the concrete mix temperature is a minimum of 40° and the air temperature is:
 - 1) After November 15, the air temperature is 36° and rising.
 - 2) After April 15, the air temperature is 32° and rising.
 - b. Concrete placement will stop when:
 - 3) After November 15, the air temperature is 37° and falling.
 - 4) After April 15, the air temperature is 32° and falling.
 - 5) With non-reinforced pavement, calcium chloride may be added to the mixing water to hasten initial set, if approved by Engineer or Engineer.
 - 6) Pavement damaged by inclement weather shall be removed and replaced.
 - 2. Temperature restrictions and protection requirements may be modified by the Engineer or Engineer under unusual conditions.
- B. Night Conditions:

1. Do not place or finish concrete under artificial light, unless approved by the Engineer.
2. In good weather, the header shall be placed at least 45 minutes before sunset.
3. In cold weather, more time must be allowed for finishing and protection.
4. All finishing and covering operations shall be performed prior to darkness.
5. Temperature restrictions and protection requirements may be modified by the Engineer under unusual conditions.

C. Cold Weather Temperature Protection:

1. All concrete pavement and curb/gutters, including exposed edges of the slab and curb, shall be cured. In addition, concrete less than 36 hours old shall be protected as follows:

Night Temperature Forecast	Type of Protection ¹
35°F to 32°F	One layer of burlap for concrete.
31°F to 25°F	Two layers of burlap or one layer of plastic on one layer of burlap.
Below 25°F	Four layers of burlap between layers of 4 mil (100 µm) plastic or equivalent commercial insulating material approved by the Engineer or Engineer.
The protection shall remain until one of the following conditions is met: a. The pavement is 5 calendar days old. b. Opening strength is attained. c. Forecasted low temperatures exceed 35°F for the next 48 hours. d. Forecasted high temperatures exceed 55°F for the next 24 hours and sub-grade temperatures are above 40°F.	

- c. Paving operations shall be shut down in time to comply with protection requirements outlined above. In good weather, the header shall be placed at least 45 minutes before sunset. During cold weather, more time must be allowed for finishing and protection. All finishing and covering operations shall be performed prior to darkness. Temperature restrictions and protection requirements may be modified by the Engineer or Engineer.
- d. When the pavement is placed directly on natural subgrade, earth check dams shall be constructed immediately after passage of the slip forms or removal of the forms to prevent water from flowing along the edge of the pavement and undermining the slab. They shall not be spaced or be of a width to provide an approach over which a vehicle may be driven onto the pavement.
- e. Equivalent commercial insulating material approved by the Engineer or Engineer may be used. This material shall be waterproof and have a minimum R value of 0.50. If initial set has not yet occurred, a layer of burlap shall be placed on top of concrete prior to placing insulating blankets.
- f. Vertical edges of pavement and back of curbs shall be cured by the same method used for curing the surface.
- g. Method of protection and materials used shall maintain the concrete above 40°F.

D. Concrete Evaporation Protection:

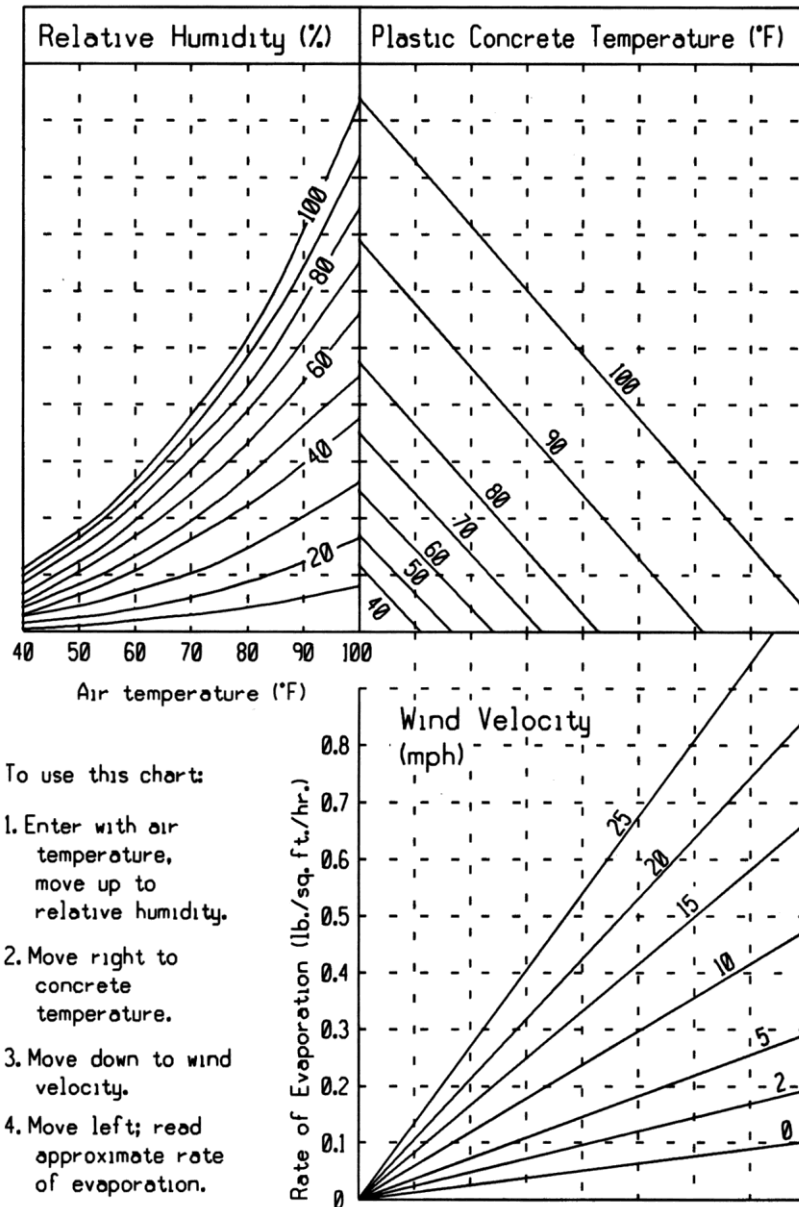
1. Hot weather condition is defined as any combination of the following conditions that tend to impair the quality of plastic concrete by accelerating the rate of moisture loss and rate

of cement hydration causing thermal shrinkage and resulting in plastic shrinkage cracking or crazing.

- High Ambient Temperature
- High Concrete Temperature
- Low Relative Humidity
- High Wind Velocity
- Solar Radiation

2. Concrete evaporation protection will be based on the theoretical rate of surface evaporation when it exceeds 0.1 lbs. per square foot per hour. The National Weather Service's maximum air temperature, relative humidity and maximum steady wind velocity without gusts, for the date and the location of the paving pour shall be used for the Theoretical Rate of Evaporation Chart.

a. THEORETICAL RATE OF EVAPORATION CHART



3. During hot weather conditions the Engineer or Engineer may restrict concrete placement to early morning or evening hours.
4. Under hot weather conditions the Contractor will advise the Engineer or Engineer of the results of the theoretical evaporation rate throughout paving operations.
5. The Contractor shall discontinue with placement of the concrete when the theoretical evaporation rate exceeds to 0.30 lbs./sq.ft./hr.
6. The protection practice by the Contractor will be as follows for the evaporation rate greater than 0.1 lbs./sq.ft./hr.
 - h. Immediately apply an approved evaporation retarder (Polymers) to the concrete pavement and curbs or increase the application cure to 1.5 times the standard specified rate.

- i. Take special precautions to assure that the forms and subgrade are sufficiently moist or protected to avoid lowering the water content at the pavement/subgrade interface. In hot weather conditions the subgrade should also be moistened the evening before operations.
 - j. Assure that the time between placing and curing is minimized and eliminate delays.
 - k. Moisten concrete aggregates that are dry and absorptive.
 - l. Use a fog spray to raise the relative humidity of the ambient air if there is a delay in immediately applying the curing compound.
 - m. Minimize solar heat by shading, wetting or covering concrete chutes or other equipment that comes in contact with plastic concrete.
 - n. If shrinkage cracks should appear during finishing the cracks can be closed by striking each side of the crack with a float and refinishing.
- E. Rain Protection:
- 1. The Contractor shall have available, near the site of the work, materials for proper protection of the edges and surface of concrete. Protective material may consist of sheets of burlap, or plastic film. Planks or other material with suitable stakes that can be used as temporary forms shall also be on hand; Iowa DOT 2301.
 - 2. If initial set has not occurred, contractor shall take every precaution necessary to protect the surface texture of the concrete.
 - 3. Failure to properly protect concrete shall constitute cause for removal and replacement of defective pavement, if so determined by the Engineer or Engineer.
- F. Safety Fence for Pavement:
- 1. The Contractor shall insure that all traffic control devices are in place in accordance with the Traffic Control Plan.
 - 2. At the end of each day's run and at all side streets, the Contractor shall erect and maintain such barriers and fencing as are necessary to protect the pavement from damage.
 - 3. Intermediate safety fences may be required for the purpose of opening the slab for access to a side road, side street, or entrance.
- G. Repair of Pavement:
- 1. The Contractor shall protect the new pavement and its appurtenances from traffic, both public and that caused by its own employees and agents, at its expense. This includes the erection and maintenance of warning signs, lights, barricades, watchmen to direct traffic, and pavement bridges or crossovers.
 - 2. Any part of the pavement damaged by traffic or other causes occurring prior to final acceptance of the pavement shall be repaired or replaced, at the discretion of the Engineer or Engineer, at the Contractor's expense.
 - 3. The Contractor shall not operate equipment with metal tracks, metal bucket blades, or metal motor patrol blades directly on new paving. The Contractor shall not unload soil or granular materials, including base rock for storage and future reloading directly onto new paving.
- H. Utilities Protection: The Contractor will not start work until all utilities are located.
- 1. Repairs: When the Contractor disrupts or breaks known utilities of the Jurisdiction or privately owned utilities, such utilities shall be repaired at the Contractor's expense. Unnecessary delays in making repairs shall cause the Engineer or Engineer to have such repairs made and the cost thereof deducted from the monies due the Contractor.
 - 2. Drains, Pipe, Tiles: Existing subsurface drains, pipe, and tiles, which are disrupted or broken by reason of the construction shall be connected to the storm sewer, or another

adequate outlet if storm sewer is not available. Should no outlet be readily available, the Engineer or Engineer shall determine a suitable solution.

3. Water Stop Boxes and Services: The adjustment of stems and castings and/or repair of those broken or damaged by the Contractor shall be at the contractor's expense.

- I. Use of Pavement: Time for opening pavement for use is determined by age or by test results from cylinder or beams taken during placement.

MINIMUM AGE OR STRENGTH OF PAVEMENT BEFORE OPENING				
Class of Mix	Type of Cement	Minimum Age For Opening without Testing ⁽⁴⁾	Minimum Compressive Strength (psi)	⁽¹⁾ Minimum Flexural Strength Center Point (psi)
A	Type I	14 Days ⁽²⁾	3,000	500
B	Type I	14 Days	2,400	400
C	Type I	7 Days ⁽³⁾	3,000	500
C	Type III	48 Hours	3,000	500
M	Type I	48 Hours	3,000	500
C-V47B	Type I	7 Days ⁽³⁾	3,000	500
C-V47B	Type IP	7 Days ⁽³⁾	3,000	500
M-V	Type I	48 Hours	3,000	500
M-V	Type IP	48 Hours	3,000	500
Optional test method for primary roads Ten days for concrete 8 inches or more in thickness Five days for concrete 9 inches or more in thickness Opening without testing only allowed upon approval of Engineer or Engineer Note: Maturity Method may be allowed with approval of the Engineer or Engineer; IM 383				

PART 2 - PRODUCTS

2.1 TYPE OF PAVEMENT

- A. Standard Concrete Pavement: Standard concrete pavement may be reinforced, or nonreinforced, as noted in the contract documents and shall consist of concrete of the class specified in the contract documents, reinforced as shown in the contract documents, placed within forms, and consolidated and finished by equipment operating on forms.

2.2 MATERIALS

- A. Portland Cement; Iowa DOT 4101 and IM 401

1. Portland cement shall meet the requirements of AASHTO M 85 specifications for the type of cement required. Cement which contains 5.0 percent or more of lumps retained on a No. 20 sieve shall be rejected.
 - a. Cement which contains less than 1.0 percent of lumps may be used without adjustment in batch weights. For each 1.0 percent or fraction thereof from 1.0 to 5.0 percent of lumps found by test, batch weights of cement used in either concrete pavement shall be increased by 2.0 percent of the original value.
 - b. Cement stored at the site of the work or local warehouses for more than 60 days, or cement stored in producer's silo more than a year shall be retested for lumps before using.
 2. Type I; Normal Portland Cement:
 - a. Unless otherwise specified, cement shall meet Type I AASHTO M 85, Type I.
 - b. When the addition of fly ash to Type I cement is allowed in accordance with Iowa DOT 2301, or AASHTO M 240, Type I (PM) or Type IP, cement may be furnished and used within the same limitations.
 - c. The cement content of the concrete shall be that specified for Type I cement.
- B. Mineral Additives:
1. Fly Ash Substitute
 - a. The use of fly ash may be substituted for Portland Cement in a Portland Cement Concrete mixture if approved by the Engineer or Engineer and shall conform to the requirements of Iowa DOT 4108, I.M. 529, and I.M. 491.17. Iowa DOT 2301 shall also apply except that fly ash substitution rates shall follow the table given in Section 321313, 2.3.
 - b. Fly ash to be substituted for Portland cement in concrete shall comply with AASHTO M 295, either Class F or Class C, including the Supplementary Optional Chemical Requirements. Sources with fly ash between 1.5 percent and 2.5 percent available alkalis may be approved. For Class C fly ash, the pozzolanic activity test with lime will not be required.
 - c. Approval of the source of fly ash will be required. This is to be based on fly ash produced when the power plant is using specific materials, equipment, and processes. Any change in materials, equipment, and processes shall void the source approval, and a new approval of the source will be required.
 - d. Inspection and acceptance of fly ash will be in accordance with Iowa DOT Materials I.M. 491.17.
 2. Ground Granulated Blast Furnace Slag Substitute
 - a. GGBFS may be substituted for Portland cement in Portland cement concrete mixes if approved by the Engineer or Engineer and shall conform to the requirements of Iowa DOT 2301, 4108, I.M. 529 and I.M. 491.14.
 - b. Inspection and acceptance of GGBFS will be in accordance with Iowa DOT Materials I.M. 491.14, appendix A.
- C. Fine Aggregate for Concrete, Iowa DOT 4110: Clean, hard, durable mineral aggregate particles free from detrimental amount of silt, shale, coal, or organic matters.
1. Natural sand as a result from disintegration of rock through erosional processes.
 2. From an approved source of not more than 2.0 percent shale and coal particles retained on a No. 16 sieve; not more than 2.5 percent silt by weight.

3. Gradation: Iowa DOT 4109, gradation No. 1.

Sieve Size	Percent Passing
3/8 inch	100
No. 4	90 to 100
No. 8	70 to 100
No. 30	10 to 60
No. 200	0 to 1.5
Engineer or Engineer may adjust gradation to allow for use of local aggregates.	

D. Coarse Aggregate for Concrete, Iowa DOT 4115: Coarse aggregate shall consist of crushed stone particles.

1. Abrasion loss, in accordance with AASHTO T 96 shall not exceed 50.
2. Freeze and thaw loss, in accordance with Iowa DOT Test Method 211, Method A, shall not exceed 6 percent.

Objectionable Materials: The percentage of such materials shall not exceed the following percentages: Objectionable Materials	Percent
Clay lumps	0.5
Coal and carbonaceous shale	0.5
Total of all shale, similar objectionable materials, and coal combined.	1.0
Sticks (wet weight) and other organic materials, except coal.	0.1
	3.0

Unsound chert particles retained on 3/8" sieve (Nonstructural concrete)	
Unsound chert particles retained on the No. 4 sieve (Gradation No. 6) (1/2" nominal maximum size)	0.5
NOTE: Chert particles which break into three or more pieces when subjected to the freezing and thawing test will be considered unsound.	
Chert in aggregate produced from limestone sources is defined as unsound when any of the fractions of the crushed or uncrushed chert do not meet the soundness requirements.	

3. Durability: Soundness - Iowa DOT Test Method 408-A.
 - a. Class 2 durability for local and minor collectors; some stone deterioration within 20 years.
 - b. Class 3 durability for major collectors and arterials; little to no stone deterioration within 20 years.
 - c. Class 2 durability stone shall be used unless stated otherwise in the contract documents or otherwise specified by the Engineer or Engineer.
4. Gradation: Iowa DOT 4109, Gradation No. 3.

Sieve Size	Percent Passing
1 1/2 inch	100
1 inch	95 to 100
1/2 inch	25 to 60
No. 4	0 to 10
No. 8	0 to 5
No. 200	0 to 1.5
Engineer or Engineer may adjust gradation to allow for use of local aggregates.	

- E. Water Requirements: Iowa DOT 4102.
 1. Free from detrimental amounts of oil, salts, acids, strong alkalis, vegetable matter, or other materials detrimental to concrete; AASHTO T 26. If practicable, potable water shall be used.
 2. Suspended matter in excess of 2000 ppm shall be filtered or otherwise clarified.

3. Hardness not more than 750 ppm, as calcium carbonate.
 4. Methyl orange, alkalinity, not more than 1,000 ppm, as calcium carbonate.
 5. Phenolphthalein alkalinity, not more than one-half the methyl orange alkalinity, as calcium carbonate.
 6. Total acidity, not more than 100 ppm as calcium carbonate.
 7. Potable water obtained from a municipal supply, suitable for drinking, may be accepted without testing.
- F. Air Entrainment Admixture: Iowa DOT 4103, IM 403, AASHTO M 154. Provisions shall be made to stir, agitate or circulate air entraining admixtures prior to use so as to insure a uniform and homogeneous mixture.
- G. Admixtures: All liquid admixtures as listed below must meet the following requirements. Other admixtures may be used subject to the approval of the Engineer or Engineer.
1. Retarding and Water Reducing Admixtures: Iowa DOT 4103, IM 403, AASHTO M194.
 - a. The retarding and water reducing admixture used shall be compatible with the air entraining agent used.
 - b. The admixtures shall be used in amounts recommended by the manufacturer for conditions which prevail on the project.
 - c. When used, they shall be introduced into the mixer after all other ingredients are in the mixer.
 - d. Retarding and water reducing admixtures shall be agitated prior to and during their use.
 - e. When fly ash is used in the concrete, the liquid admixture dosage shall be applied to both the cement and fly ash weight combined.
 2. Accelerating admixtures (calcium chloride): Iowa DOT 2529.
 - a. When calcium chloride is required, it shall be furnished at the job site.
 - b. Calcium chloride solution shall be a commercial 32 percent solution or equivalent, prepared by the Contractor as follows:

	Solution	
	lbs. solid produced	
	per gallon	per gallon
	<u>of water of water</u>	
Type 1 - Regular Flake (77% material)	7	1.35
Type 2 - Concrete Flake or pellets (94% material)	5	1.18

- c. The solution shall be added at a maximum rate of 2.75 gallons per cubic yard of concrete.
 - d. Mixture shall be agitated until the calcium chloride is completely in solution and agitation shall be continued, as necessary, to maintain uniformity.
- H. Reinforcing Steel:
1. Deformed Bars: Billet steel bar, Iowa DOT 4151.
 - a. All deformed bars shall be epoxy coated, Iowa DOT 4151.
 - b. Tie bars shall be bent back reasonably straight. Tie bars broken during rebending shall be replaced by the Contractor at no cost by drilling a hole and setting the bar in epoxy. Tie bars shall meet the requirements of ASTM A 615 Grade 40 or 60.

- c. All damage to epoxy coated bars shall be repaired by an approved patching material.
- 2. Plain Bars, carbon steel, ASTM A 663, Grade 40. Epoxy coated complying with Iowa DOT 4151.
- 3. Smooth Dowel Bars, carbon steel, ASTM A 615, grade 40 fabricated from plain bars cut without deformation of ends; Iowa DOT 4151.
 - a. Epoxy coated complying Iowa DOT 4151.
 - b. Dowels, with exception of end of run and header joints, shall be furnished in approved assemblies.
 - c. Sawed ends of dowels shall be free of burrs and projections. Sawed ends need not be coated.
 - d. Assemblies dipped in MC-70, RC-70, RC-250, CRS-1, CRS-2, CSS-1H, HFMS-2, HFMS-2H, or HFMS-2S prior to delivery to work site.
- 4. Welded Wire Fabric, Iowa DOT 4151, ASTM A 185.
 - a. Epoxy coated complying Iowa DOT 4151.
 - b. Used as conventional reinforcement shall be of the size and spacing shown in the contract documents.
- I. Metal Keyways: Iowa DOT 4191; Fabricated 24 gage sheet steel; provide lengths in multiples of tie bar spacing; punch at the centerline to receive tie bars; support metal keyway with legs unless installed by paving machine. Keyways formed on the grade during the paving operation may be of coated or uncoated sheets of 26 gage iron or steel.
- J. Supports for Reinforcing Steel: Iowa DOT 2301.
 - 1. Support tie bars as required to place and maintain correct location during construction.
 - 2. Support dowel bars at expansion and contraction joints.
 - 3. Epoxy Coated Reinforcement: Support with epoxy coated or plastic chairs; tie with plastic coated tie wires.
- K. Joint Fillers and Sealers:
 - 1. Contraction Joint Sealers: Material for sealing sawed contraction and center line joints and other joints, as shown in the contract documents, shall meet the following requirements:
 - a. Poured Joint Sealer: Iowa DOT 4136. Hot poured joint sealer shall be composed of petropolymers and be supplied in solid form. The sealer shall meet requirements of ASTM D 3405 with the following modifications:
 - 1) Penetration of 90 - 150 at 77 degrees F (25 degrees C).
 - 2) Bond at -20 degrees F (-29 degrees C) standard specimen, 3 cycles, 200% extension, Passes.
 - b. Cold applied joint sealers meeting the above physical requirements may be used with the approval of the Engineer or Engineer.
 - 2. Preformed Expansion Joint Filler and Sealer: Preformed material for filling expansion joints shall be one of the following types. When the type is not specified, resilient filler shall be used.
 - a. Resilient Filler: Iowa DOT 4136, AASHTO M 213. Resilient filler shall be furnished in strips of dimensions shown in the contract documents.
 - 1) When the self-expanding type is specifically required, the material shall meet requirements of AASHTO M 153, Type III.

- 2) Sealer used with these fillers shall meet requirements of Iowa DOT 4136 or shall be two component, synthetic polymer type meeting requirements of ASTM D 1850.
- b. Polyethylene Joint Filler: Iowa DOT 4136, AASHTO T 42.
 - 3) Polyethylene joint filler shall be resistant to petroleum derivatives and comply with the following requirements:
 - a) Compression: 45 p.s.i. maximum
 - b) Recovery: 90% minimum
 - c) Extrusion: 0.25 inches maximum
 - 4) Sealer used with this filler shall be a two component, synthetic polymer type meeting requirements of ASTM D1850.
- c. Elastomeric Joint Seals: Iowa DOT 4136, AASHTO M 220.
 - 5) Elastomeric joint seals shall be of the size and shape designated in the contract documents.
 - 6) Seals with splices shall be acceptable only when splices are made using factory type methods. A splice shall not occur within one foot of a sharp bend, when placed in final position, and no piece shall have more than one splice.
- d. Preformed Urethane Foam Expansion Joint Filler: Iowa DOT 4136, IM 436.
 - 7) Preformed urethane foam expansion joint filler shall be made with a semi-open cell, flexible polyurethane foam which is molded to such cross sectional shape that it can be easily installed in a 3¼ inch to 4¼ inch wide pavement joint with parallel sides and shall be sufficiently self locking to prevent the material from floating out of the joint.
 - 8) The joint filler may be produced in any convenient lengths in excess of 4 feet and shall have the following cross sectional dimensions:
 - a) Top Width 4½ inches plus or minus 1/8 inch
 - b) Overall depth 7-3/4 inches plus or minus ½ inch
 - 9) A lubricating adhesive, recommended by the manufacturer for the intended use, shall be provided with the joint filler.
 - 10) The properties of the urethane foam when determined on skin free specimens shall meet the following requirements:
 - a) Density: 6.5 to 10.0 lb. per cu. ft.
 - b) Compressive load, 50% deflection: 20.0 psi, max.
 - c) Recovery: 95% min.
 - d) Water absorption: 35% by volume, max.
 - e) Chemical Resistance. The material shall be resistant to petroleum solvents and linseed oil.
- L. Liquid Curing Compounds: Iowa DOT 4105, AASHTO M 148.
 1. Compounds shall be of such consistency that they can be readily applied by spraying to a uniform coating at a material temperature above 40 degrees F.
 2. Moisture Retention shall meet this requirement of Iowa DOT Material Laboratory Test Method 901.
 3. Liquid curing compounds shall dry to the touch in not more than 4 hours. After 12 hours, the compounds shall not track off the concrete when walked upon.
 4. White Pigmented Compounds. Iowa DOT 4105.

- a. Shall consist of finely ground, white pigment and vehicle, ready mixed for use without alteration.
 - b. The pigment shall not settle excessively or cake in the container.
 - c. After the compound sprayed on a test slab has dried, it shall have an apparent daylight reflectance not less than 60 percent relative to magnesium oxide.
 - d. The compound shall be agitated just prior to being removed from the container and continuously during application.
5. Dark colored compounds shall consist of asphalt emulsion or asphalt cut back with a volatile solvent and shall contain not less than 50.0 percent asphalt.
- M. Burlap Covering: Iowa DOT 4104.
- 1. Jute and manilla fibers shall weigh not less than 10 ounces per square yard.
 - 2. Shall be new material or reclaimed material which shall not have a deleterious affect upon fresh concrete.
- N. Pavement Seals: Linseed Oil Emulsion.
- 1. Shall be non-pigmented and homogenized to produce uniform mixture as set forth in the United States Department of Agriculture Patent Number 3,873,326.
 - 2. Comply with requirements of ASTM C 309 and C 156.
 - 3. Shall be used on pavements subject to receiving large quantities of salt. Engineer or Engineer will determine pavements to receive linseed emulsion
 - 4. Apply after curing compound has dried.
- O. Epoxy Bonding Compound: Iowa DOT 2301 and IM 491.11.
- 1. Epoxy bonding compound (polymer grouts) shall meet the requirements of Iowa DOT 2301 and IM 491.11 for each particular application.
 - 2. The material shall be an approved brand as listed in IM 491.11.

2.3 MIXES: IOWA DOT IM 529

- A. Mix Design: Unless otherwise specified, the mix design shall be Class C or C-V47B mix with air entraining. If a different mix is specified in the contract documents or if the Contractor requests a mix different than C or C-V47B, the Contractor shall submit to the Engineer or Engineer the paving mix design for approval two weeks prior to starting paving operations. The submittal shall contain the mix number as described below and admixtures in accordance with Section 321313, 2.3E. Unless otherwise specified, the minimum compressive strength of the mix shall be 4,000 pounds per square inch at 28 days.
- B. Mix Number: Mix numbers designate numerous aspects of the particular mix. The following is an explanation of the various aspects of the mix number. For example: C-4WR-C10.
- 1. The first letter designates the class of concrete as designated in the contract documents.
 - 2. The number indicates the relationship of coarse aggregate to fine aggregate. A mix with a 4 is a 50/50 mix. The following chart shows the number within the mix number and the proportions of the aggregates for each number:
- | | |
|---|---|
| 2 | is composed of 40% fine and 60% coarse. |
| 3 | is composed of 45% fine and 55% coarse. |
| 4 | is composed of 50% fine and 50% coarse. |
| 5 | is composed of 55% fine and 45% coarse. |
| 6 | is composed of 60% fine and 40% coarse. |
| 7 | is composed of 65% fine and 35% coarse. |
| 8 | is composed of 70% fine and 30% coarse. |

3. The letters WR indicate water reducer is used in this mixture.
4. When a C or an F is shown toward the end of the mix number, fly ash is a part of the mixture and C-fly ash or F-fly ash, respectively, is used. The percentage of fly ash being used in the mixture shall be designated at the end of the mix number.
5. In certain mix designations, the letter V appears after the first hyphen. This indicates that a Class V aggregate is to be used. If no letter is shown, aggregate other than Class V shall be used.

C. Concrete Mixes: Shall meet the following design targets, as per Iowa DOT 2301, IM 529.

Basic Absolute Volumes of Materials for Unit Volume of Concrete							
Mix	W/C Basic	W/C Max.	Cement Min.	Water	Entrained Air	Fine Aggregate	Course Aggregate
A-4 ⁽¹⁾	0.474	0.532	0.108	0.161	0.060	0.335	0.336
B-4 ⁽²⁾	0.536	0.600	0.093	0.157	0.060	0.345	0.345
C-3WR	0.430	0.489	0.108	0.146	0.060	0.309	0.377
C-4	0.430	0.488	0.118	0.159	0.060	0.331	0.332
C-4WR	0.430	0.489	0.112	0.151	0.060	0.339	0.338
M-4	0.328	----	0.156	0.161	0.060	0.312	0.311
O-4WR	0.327	-----	0.156	0.160	0.060	0.312	0.312
(1) Concrete Base or temporary pavement only.							
(2) Temporary only.							
Other approved mixes will follow Iowa DOT IM 529.							

Basic Absolute Volumes of Materials for Unit Volume of Concrete							
Mix	W/C Basic	W/C Max.	Cement Min.	Water	Entrained Air	Class V.	Limestone
C-V47B	0.440	0.560	0.107	0.148	0.060	0.479	0.206
M-V	0.390	----	0.160	0.196	0.060	0.555	0.029

The above mixtures are based on Type I cements (Sp. G. = 3.14). Mixes using blended cements (Type IP, I(PM), IS, or I(SM)) must be adjusted for specific gravities listed in Iowa DOT I.M. 401.

- D. Consistency and Workability: The amount of materials used shall produce a concrete of uniform consistency, workability and a satisfactory surface finish.

Paving	Type of Concrete	Slump-in		% Air Content of Fresh Un-consolidated Concrete (Before Paver)			Target % Air, Consolidated Concrete (After Paver)
		Min.	Max.	Target or Initial*	Acceptable Range		
					Minus	Plus	
Machine Finish	A, B, C, C-V47B	½	2½	7.5	1	1 1/2	6
Hand Finish	A, B, C, C-V47B	½	4	7	1	1 1/2	6
Curb & Gutter	C, C-47B	----	3	7	1	1	6
Base (Machine Finish)	A	½	2½	7	1	1 1/2	6
Base (Hand Finish)	A	½	4	7	1	1 1/2	6
Patches with CaCl	M, M-V	1	3	5**	2	2	N/A
Patch w/o CaCl	M, M-V	1	3	6 1/2	1 1/2	1 1/2	N/A

As per Iowa DOT 2301, 2511, 2512, 2529, and 2530.

* The initial values for fresh concrete listed in the table above account for anticipated air loss during consolidation of concrete during placement and paving. Actual air loss and target value for air content of fresh concrete are established below.

** Prior to addition of Calcium Chloride

E. Air Content :

1. Establishing the Target Air Content

- a. On the first day of paving, the air content of fresh, unconsolidated concrete shall be in accordance with the table above for Initial Air Content.
- b. The air content of concrete before and after consolidation (in front of and behind the paver), shall be tested within the first 10 loads. The air content behind the paver shall be checked at two locations. Samples behind the paver shall be taken such that they are representative of the entire cross section (one sample from each side of the slab) and the results averaged.
- c. The target air content for fresh, unconsolidated concrete for a specific concrete mixture and paver shall be established based on the initial samples taken. The air loss due to consolidation (the difference in air content before and after the paver) shall be added to the target value for finished concrete and rounded to the next higher 0.5% to establish the target air content for fresh, unconsolidated concrete.

2. Minimum Testing Frequency

- a. The air content of fresh, unconsolidated concrete (in front of the paver) shall be tested every 200 CY.
- b. The target air content for fresh, unconsolidated concrete shall be reestablished whenever the concrete material sources, concrete mix, and/or paver are changed

3. Adjustments

- a. The air content of the fresh, unconsolidated concrete shall be maintained at the established target air content within the range allowed by Section 321313, 2.3D.
- b. A new target air content for fresh concrete shall be established, and the mix adjusted as required, if the loss through the paver changes by more than 0.5% from the previously established air loss.

- F. Use of Fly Ash: The Contractor shall notify the Engineer or Engineer prior to making concrete mixture changes which have been approved. Mix proportions for the various mixes using fly ash are included in the Iowa DOT Materials I.M. 529. The following fly ash substitution rates shall replace those given in Iowa DOT 2301 and as referenced in Iowa DOT IM 529:

Fly Ash Substitution Rate		
Time Period	Cement Type	Fly Ash Substitution Rate by Weight
March 16 through September 14 ***	Type I and Type II	Not more than 20 percent
March 16 through September 14 ***	Type IP and Type I(PM)	Not more than 5 percent *
September 15 through October 15	Type I and Type II	Not more than 15 percent
September 15 through October 15	Type IP and Type I(PM)	None
October 16 thru March 15	Type I, Type II, & Type III	None

October 16 thru March 15	Type IP and Type I(PM) **	None
March 16 thru October 15	Type I, Type II, or Type III used in Class M mixtures	Class C fly ash only at not more than 10 percent
* Note: If the cement manufacturer provides the Engineer or Engineer with satisfactory concrete strength and freeze-thaw durability test results equivalent to concrete with the same Type IP or Type I(PM) cement without fly ash, the substitution rate may be increased to 10 percent. The testing and acceptance criteria shall be in accordance with Materials I.M. 401.		
** Note: Proportions of Type IP and Type I(PM) shall be increased 15 percent, by weight, during this time period.		
*** Note: The March 16 through September 14 substitution rate may be used at any time the maturity method for monitoring concrete strength is utilized.		

Fly ash shall be transported, stored, hauled, and batched in such a manner to keep it dry.

2.4 MIXING EQUIPMENT

- A. Weighing and Proportioning Equipment: Iowa DOT 2001.
- B. Mixing Equipment: Iowa DOT 2001.
- C. Material Bins: Iowa DOT 2001.

2.5 CONCRETE BATCHING: IOWA DOT 2301

- A. Plant batching shall be Iowa DOT calibrated and approved. Provide copy of current calibrations and approvals.
- B. Batch plant operation and batch trucks shall be coordinated with the paving operation in order to ensure a steady supply of materials.
- C. Batch plant and trucks shall be operated to minimize dust, noise or truck nuisances.

2.6 CONCRETE MIXING

- A. Construction or Stationary Mixer: Iowa DOT 2301.
 1. The concrete shall be uniform in composition and consistency. If this condition is not produced because of the size of the batch, the size of the batch may be reduced or the mixing time increased, or both, until this result is obtained. If non-uniform, concrete producers shall take corrective action.
 2. Concrete transported without continuous agitation shall not be used if the period elapsed between the time the concrete is mixed and the time it is placed is greater than 30 minutes. The mixed-to-placed time period may be extended an additional 30 minutes with the use of a retarding admixture, upon approval of Engineer or Engineer.
 3. Concrete transported with agitation shall not be used when the time between start of mixing and placement is more than 90 minutes.
 4. The methods of delivering and handling the concrete shall be such that objectionable segregation or damage to the concrete will not occur, and that which will facilitate placing with a minimum of handling.
 5. The compartment in which concrete is transported to the work shall be thoroughly cleaned and flushed with water at such intervals as may be necessary to insure that

hardened concrete will not accumulate in the compartment. Flushing water shall be discharged from the compartment before it is charged with the next batch.

B. Ready Mixed Concrete: Iowa DOT 2301.

1. The concrete shall be uniform in composition and consistency. If non-uniform, concrete producers shall take corrective action.
2. Proportioned in a central plant and mixed in a stationary mixer for transportation in trucks without agitation.
3. Proportioned at a central plant, and only partially mixed in a stationary mixer for transportation and finish mixing in a transit mixer.
4. Proportioned at a central plant, and then mixed in a transit mixer prior to or during transit.
5. When necessary to add additional mixing water at the site of placement, the batch shall be mixed at least an additional 30 revolutions of the drum at mixing speed.
6. For main portions of the work it must be demonstrated before the work starts that each vehicle in which concrete will be delivered is capable of discharging concrete having a slump not over 2 inches at an overall rate for its entire load of not less than 1.25 cubic yards per minute. The concrete shall be delivered at a rate sufficient to maintain a sustained rate of progress of not less than 100 feet per hour for the width and depth of slab to be placed.
7. Concrete transported without continuous agitation shall not be used if the period elapsed between the time the concrete is mixed and the time it is placed is greater than 30 minutes. The mixed-to-placed time period may be extended an additional 30 minutes with the use of a retarding admixture upon approval of the Engineer or Engineer.
8. Concrete transported with agitation shall not be used when the time between start of mixing and placement is more than 90 minutes. However with the approval of the Engineer or Engineer, an approved retarding admixture may be used at the rate prescribed in Materials IM 403.
9. The compartment in which concrete is transported to the work shall be thoroughly cleaned and flushed with water at such intervals as may be necessary to insure that hardened concrete will not accumulate in the compartment. Flushing water shall be discharged from the compartment before it is charged with the next batch:
 - a. Concrete with Type III cement and transported without agitation shall be delivered and placed within 30 minutes after mixing.
 - b. With the approval of the Engineer or Engineer, an approved retarding admixture may be used at the rate prescribed in Materials IM 403 and the mixed-to-placed time may be extended by an additional 30 minutes.

C. All Methods: Each truck load shall be identified by a plant charge ticket showing plant name, contractor, project data, quantity, class, time batched, and water added at site.

2.7 CONCRETE PLACEMENT EQUIPMENT: IOWA DOT 2301

- A. Subgrade Finishing Equipment: Use mechanical excavating equipment designed for this purpose, approved by Engineer or Engineer.**
1. Form line or path area for slip-form paving machine shall be constructed to final grade by form-line excavating equipment with automatic grade controls.
 2. Subgrade between forms or between path areas for slip-form machines constructed to final grade with automatically controlled subgrade excavating machine
- B. Side Forms: Steel, minimum thickness: 5 gage, height at least equal to design thickness of pavement with base width at least 6 inches.**
1. Minimum section length: 10 feet, joint connections designed to permit horizontal and vertical adjustment with locking device to hold abutting sections firmly in alignment.

2. Bracing, support, and staking must prevent deflection or movement of forms.
- C. Flexible Forms: Use steel or wood flexible forms for curves with radius less than 100 feet.
 1. Bracing, support, and staking must prevent deflection or movement of forms.
 2. Forms used to form back of curbs at returns shall have height at least equal to design thickness of pavement and curb height.
 3. Forms must be free from scale and surface irregularities; coat with release agent (see Section 323113, 3.3.G) prior to concrete placement.
- D. Consolidating and Finishing Equipment: Fixed form or slip form paving machines specifically designed for placing, striking off, consolidating, and finishing in single pass to required cross section.
 1. Consolidation of concrete by single pass of approved surface, tube, or internal vibrator operated in accordance with manufacturer's recommendations.
 2. Slip form equipment: Automatic horizontal and vertical controls required; equipment must spread concrete to uniform depth prior to finishing.
 3. Air screeds and vibrating screeds are approved consolidating and finishing equipment for cul-de-sacs, drives and some intersections. Small runs of pavement up to 250 feet maximum may also require screeds if paving machines are not practical.
 4. Equipment subject to approval of Engineer or Engineer.
- E. Hand Finishing Equipment: Contractor shall provide tools including wood or magnesium floats, wood hand floats, point trowels, edgers, or other equipment necessary for proper finishing of concrete.
 1. Provide 2 light straightedges, 10 feet long, with handles not less than 12 feet long for use in detecting irregularities in surface; provide 2 heavy straightedges of similar size for use in correcting surface; provide 2 light straightedges 10 feet long for checking curb and gutter line.
 2. Provide approved vibrators for consolidating concrete.
 3. Provide metal or wood screed true to crown.
- F. Curing Equipment: Use pressure sprayer capable of applying a continuous uniform film of curing compound.
- G. Concrete Saws: Power operated concrete saws capable of cutting hardened concrete neatly.
- H. Joint Sealing Equipment: Equipment capable of heating and installing sealant in joints in accordance with manufacturer's recommendations.

2.8 PAVEMENT MARKINGS

- A. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than **45** minutes.
 1. Color: White, for parking stalls
 2. Color: Blue, for ADA Accessible stalls and aisles
- B. Pavement-Marking Paint: MPI #97 Latex Traffic Marking Paint.
 1. Color: White, for parking stalls
 2. Color: Blue, for ADA Accessible stalls and aisles

2.9 WHEELS STOPS

- A. Install wheel stops as shown on the plans and in compliance with MUTCD.
 1. Type: Concrete or approved equal.

PART 3 - EXECUTION

3.1 FINAL SUBGRADE/SUBBASE PREPARATION

A. Natural Subgrade:

1. Subgrade construction shall meet the requirements of Section 312000 "Earth Moving".
2. Should the subgrade be left high or not prepared for final template shape by a previous contractor, the subgrade shall be proof rolled and depressions filled in accordance with Section 31200 "Earth Moving".
3. Trimming:
 - c. The subgrade shall be checked by the most accurate practical method, subject to approval of the Engineer or Engineer.
4. Unless otherwise ordered by the Engineer or Engineer, the subgrade, at time of placing concrete for Concrete Pavement, shall be in a uniformly moist but not muddy condition to a depth of not less than one inch.
5. Subgrade Loading:
 - d. Where concrete trucks must travel on a prepared soil-type subgrade to unload and, as approved by the Engineer or Engineer, watering of the subgrade must be limited to just ahead of the paving machine.
 - e. Repetitive loading on the subgrade by concrete trucks shall be minimized.
 - f. Loads in excess of the legal axle load shall not be allowed on the completed subgrade.
 - g. Partially loaded trucks may be required.
 - h. If subgrade/subbase failure occurs, the repair shall be coordinated with the Engineer or Engineer.
6. Paving Suspended:
 - i. The paving operation shall be suspended where subgrade stability has been lost.
 - j. No concrete shall be placed upon a subgrade which has become unstable, bears ruts or tire marks of Contractor's equipment or which is excessively softened by rain until such subgrade has been reconsolidated and replanned or reshaped to correct the objectionable condition.
 - k. If necessary, scarify to a minimum depth of 6 inches, aerating, and recompact at the Contractor's expense. Recompaction shall meet requirements of Section 312000 "Earth Moving".
7. Maintenance of Subgrade:
 - l. The Contractor is responsible for maintenance of the completed subgrade during subsequent construction activities.
 - m. Before allowing hauling equipment to use the completed subgrade, the Contractor must be satisfied as to the effect this hauling equipment may have on the partially completed work.

B. Granular Subbase:

1. Granular Class A, B, C, and D subbase construction shall meet the requirements of this section.
2. Should the Contractor who constructed the subbase elect to overbuild the subbase, the paving contractor shall trim down to the design elevation and shape to the final template with an automatically controlled trimming machine.

3. Excess material shall be salvaged and spread for use on any other approved project location or operation.
4. The top 1 inch of the subbase shall be uniformly moist prior to paving.
5. Construction traffic may be allowed only on Class A subbase (special backfill), Class C subbase (RAP special backfill), and Class D subbase (modified) upon approval of Engineer or Engineer. (See Section 312000 "Special Backfill")
6. The paving operation shall be suspended where subbase stability has been lost.

3.2 SURFACE FIXTURE ADJUSTMENT

- A. Adjust manhole frames and other fixtures within area to be paved to conform to finished surface.
- B. Clean outside of fixture to depth of pavement before concrete placement.
- C. Box out fixtures for later adjustment where allowed. Size and shape of box out for intakes as shown in Standard Drawings.

3.3 FORM SETTING

1. Use form line excavating machine to establish subgrade of forms.
2. Set base of forms at or below subgrade elevation with top of forms at pavement surface elevation.
3. Extra height forms with Engineer or Engineer approval may be used to back up integral curb and paving slab; set base at or below subgrade elevation with top of form at top of curb elevation.
4. Secure forms in place to required grade and alignment.
5. If voids occur under forms, remove forms and rework subgrade to proper elevation and density; reinstall forms.
6. If the soil supporting the form is softened by rain or standing water so that form is inadequately supported, remove forms and rework subgrade to proper elevation and density; reinstall forms.
7. Coat forms with release agent before concrete is placed.
8. Place forms true to alignment and free of latent concrete.

3.4 BAR AND REINFORCING PLACEMENT

- A. Reinforcing metal shall be clean, straight, free from distortion and rust, and shall be firmly secured in position as detailed.
- B. All reinforcing metal shall be placed in approved storage to prevent damage; do not distribute along the work site except as needed to avoid delay in paving.
- C. Tie Bars:
 1. Place bars prior to vibration. Bars may be supported by approved chairs or may be placed in position by a machine or method approved by the Engineer.
- D. Dowel Bar Assemblies:
 1. When dowel bar assemblies are required in the contract documents, accurately place these assemblies as shown. To prevent their movement during subsequent concrete paving operations, securely stake or fasten to the base to line and grade.
 2. Do not use assemblies that are damaged prior to placement. If assemblies are damaged after placement, replace prior to paving. Ensure horizontal and vertical alignment of the load transfer bars does not exceed $\frac{1}{4}$ inch from parallel line and grade. Place each assembly so the bars are in a horizontal plane at $T/2 \pm \frac{1}{2}$ inch.

3. Check the placement of each assembly and the position of the bars within the assembly using a suitable template or other device approved by the Engineer. If the assembly is found to be placed outside of the above tolerances, correct the placement.
 4. Cutting the tie wires of the load transfer assemblies is optional.
- E. Bar Mats for Reinforced Pavement
1. When reinforced pavement is specified, assemble bar mats accordingly and firmly fastened altogether at all bar intersections.
 2. Place, secure, latch, and tie bar mats for a continuous mat as specified in the contract documents. Displacement during concrete placement operations is not allowed.
 3. Use chairs to ensure proper placement of bar mats.
- F. Tie Bars and Dowel Bar in Existing Pavement
1. When anchoring in existing concrete, use a grout system according to the manufacture's instructions. Obtain the Engineer's approval for the grout system.
 2. For horizontal installations, use either a pressure injection system with mechanical proportioning and mixing, or use encapsulated chemical anchors. Install as follows:
 - n. Ensure drilled holes to receive the grout match the dimensions and spacing specified in the contract documents. When not specified in the contract documents, the maximum nominal diameter of the hole must be 1/8 inch larger than the outside diameter of the dowel or bar, or as recommended by the manufacturer. Drill holes for tie bars and dowel bars into the face of the existing pavement at midpoint. To ensure proper horizontal alignment, do not allow any hole misalignments to exceed 1/4 inch in the vertical or horizontal plane. Clean the hole with compressed air immediately prior to placing the grout.
 - o. Use a polymer grout to secure the dowels in the existing pavement. Inject the grout into the rear of the hole with pressure. Use sufficient grout so that when the bar to be grouted is placed in position, excess grout will be forced out the front of the hole. Rotate the bar during the insertion process to ensure complete coating with the grouting material. Hand proportioning and mixing is not allowed.
 - p. If using grout with approved encapsulated anchors, install according to the manufacturer's recommendations.
 - q. Use horizontal installation procedures for vertical or angled installations; however, pourable grouts may be used. Pourable grouts must be mechanical mixed.

3.5 CONSTRUCTION OF JOINTS

A. General:

1. Longitudinal and transverse joints shall be constructed of the type, dimensions, and at the locations required, as described by these specifications, or as detailed by the plans or special provisions.
2. Longitudinal joints shall be coincident with or parallel to the pavement center line unless shown otherwise on the plans.
3. All transverse joints shall be at right angles to the center line and shall extend the full width of the pavement unless otherwise specified.
4. All joints shall be perpendicular to the finished grade of the pavement and the alignment across the joint shall not vary from a straight line by more than 1 inch.
5. All joint fillers shall be installed as shown in the contract documents.
6. The Contractor shall exercise care in placing, consolidating, and finishing the concrete at and about all joints.
7. The edges of the pavement at tooled joints shall be rounded, where required, as specified on the standard detailed plates.

8. Wet sawing shall be used when required by the contract documents for dust control.

B. Expansion Joint:

1. Install expansion joints where shown on plans and as shown on Standard Drawings.
2. Prevent movement of or damage to joint assembly when placing concrete; set joint material low enough to clear the finish machine.
3. Construct double width expansion joint in curb over expansion joint in pavement. The backside of the joint must be clear of concrete.
4. The expansion joint shall be aligned straight and true.
5. If joint fillers are assembled in sections, or if joints as a whole are constructed in sections, then no offsets shall be between adjacent units.
6. Where more than one section is used in a joint, the sections shall be securely laced or clipped together. Damaged basket assemblies shall not be used.

C. Saw Joints:

1. Joint locations shall be chalked with a string line before sawing.
2. Joint dimensions:
 - r. All transverse contraction joints shall be sawed at a maximum spacing of $21T$, where T is the thickness of the pavement in feet.
 - s. All joints shall be sawed to a depth shown below and on the detail plate.

	Minimum Sawcut Depth	
	Conventional Saw	Early "Green" Saw
Transverse "C" Joint	$T/3$	1 1/4"
All other Transverse Contraction joints	$T/3$	1 1/4"
Longitudinal Joint	$T/3$	Not Allowed

- t. The Contractor shall closely monitor joint sawing for both longitudinal and transverse joints for depth and spacing and immediately report any deviations from the specifications. The Contractor shall take immediate steps to correct any deviations.
3. In order to prevent shrinkage cracks, sawing shall be commenced promptly after the pavement has obtained sufficient strength to resist tearing of the concrete adjacent to the joint during the process of sawing.
4. Pavement pours shall be scheduled to allow transverse joints to be sawn within 24 hours of the concrete being placed.
5. Longitudinal joints shall be sawn within 24 hours of the concrete being placed.
6. If necessary, the sawing operations shall be carried on both day and night.
7. Joints sawed with an early "green" concrete saw shall be washed out prior to sealing. The concrete must be capable of supporting the sawing operations to allow the use of an early green concrete saw.

D. Construction Joints:

1. Longitudinal or transverse construction joints shall be placed between adjacent lanes of concrete and at end-of-day header runs.
2. Manhole boxouts shall be located and placed on grade prior to paving. Manhole boxouts are required for two piece castings for sanitary/storm manholes.
3. The longitudinal construction joints shall be an approved key type joint with legs unless machine placed.

4. Transverse construction joints shall employ load transfer devices (Header) and shall be placed whenever concrete placement is delayed for more than 30 minutes.
5. Saw and seal to the dimensions shown for a "B" joint on the detail plate.

3.6 CONCRETE PAVEMENT PLACEMENT

- A. Set survey control stakes at 25 foot maximum spacing including high and low points. Additional staking may be required by the Engineer or Engineer.
- B. The concrete shall be placed, consolidated, and finished to the widths and depths outlined in the plans.
- C. Integral curbs shall be poured with the slab in a single paving machine operation. Normal mainline paving will not have construction joints at integral curbs.
- D. The concrete shall be deposited upon the supported reinforcement keeping segregation to a minimum.
- E. Concrete shall be deposited to the full depth of the pavement in a single operation.
- F. Necessary hand spading and spreading shall be done with shovels and not rakes.
- G. Use paving machine for all uniform width slabs 8 ½ feet or more in width and 250 feet or more in length.
- H. When pavement is constructed in separate lanes, the junction line in straight sections shall not deviate from the true line shown on the plans by more than ½ inch at any point and shall be tooled to the radius shown on the plans. A joint formed with a metal keyway shall be used between separately poured lanes.
- I. Place concrete to full depth in single operation. Keep a uniform pile of concrete in front of the paving machine, up to a maximum of 6 to 8 inches above the design surface elevation.
- J. The concrete shall be distributed and spread as soon as placed. A mechanical concrete spreader may be used.
- K. Concrete Screed:
 1. The concrete shall then be struck off and screeded by mechanical means.
 2. The striking off or screeding shall conform to the crown and cross section shown on the plans.
 3. If, in the operation of subgrade or finishing equipment, it is necessary to operate one or both sets of wheels or tracks on previously placed concrete, the wheels or tracks shall be adjusted so that the bearing on the concrete will be not less than 3 inches from the edge of the pavement.
 4. When operating with two wheels on the previously placed concrete and two wheels on the form, the form wheels shall be double flanged.
 5. All wheels operating on the pavement shall be flangeless and rubber tired. All tracks operating on the pavement shall use rubber, wood, or belting pads.
- L. The top of the forms shall be kept clean from accumulations of concrete, and the travel of the finishing machine on the forms shall be maintained true without lift, wobbling, or other variations tending to affect precision of finish.
- M. When finishing by hand methods, concrete shall be consolidated by use of vibrating units operating in the concrete. Unless the vibrating apparatus is such that the full width of concrete is consolidated in a single passage, a definite system or pattern shall be used in the operation of the vibrator so the full width of concrete in each linear foot of lane will receive adequate and uniform consolidation. The system and methods of vibrating shall be subject to approval of the Engineer or Engineer. Vibrating equipment shall meet the requirements of IDOT Section 2301.07. Vibrating equipment shall, under no circumstances, be used as a tool for moving concrete laterally on the grade.

3.7 CURB AND GUTTER CONSTRUCTION

- A. Construct curb and gutter as shown on Standard Drawings.
- B. Use paving machine slip-form for curb; curb mule or similar mechanical equipment providing equivalent results.
- C. Hand methods shall be allowed for radius, returns, and sections of curb and gutter 100 feet or less in length.
- D. When depressed curb at driveways and where sidewalk intersects street, use templates to form backs of such curbs. See standard plates for shape of depressed curbs.
- E. Form and construct curb by hand only where barrier or depressed curb is required and where small radii or other special sections preclude use of mechanical equipment.
- F. Finish curb as rapidly as finishing operations on pavement permit. Maximum distance behind paving machine is 100 feet.
- G. Remove free water, latency, dust, leaves, or other foreign matter prior to placing concrete for curb.
- H. Use freshly mixed concrete; do not store concrete in receptacles at side of pavement for use in curb at a later time; do not use concrete requiring retempering.
- I. Vibrate or puddle concrete to secure bond with paving slab and eliminate rock pockets.
- J. Secure final finish on curbs by hand method, including 6 foot straightedge or 6 foot slipform.
- K. Edge, protect, and cure curb in same manner as pavement.
- L. Check surfaces of curb and gutter with 10 foot straightedge; correct variations greater than 1/8 inch; remove and replace curbs having varying cross section.

3.8 FINISHING

- A. Grade and Crown: Promptly after concrete has been placed and vibrated, the surface shall be struck off to the true section by the screed. The surface shall be finished true to crown and grade.
- B. Watering the Surface: The practice of lubricating the pavement surface with wet burlap or by sprinkling water from brushes or from sprinkler containers to afford greater ease in finishing operation shall not be allowed.
- C. Floats: Finish surface with wood or magnesium floats; finish from both sides simultaneously if pavement is placed to full width with one pass of paving machine.
- D. Straight Edging:
 - 1. After the longitudinal floating has been completed and the excess water has been removed, and while the concrete is still plastic, the slab shall be tested for trueness with a channel radius float, or approval equal. ("channel radius float" is manufactured by Owens Industries, Inc.)
 - 2. The channel radius float shall be held in successive positions parallel to the road center line in contact with the surface and the whole area worked from one side of the slab to the other as necessary.
 - 3. Advancement along the pavement shall be in successive stages of not more than one half the length of the channel radius float.
 - 4. Any depressions found shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished.
 - 5. Check surface longitudinally while concrete is still plastic; correct any surface deviations greater than 1/8 inch in 10 feet. Round edges of pavement to 1/8 inch radius.
- E. Surface Treatment:
 - 1. Dragged Surface Treatment: Unless otherwise specified, the finished surface shall be textured with a dragged surface treatment.

- u. Astroturf or burlap shall be dragged longitudinally over the finished surface to produce a tight, uniform, textured surface, and the edges shall be rounded in a workmanlike manner.
 - v. The Astroturf or burlap drag shall be removed from the pavement surface at regular intervals and cleaned with water to remove accumulated concrete from the fabric in order to maintain a consistent finished texture.
 - w. When, for any reason, the desired texture normally obtained by the drag is not secured, the Engineer or Engineer may require that the final finish be a broom finish, in lieu of or in addition to the drag.
2. Edge Finish: Before the concrete has taken its initial set, all edges of the slab shall be carefully finished with an edging tool and the pavement shall be left smooth and true to line and grade.

3.9 SURFACE CURING

- A. Apply liquid curing compound in a fine spray to form a continuous, uniform film on the horizontal surface and vertical edges of pavement, curbs and back of curbs immediately after surface moisture has disappeared, but no later than 30 minutes after finishing. With approval of the Engineer or Engineer, the timing of cure application may be adjusted due to varying weather conditions and concrete mix properties to ensure acceptable macrotexture is achieved.
 - 1. Use a white pigment liquid curing compound for concrete not receiving an asphalt overlay.
 - 2. Use a dark-colored curing compound for concrete receiving an asphalt overlay.
- B. Apply compound with power sprayer; rate of application not less than 0.067 gallon per square yard (15 square yards per gallon); do not dilute compound. For concrete receiving an asphalt overlay, the minimum rate for black cure shall be not less than 0.08 gallon per square yards (12.5 square yards per gallon) in accordance with Iowa DOT 4105.
- C. If forms are used, apply to pavement edges and back of curbs within 30 minutes after forms are removed.
- D. Protect concrete pavement during cold weather for at least 5 days, or protect a minimum of 24 hours and flexural strength of 500 psi.

3.10 JOINT SEALING

- A. Timing:
 - 1. Unless otherwise provided, before any portion of the pavement is opened to the Contractor's forces or to general traffic, joints that require sealing shall be sealed.
 - 2. The Jurisdiction Engineer may limit the wheel loads and axle loads of equipment operating on the pavement during this operation, if prior to the age and strength specified in this Section. Additional tests to determine the modulus of rupture may be required.
- B. Cleaning:
 - 1. For those joints that are not to be sealed, cleaning is not required.
 - 2. For those joints that are to be sealed, the residue from sawing shall be removed from the crack. An air compressor that provides moisture-free and oil-free compressed air shall be used. Removal of wet-sawing residue by flushing with high pressure water may be necessary prior to blowing the crack clean.
- 3. Joint Sealer:
 - x. Joint sealer shall be prepared and installed in the joint and to the proper level as shown in the contract documents and as recommended by the manufacturer.
 - y. Hot-poured sealers shall be heated in a thermostatically controlled heating kettle; the material shall be heated to the temperature required for use, but not above that

recommended by the manufacturer. After sealing, excess sealer shall be removed from the pavement surface.

- z. Joint sealer shall be placed only when the pavement and ambient air temperatures are 40° or higher. When near this minimum, additional air blasting or drying time or both may be necessary to assure a satisfactory bond to the joint surfaces.
- aa. When this sealer cannot be properly placed due to late fall work, the Contractor shall submit a joint construction plan and sealing details to the Engineer or Engineer for approval before paving can begin.
- bb. Joints shall be sealed the same day they are cleaned. Sealing shall be done only when the joint surfaces appear dry by visual examination.
- cc. If surface correction required the joints may need to be re-cleaned and re-sealed.

3.11 FORM REMOVAL

A. Timing:

- 1. Forms shall not be removed before the initial set of the concrete has taken place.
- 2. Remove stakes and forms with care to prevent cracking, spalling, or over stressing concrete. If damage does occur, the minimum repair shall be to saw cut full depth and remove a 4 by 2-1/2 feet wide area, dowel into adjoining sound concrete and pour back full depth; or as required by the Engineer or Engineer.
- 3. Clean forms before resetting.

B. Honeycomb Repair:

- 1. When the side forms are removed, honeycomb shall be filled with mortar composed of 1 part cement and 2 parts fine aggregate by weight.
- 2. If the honeycombing is to the degree and nature that it is considered by the Engineer or Engineer as defective work, it shall be removed and replaced at the expense of the Contractor.

- C. Paving Protection: The area behind the curbs and slab shall be backfilled immediately after the forms are removed. Dams or other protection shall be constructed to insure that no saturation or erosion of the subgrade under or near the pavement shall occur. This may include check dams, pumping, etc.

3.12 PAVEMENT MARKING

- A. Allow concrete paving to cure for a minimum of 28 days and be dry before starting pavement marking.
- B. Sweep and clean surface to eliminate loose material and dust.

Apply paint with mechanical equipment to produce markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

3.13 DETECTABLE WARNING INSTALLATION

- A. Set detectable warning panels in fresh concrete according to the manufacturer's recommendations.

3.14 WHEEL STOP INSTALLATION

- A. Set wheel stops as shown on the plans and anchor to pavement per manufacturer's recommendations.

3.15 TESTING FOR PORTLAND CEMENT CONCRETE (Minimum Frequencies)

MATERIAL OR CONSTRUCTION ITEM	TESTS (as per IDOT requirements)	METHODS OF ACCEPTANCE OF SAMPLING & TESTING	FIELD SAMPLING & TESTING			REMARKS
			FREQUENCY (minimum)	DESIGNATED RESPONSIBLE AGENT	REPORT	
Aggregates-Fine	Gradation (1)	Cert. Plant Inspector	1/250 CY or min 1/day (2)	Supplier/ Contractor	IDOT Form 830224	For federal, state or county projects.
	Moisture	Cert. Plant Inspector	1 per 1/2 day			
	Specific Gravity	Cert. Plant Inspector	1/250 CY or min 1/day (2)			
	Quality	Quality Certification	Prior to use			
Aggregates-Course	Gradation (1)	Cert. Plant Inspector	1/250 CY or min 1/day (2)		IDOT Form 830224	
	Moisture	Cert. Plant Inspector	1 per 1/2 day			
	Specific Gravity	Cert. Plant Inspector	1/250 CY or min 1/day (2)			
	Quality	Quality Certification	Prior to use			
Portland Cement	Quality	Quality Certification	Prior to use		IDOT Form 830224	
	W/C Ratio	Cert. Plant Inspector	1/250 CY or min 1/day (2)			
Fly Ash	Quality	Quality Certification	Prior to use			
GGBFS	Quality	Quality Certification	Prior to use		IDOT For 830211	
Curing Compound	Quality	Quality Certification	Prior to use	Supplier	Cert.	
Joint Sealer	Quality	Quality Certification	Prior to use			
Steel Reinforcing	Quality	Quality Certification	Prior to use			
Plastic Concrete	Air Content	Field Testing	1/200 CY or min. 1/day (2)	Jurisdiction	IDOT Form 830224	1/350 CY on primary roads
	Slump	Field Testing	1/200 CY or min. 1/day (2)			
	Cylinders 6" non-primary roads	Field Testing	2/500 CY or 2/day (2) (3)	Jurisdiction / Contractor	Field Book/ Lab Report	
	Cylinders 6" (Structures)	Field Testing	1 per 3 structures or min 1/day (2)			
	Beams (Paving)	Field Test	1/2000 CY or 2/day (2) (3)		IDOT Form 830224	May be required on federal, state and county projects
	Beams (Structures)	Field Test	2 per section (4)			
	Thickness	Field Testing	1/200 CY	Jurisdiction	Field Book	
Hardened Concrete	Thickness	Field Testing	1 core/1000 SY or 3 cores/project (2)	Contractor	Field Book/ Lab Report	Frequency may decrease with larger projects

	Width	Field Testing	1/day or as needed	Jurisdiction		
	Smoothness	Field Testing	Section 7010, 3.15	Contractor	Cert.	
	Compressive Strength	Maturity Tests	Test each day's pour		Lab Re- port	Follow IDOT Maturity Testing Re- quirements

Gradation submittal may be required by Engineer or Engineer on local projects.

Use most restrictive frequency.

The two samples will be collected at the same time.

Pours greater than 25 CY per day and 75 CY per week.

If maturity method is desired, the contractor shall be responsible for developing the maturity curve for the specified mix, taking maturity readings, and delivering a copy of the results to the Engineer or Engineer. IDOT IM 383.

3.16 DEFECTS OR DEFICIENCIES

- A. Pavement containing excessive cracks, fractures, spalls, or other defects shall be removed and replaced or repaired at no cost to the owner. Remedy to be determined by Engineer or Engineer. In lieu of the above, the Engineer or Engineer may approve an extended warranty.

3.17 REPAIRS AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Engineer.
- B. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 32 9200
TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Seeding.

1.2 DEFINITIONS

- A. Compost: Decomposed organic materials composed from plant material and free from animal waste used as a soil amendment.
- B. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- C. Finish Grade: Elevation of finished surface of planting soil.
- D. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- E. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- F. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- G. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- H. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
- I. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- J. Surface Soil: Whatever soil is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Certification of grass seed.
 - 1. Certification of each seed mixture for turfgrass sod.
- C. Product certificates.

1.4 QUALITY ASSURANCE

- A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 1. Pesticide Applicator: State licensed, commercial.
- B. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory.
 - 1. The soil-testing laboratory shall oversee soil sampling.
 - 2. Report suitability of tested soil for turf growth.

- a. State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
- b. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.
- B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

1.6 MAINTENANCE SERVICE

- A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:
 1. Seeded Turf: 60 days from date of planting completion.
 - a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.
 2. Sodded Turf: 30 days from date of planting completion.

PART 2 - PRODUCTS

2.1 SEEDING

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Mixtures and Seeding Dates
 1. See the contract documents for the specified seed mixture. If none is specified, use the following:
 2. The Contractor may submit a modification of the mixture for the Engineer's consideration.
 - a. Type 1 (Permanent Lawn Mixture): Used for residential and commercial turf site, fertilized, typically mowed.

Seeding Dates: March 1 – May 31, August 10 – September 30

Common Name	Application Rate lb/acre
Kentucky Bluegrass Cultivar ¹	65
Kentucky Bluegrass Cultivar ¹	65
Kentucky Bluegrass Cultivar ¹	65
Creeping Red Fescue	25
Fine-Leafed Perennial Ryegrass ²	20
Fine-Leafed Perennial Ryegrass ²	20
Annual Ryegrass	40

¹ Choose three different cultivars of Kentucky Bluegrass, at 65 pounds/acre each.

² Choose two different cultivars of Fine-Leafed Perennial Ryegrass, at 20 pounds/acre each.

- b. Type 4 (Urban Temporary Erosion Control Mixture): Short-lived (6-8 months) mix for erosion control.

Common Name	Application Rate lb/acre
SPRING – March 1 - May 20:	
Oats*	65
Annual Ryegrass	40
SUMMER – May 21- August 14:	
Oats*	95
Annual Ryegrass	50
FALL – August 15-September 30:	
Oats*	65
Annual Ryegrass	40

* Engineer may delete for previously established urban areas.

2.2 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 - 1. Class: O, with a minimum of 95 percent passing through No. 8 (2.36-mm) sieve and a minimum of 55 percent passing through No. 60 (0.25-mm) sieve.
- B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 (3.35-mm) sieve and a maximum of 10 percent passing through No. 40 (0.425-mm) sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Aluminum Sulfate: Commercial grade, unadulterated.
- E. Perlite: Horticultural perlite, soil amendment grade.
- F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 (0.30-mm) sieve.
- G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.
- H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.3 ORGANIC SOIL AMENDMENTS

- A. Compost:
 - 1. Derived from a well-decomposed and stable source of organic matter from plant products (animal waste is not allowed).
 - 2. pH range of 5.5 to 8
 - 3. Moisture content 35 to 55 percent by weight;
 - 4. Soluble salt content of 5 to 10 decisiemens/m;
 - 5. Not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.
 - 6. Produced using an aerobic composting process, meeting Code of Federal Regulations (CFR) 503 for time, temperature, and heavy metal concentrations.
 - 7. No visible admixture of refuse or other physical contaminants, nor any material toxic to plant growth.
 - 8. Certified by the U.S. Composting Council's Seal of Testing Assurance (STA) program.

9. Conforms to chemical, physical, and biological parameters of AASHTO MP 10-03, with the following additional requirements:
 - a. Follow U.S. Composting Council's TMECC guidelines for all testing.
 - b. Organic Matter Content: 30% minimum.
 - c. pH: between 6.0 and 8.0.
 - d. Maturity (growth screening): Minimum 90% emergence for all compost to be vegetated.
 - e. Particle Size:

Sieve Size	Percent Passing
2"	100
1"	90-100
3/4"	65-100
3/8"	0-75

10. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste (3/8 inch diameter or less); of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

2.4 FERTILIZERS

- A. Fertilizer shall comply with the rules of the Iowa Department of Agriculture and as follows:
 1. The grade of fertilizer will be identified according to the percent nitrogen (N), percent of available phosphoric acid (P₂O₅), and percent water soluble potassium (K₂O), in that order, and approval will be based on that identification.
 2. All fertilizer shall be furnished from an established fertilizer dealer and guaranteed percentage analysis shall be provided by the fertilizer supplier on each container with the proper scale weight records.
 3. Fertilizer shall be of a type that can be uniformly distributed by the application equipment. Fertilizer may be furnished in a dry (granular) or liquid form.
 4. When applied dry, the fertilizer shall be a granular, non-burning product composed of not less than 50% organic slow acting, guaranteed analysis professional fertilizer. Granular or pellet form shall be uniform in composition, dry, and free flowing without caking or other damage not suitable for use.
 5. When applied in a liquid form, fertilizer may be or may be furnished as separate ingredients.
 6. Upon request of the Contracting Authority, the Contractor shall provide a test of the fertilizer for conformance with the required analysis at no additional compensation; a tolerance of 1.0 percentage point plus or minus will be considered substantial compliance.

2.5 PLANTING SOILS

- A. Planting Soil: Existing, native surface topsoil formed under natural conditions with the duff layer retained during excavation process. Verify suitability of soil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.

2.6 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

- B. Muck Peat Mulch: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.
- C. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.

2.7 PESTICIDES

- A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

PART 3 - EXECUTION

3.1 SEEDED AREA PREPARATION

- A. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches (150 mm). Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply fertilizer directly to subgrade before loosening.
 - 2. Thoroughly blend planting soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 - 3. Spread planting soil to a depth of 6 inches (150 mm) but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - a. Reduce elevation of planting soil to allow for soil thickness of sod.
- B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch (13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
- C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- D. Before planting, obtain Engineer's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.2 SEEDING

- A. Areas not designated to receive sod shall be seeded, including all areas used for stockpiling materials and access routes
 - 1. All existing lawn shall be restored to existing conditions. Areas used for stockpiling and access routes shall be repaired as follows:
 - a. Remove gravel, concrete and construction debris from the area and restore the original grade by smoothing any ruts.
 - b. De-compact the soil by aerating with a deep tine aerator. Take care when working under the drip line of existing trees to prevent damage to surface feeder roots.
 - c. Spread a 1/4 to 1/2 inch layer of compost over the surface prior to overseeding.
 - 2. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Rake seed lightly into top 1/8 inch (3 mm) of soil, roll lightly, and water with fine spray.

- C. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre (42 kg/92.9 sq. m) to form a continuous blanket 1-1/2 inches (38 mm) in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.
 - 1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.
- D. On all slopes of 5:1 or greater, temporary Rolled Erosion Control Product (RECP), Type 2 C meeting the requirements of section 31 10 00 shall be placed over the seeded area to stabilize the slope.

3.3 LAWN/SEED MAINTENANCE

- A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
- B. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain height appropriate for species without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings.
- C. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

3.4 SATISFACTORY LAWN SEED

- A. Turf installations shall meet the following criteria as determined by Engineer:
 - 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 5 by 5 inches (125 by 125 mm).
 - 2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

END OF SECTION

SECTION 323113 - CHAIN LINK FENCES AND GATES

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. Chain-link fences.
 - 2. Gates: Swing
- B. Relates Sections:
 - 1. Section 033053 "Miscellaneous Cast-in-Place Concrete" for cast-in-place concrete post footings.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design chain-link fences and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Chain-link fence and gate framework 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. Minimum Post Size: Determine according to ASTM F 1043 for framework up to 12 feet high and post spacing not to exceed 10 feet.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.
 - 1. Fence and gate posts, rails, and fittings.
 - 2. Chain-link fabric, reinforcements, and attachments.
 - 3. Accessories: Vinyl privacy slats and trims
 - 4. Swing gates and hardware.

- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.
- C. Delegated-Design Submittal: For chain-link fences and gate framework indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Samples for Verification: Prepared on Samples of size indicated below:
 - 1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of chain-link fence and gate, from manufacturer.
- B. Product Test Reports: For framing strength according to ASTM F 1043.
- C. Field quality-control reports.
- D. Warranty: Sample of special warranty.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing fence grounding. Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.
- C. Mockups: Build mockups to set quality standards for fabrication and installation.
 - 1. Include 10-foot length of fence and gate.
- D. Pre-installation Conference: Conduct conference at project site.

1.7 PROJECT 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.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which installer agrees 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. Faulty operation of gate operators and controls.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:
1. Fabric Height: As indicated on Drawings.
 2. Steel Wire Fabric: Wire with a diameter of 0.192 inch
 - a. Mesh Size: 2 inches
 - b. Polymer-Coated Fabric: ASTM F 668, Class 2b over zinc-coated steel wire.
 - 1) Color: Black, complying with ASTM F 934.
 - c.
 - d. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.
 3. Selvage: Knuckled at both selvages.

2.2 FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, 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: 112 inches (see elevations - field verify)
 2. Light Industrial Strength: Material Group IC-L, round steel pipe, electric-resistance-welded pipe
 - a. Line Post: 2.875 inches in diameter.
 - b. End, Corner and Pull Post: 4.0 inches in diameter.

3. Horizontal Framework Members: Intermediate, top, and bottom rails complying with ASTM F 1043.
 - a. Top Rail: 1.66 inches in diameter.
4. Brace Rails: Comply with ASTM F 1043.
5. Metallic Coating for Steel Framing:
 - a. Type A, consisting of not less than minimum 2.0-oz./sq. ft. average zinc coating per ASTM A 123/A 123M or 4.0-oz./sq. ft zinc coating per ASTM A 653/A 653M.
6. Polymer coating over metallic coating.
 - a. Color: Black, complying with ASTM F 934.

2.3 TENSION WIRE

- A. Polymer-Coated Steel Wire: 0.177-inch-diameter, tension wire complying with ASTM F 1664, Class 2b over zinc-coated steel wire.
 1. Color: Black, complying with ASTM F 934.

2.4 SWING GATES

- A. General: Comply with ASTM F 900 for gate posts and single and/or double swing gate types.
 1. Gate Leaf Width: 36 inches.
 2. Gate Fabric Height: 112 inches.
- B. Pipe and Tubing:
 1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing.
 2. Gate Posts: Round tubular steel.
 3. Gate Frames and Bracing: Round tubular steel.
- C. Frame Corner Construction: Welded
- D. Hardware:
 1. Hinges: 360-degree inward and outward swing.
 2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.

2.5 FITTINGS

- A. General: Comply with 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 long.
 - 2. Rail Clamps: Line and corner boulevard clamps for connecting bottom rails in the fence line-to-line posts.
- E. Tension and Brace Bands: Pressed steel.
- F. Tension Bars: Steel, length not less than 2 inches 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. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
 - 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
 - a. Hot-Dip Galvanized Steel: 0.148-inch-diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.
- H. Finish:
 - 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.
 - a. Polymer coating over metallic coating.

2.6 PRIVACY SLATS

- A. Material: Polyethylene tubular slats, not less than 0.023-inch-thick, manufactured for chain-link fences from virgin polyethylene containing UV inhibitor, sized to fit mesh specified for direction indicated; with vandal-resistant fasteners and lock strips.
- B. Color: Black.

2.7 GROUT AND ANCHORING CEMENT

- A. Non-shrink, Nonmetallic Grout: Premixed, factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Erosion-Resistant Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide

formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

2.8 FENCE GROUNDING

- A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 - 1. Material above Finished Grade: Copper.
 - 2. Material on or below Finished Grade: Copper.
 - 3. Bonding Jumpers: Braided copper tape, 1 inch wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
- B. Connectors and Grounding Rods: Comply with UL 467.
 - 1. Connectors for Below-Grade Use: Exothermic welded type.
 - 2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, 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 only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

- A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.
 - 1. Install fencing on established boundary lines inside property line.

3.4 CHAIN-LINK FENCE INSTALLATION

- A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- B. Post Setting: Set posts in concrete at indicated spacing 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 to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Concealed Concrete: Top 2 inches below grade as indicated on Drawings to allow covering with surface material.
- C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of as indicated on Drawings.
- D. Line Posts: Space line posts uniformly at 96 inches o.c.
- E. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire as required per manufacturers recommendations.
- F. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. 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.
- G. Intermediate and Bottom Rails: Install and secure to posts with fittings.
- H. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1 inch between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- I. 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 o.c.
- J. 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 per 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 o.c. and to braces at 24 inches o.c.
- K. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.
- L. Privacy Slats: Install slats in direction indicated, securely locked in place.
 1. Vertically, full height of fence.

3.5 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.6 GROUNDING AND BONDING

- A. Fence Grounding: Install at maximum intervals of 1500 feet except as follows:
 1. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.
 - a. Gates and Other Fence Openings: Ground fence on each side of opening.
 - 1) Bond metal gates to gate posts.
 - 2) 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 below finished grade.
- B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.
- C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.
- D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location, including the following:
 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.
- E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

- F. Connections: Make connections to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be 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.

3.7 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

END OF SECTION 323113

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**SECTION 33 10 00
FACILITY SANITARY SEWERS**

PART 1 GENERAL

1.04 SECTION INCLUDES

- A. Pipe and Fittings

1.05 SUBMITTALS

- A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- B. Product Certificates: For each type of cast-iron pipe and fitting, from manufacturer.
- C. Field quality-control reports.
- D. As-Built drawings.

PART 2 PRODUCTS

2.04 SANITARY SEWER SERVICES

- A. Service Pipe: Use products as required by local plumbing code or regulations, if applicable. Otherwise, use the following:
 - 1. PVC:
 - a. Comply with ASTM D 3034, minimum thickness SDR 23.5 minimum pipe stiffness of 153 psi as per ASTM D 2412.
 - b. PVC plastic meeting ASTM D 1784, Cell Classification 12454.
 - c. Integral bell and spigot type rubber gasket joint complying with ASTM D 3212.
 - 2. DIP: As specified for sanitary sewer force main, including polyethylene encasement.
- B. Connection to Existing Service:
 - 1. Style: Full circle, fully lined, bolted.
 - 2. Length: 12 inches, minimum.
 - 3. Materials and Manufacturer:
 - a. Shells, armors, side bars, lugs, Turner lifting bars, bolts and nuts; complying with ASTM A 240, Type 304 stainless steel.
 - b. MIG welds, fully passivated.
 - c. Rubber gasket complying with ASTM D 2000, AA415 with full coverage and a grid pattern.
 - d. Stainless steel armor bonded to gasket to bridge lug area.
 - 4. Nuts and Bolts: 1/2 inch or 5/8 inch, Teflon coated threads.

2.05 TRACER SYSTEM:

- A. Tracer Wire:
 - 1. Open Cut:
 - 2. Solid Single Copper Conductor:
 - a. Size: #12 AWG
 - b. Insulation Material: Linear low-density polyethylene (LLDPE) insulation suitable for direct burial applications
 - c. Insulation Thickness: 0.030 inches, minimum
 - d. Tensile Strength: 150 pounds, minimum
 - e. Operating Voltage: Rated for 30 volts
 - 3. Bimetallic Copper Clad Steel Conductor:
 - a. Size: #14 AWG

- b. Rating: Direct burial
 - c. Operating Voltage: Rated for 30 volts
 - d. Conductivity: 21%
 - e. Copper Cladding: 3% of conductor diameter, minimum
 - f. Insulation Material: High density, high molecular weight polyethylene
 - g. Insulation Thickness: 0.030 inches, minimum
 - h. Tensile Strength: 175 pounds, minimum
 - i. Directional Drilling/Boring:
- 4. Bimetallic Copper Clad Steel Conductor:
 - a. Size: #12 AWG
 - b. Rating: Direct burial
 - c. Operating Voltage: Rated for 30 volts
 - d. Conductivity: 21%
 - e. Copper Cladding: 3% of conductor diameter, minimum
 - f. Insulation Material: High density, high molecular weight polyethylene
 - g. Insulation Thickness: 0.045 inches, minimum
 - h. Tensile Strength: 1,100 pounds, minimum
- B. Ground Rod: 3/8 inch diameter, 60 inch steel rod uniformly coated with metallically bonded electrolytic copper.
- C. Ground-rod Clamp: High-strength, corrosion-resistant copper alloy.
- D. Splice Kit: Inline resin splice kit with split bolt (1 kV and 5 kV) for use with single conductor and unshielded cable splices in direct bury and submersible applications.

2.06 TRACER WIRE STATION:

- A. Two internal terminals with shunt.
- B. Five to six-foot plastic post.
- C. Removable top cap with lock.
- D. Decals indicating "Sewer Force Main" or similar language.

2.07 CLEANOUTS

- A. Cast-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
 - 1. Top-Loading Classification(s): Light Duty, Medium Duty, Heavy Duty, and Extra-Heavy Duty.
 - 2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.08 INSERTA-TEE

- A. Connections: shall consist of a PVC hub, Rubber Sleeve, and a stainless Steel band. Connection shall be a compression fit into the cored wall of a mainline pipe. Hub shall be made from heavy-duty PVC material. Stainless steel clamping assembly shall be of SS#301 for the band and housing and SS #305 for screws. Rubber Sleeve and gasket when applicable, shall meet the requirements of ASTM F477. Gaskets shall be installed by the manufacturer. A water-based solution provided by the manufacturer shall be used during assembly.
- B. Joint Performance: Inserta Tee product shall provide a watertight connection according to the requirements of ASTM D3212 or ASTM F2946-12,

2.09 PRECAST RISER JOINTS

- A. Joint Ends:

1. Use tongue and groove ends.
 2. If cast-in-place base is used, provide bottom riser with square bottom edge.
- B. Joint Sealant:
1. Rubber O-ring or Profile Gasket: Flexible joint, complying with ASTM C 443.
 2. Bituminous Jointing Material: Use a cold-applied mastic sewer joint sealing compound recommended by the manufacturer for the intended use and approved by the Engineer. Comply with ASTM C 990.
- C. Butyl Sealant Wrap: Comply with ASTM C 877.

2.10 PIPE CONNECTIONS

- A. Flexible, Watertight Gasket: Comply with ASTM C 923.
- B. Non-Shrink Grout: Comply with Section 6010, 2.04.
- C. Waterstop: Provide elastomeric gasket that surrounds pipe and attaches with stainless steel bands and is designed to stop the movement of water along the interface between a pipe and a surrounding concrete collar.
- D. Concrete Collar: Use Class C concrete. Comply with IDOT Specification and materials I.M.s.

2.11 OIL WATER SEPERATOR

- A. Sudas standard specifications, current edition shall apply to all sanitary and wastewater work.
- B. Manufacturers certification shall be submitted to insure material complies with specified requirements and are suitable for intended use,
- C. Manufacturer regularly engaged in the manufacturing of soil water separators of similar type to that specified for a minimum of 10 years.
- D. Oil water separator shall be design in coordination with daily flow rate calculated by the Mechanical Engineer.

2.12 NON-SHRINK GROUT

- A. Shall comply with IDOT Materials I.M.491.13
- B. Compressive Strength ASTM C 109
 1. Plastic State:
 - a. 1 day 3000 psi (20.7 MPa)
 - b. 7 days 5000 psi (34.5 MPa)
 2. High Flow State:
 - a. 1 day 800 psi (5.5 MPa)
 - b. 7 days 3000 psi (20.7 MPa)
- C. Shrinkage
 1. Plastic State
 - a. ASTM C 827 (The manufacturer shall provide independent test result of C 827 for evaluation).
 - b. In plastic state, the grout must not shrink, and the grout must not expand by more than 2%
 2. Hardened State
 - a. ASTM C 157
 - b. 0.20% Maximum
- D. When casting specimens for above tests, consistency shall meet the following requirements:

1. Plastic State: ASTM C 109 110 $\pm$ 5%
2. High Flow State: ASTM C 939/IM 375 20 $\pm$ 5 seconds

PART 3 EXECUTION

3.01 EXAMINATION

- A. The contractor shall locate existing service lines that will be used and connected to. Location includes exposure of the piping and verification of flowlines prior to installing new sanitary sewer services.

3.02 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.03 GENERAL REQUIREMENTS

- A. Subgrade Preparation:
 1. Cut Sections (Undisturbed Soil): Prepare subgrade to accurate elevation required to place structure base or subbase.
 2. Fill Sections: Compact to 95% of maximum Standard Proctor Density and hand grade to accurate elevation required to place structure base or subbase, or install stabilization material as directed by the Engineer.
 3. Unstable Soil: Install stabilization material as directed by the Engineer.
- B. Subbase:
 1. Cast-in-place Structures: No subbase material is required.
 - a. Precast Structures: If precast structure is provided, install 8 inch thick pad of Class I bedding material a minimum of 12 inches outside footprint of the structure.

3.04 SANITARY SEWER SERVICE INSTALLATION

- A. Provide sanitary sewer service at locations specified in the contract documents.
- B. Install service from sewer main or stub to 5' from the building.
 1. Install service with a slope between 2% and 5% for 4 inch pipes, and between 1% and 5% for pipes 6 inches and greater.
 2. If the depth of the sewer main causes the service to exceed a depth of 12 feet or a slope of 5%, install a service riser.

3.05 TOLERANCES

- A. Apply the following tolerances to utilities installed by open trench construction. For trenchless construction, comply with Section 312000 "Earth Moving".
- B. Gravity Main:
 1. Do not allow horizontal and vertical alignment of trenched gravity sewer lines to vary from design line and grade at any point along the pipe by more than 1% of the inside diameter of the pipe or 1/4 inch, whichever is larger.
 2. This tolerance is allowed for trenched gravity sewer lines only if design line and grade is sufficient to prevent backslope when tolerance limits are reached.
 3. Reverse slope on gravity pipe is prohibited. Remove and reinstall pipe to proper grade.
 4. Low spots holding water exceeding 1/2" must be removed and reinstalled to proper grade.
- C. Force Main:

1. Do not allow horizontal and vertical alignment of trenched force mains to vary from design line and grade by more than 3 inches.

3.06 CONFLICTS

- A. Provide temporary support for existing water, sewer, gas, telephone, power, and other utilities or services that cross the trench.
- B. Compact backfill material under existing utility crossing as specified in Section 312000 "Earth Moving", or construct utility line supports where specified in the contract documents or as directed by the Engineer.
- C. The following separation information is derived from Iowa DNR's Iowa Wastewater Facilities Design Standards, Chapter 12, Section 12.5.8:
 1. Horizontal Separation of Gravity Sewers from Water Mains: Separate gravity sewer mains from water mains by a horizontal distance of at least 10 feet unless:
 - a. The top of a sewer main is at least 18 inches below the bottom of the water main, and
 - b. The sewer is placed in a separate trench or in the same trench on a bench of undisturbed earth at a minimum horizontal separation of 3 feet from the water main.
 - c. When it is impossible to obtain the required horizontal clearance of 3 feet and a vertical clearance of 18 inches between sewers and water mains, the sewers must be constructed of water main materials meeting the requirements of Section 221113 "Facility Water Distribution Piping". However, provide a linear separation of at least 2 feet.
 2. Separation of Sewer and Water Main Crossovers:
 - a. Vertical separation of sanitary sewers crossing under any water main should be at least 18 inches when measured from the top of the sewer to the bottom of the water main. If physical conditions prohibit the separation, the sewer may be placed not closer than 6 inches below a water main or 18 inches above a water main. Maintain the maximum feasible separation distance in all cases.
 - b. Where the sewer crosses over or less than 18 inches below a water main, locate one full length of sewer pipe of water main material so both joints are as far as possible from the water main. The sewer and water pipes must be adequately supported and have watertight joints. Use a low permeability soil for backfill material within 10 feet of the point of crossing.

3.07 CONNECTIONS TO BUILDING AND EXISTING PIPING

- A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains.
- B. Make connections to existing piping.
 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch (150-mm) overlap with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
 2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
 3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to

shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches (150 mm) of concrete for minimum length of 12 inches (300 mm) to provide additional support of collar from connection to undisturbed ground.

- a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi (20.7 MPa) unless otherwise indicated.
- b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.08 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.
 1. Submit separate report for each system inspection.
 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 1. Do not enclose, cover, or put into service before inspection and approval.
 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

3.09 CLEANING

- A. Clean all sanitary sewers by flushing with high pressure water and removing debris by vacuum extraction, and by removing sheeting, bracing, shoring, forms, soil sediment, concrete, or other debris.
- B. Do not discharge soil sediment or debris to drainage channels, existing storm sewers, or existing sanitary sewers.

END OF SECTION

SECTION 33 32 00
FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe
 - 2. Fittings
 - 3. Special Fittings
 - 4. Pipeline Accessories
 - 5. Gate Valves
 - 6. Tapping Valve Assemblies
 - 7. Valve Boxes
 - 8. Testing and Disinfection
- B. Description of Work:
 - 1. Construct building service pipes.
 - 2. Install valves.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings
- C. Field quality-control test reports.
- D. As-Built drawings.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
 - 2. Comply with standards of authorities having jurisdiction for potable water service piping, including materials, installation, testing, and disinfection.
 - 3. Comply with standards of authorities having jurisdiction for fire suppression water service piping, including materials, hose threads, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Remove pipe, fittings, valves, and appurtenances contaminated with mud and surface water from the site. Do not use in construction unless thoroughly cleaned, inspected, and approved by the owner.
- D. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.
- E. NSF Compliance:
 - 1. Comply with NSF 14 for plastic potable water service piping. Include marking "NSF-pw" on piping.
 - 2. Comply with NSF 61 for materials for water service piping and specialties for domestic water.
- F. Scheduling and Conflicts
 - 1. Expose possible conflicts in advance of construction, such as utility lines and drainage structures. Verify elevations and locations of each and verify clearance for proposed construction.

2. Complete other elements of the work that can affect line and grade in advance of other open cut construction unless noted on the plans.
3. Notify Engineer of conflicts discovered or changes needed to accommodate unknown or changed conditions.

1.4 PROJECT CONDITIONS

- A. Interruption of Existing Water-Distribution 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 water-distribution service according to requirements indicated:
 1. Notify Architect no fewer than two days in advance of proposed interruption of service.
 2. Do not proceed with interruption of water-distribution service without Architect's written permission.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER SERVICE PIPE AND FITTINGS

Water Service shall be Ductile-Iron Pipe per LUST requirements.

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated. Polyethylene wrap is required
 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C111, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C111, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 2. Gaskets: AWWA C111, rubber.
- C. Grooved-Joint, Ductile-Iron Pipe: AWWA C606, with cut, rounded-grooved ends.
 1. Grooved-End, Ductile-Iron Pipe Appurtenances:
 - 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) Anvil International, Inc.
 - 2) Victaulic Company of America.

2.2 JOINING MATERIALS

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for commonly used joining materials.
- B. Brazing Filler Metals: AWS A5.8, BCuP Series.
- C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.
- D. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.3 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Tubular-Sleeve Pipe Couplings:

1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.
 - a. Standard: AWWA C219.

2.4 VALVE

A. General:

1. Same size as pipeline in which it is installed, unless noted otherwise on the plans.
2. Manufacturer's name and pressure rating cast on valve body.
3. Direction of Opening: The opening direction is counterclockwise as viewed from the top, unless otherwise specified in the contract documents or as directed by the Jurisdiction.
4. Joints:
 - a. For buried installations, use mechanical joints per AWWA C111. Comply with Section 5010 for joint nuts and bolts.
 - b. For installation within structures, flanged with dimensions and drillings per AWWA C110 or ANSI B16.1 class 125.

B. Gate Valves:

1. Comply with AWWA C509 (gray iron or ductile iron) or AWWA C515 (ductile iron) and NSF 61.
2. Stem Seals: Double O-rings permanently lubricated between seals. Lubricant certified for use in potable water.
3. External Bolts and Hex Nuts: Stainless steel per ASTM A 240, Type 304.

C. Tapping Valve Assemblies:

1. Tapping Valve: Gate valve complying with AWWA C509 or AWWA C515.
2. Sleeve:
 - a. Minimum 14 gauge.
 - b. Stainless steel per ASTM A 240, Type 304.
 - c. Working pressure 150 psi.
 - d. Must fully surround pipe.
 - e. Flanged with dimensions and drillings per AWWA C110 or ANSI B16.1 class 125.
3. Minimum Sleeve Length:

Outlet Flange Size	Minimum Sleeve Length
4"	15"
6"	15"
8"	20"

4. Gasket:

- a. To completely surround pipe.
- b. Minimum thickness 0.125 inch.
- c. Use nitrile rubber.

5. Outlet Flange:

- a. Stainless steel ASTM A 240, Type 304.
- b. ANSI B16.1, 125 pound pattern.

6. Hex Nuts and Bolts: Stainless steel per ASTM A 240, Type 304.
 7. Use tapping valve assemblies only where shown on the plans.
- D. Valve Box:
1. Applicability: For all buried valves.
 2. Manufacturer: As allowed by the Jurisdiction or specified in the contract documents.
 3. Type:
 - a. In paved areas, use a slide type.
 - b. In all other areas, use a screw extension type.
 4. Material: Gray iron.
 5. Cover: Gray iron, labeled "WATER"
 6. Wall Thickness: 3/16-inch, minimum.
 7. Inside Diameter: 5 inches, minimum.
 8. Length: Adequate to bring top to finish grade, including valve box extensions, if necessary.
 9. Factory Finish: Asphalt coating.
 10. Valve Box Centering Ring: Include in installation.
- E. Valve Stem Extension: For all buried valves, provide as necessary to raise 2-inch operating nut to within 3 feet of the finish grade. Stem diameter per valve manufacturer's recommendations, but not less than 1 inch.
- F. Post Indicator Valve: As per the jurisdiction specifications.

2.5 CONCRETE THRUST BLOCKS

- A. Use concrete with a compressive strength of 4000 psi at 28 days.
- B. Comply with the contract documents for dimensions and installation of thrust blocks.
- C. Use at all bends and tees as follows:

Size of Pipe (in)	Minimum Bearing Surface (SF)				
	Bends				Tee or Dead End
	11.25°	22.5°	45°	90°	
4	1.0	1.0	2.0	4.0	3.0
6	1.0	2.0	4.0	8.0	6.0
8	2.0	4.0	7.0	14.0	10.0
10	3.0	6.0	11.0	21.0	15.0
12	4.0	8.0	16.0	29.0	21.0

2.6 ACCESSORIES

- A. Polyethylene Wrap:
 1. Use on all ductile iron pipe and fittings in buried service.
 2. Comply with AWWA C105.
 3. 8 mil minimum thickness.
- B. Tracer Wire:
 1. Solid Single Copper Conductor:
 - a. Size: #12 AWG

- b. Insulation Material: Linear low-density polyethylene (LLDPE) installation suitable for direct burial applications.
 - c. Insulation Thickness: 0.045 inches, minimum.
- 2. Bimetallic Copper Clad Steel Conductor:
 - a. Size: #12 AWG.
 - b. Rating: Direct burial.
 - c. Operating Voltage: 30 volts.
 - d. Conductivity: 21%.
 - e. Copper Cladding: 3% of conductor diameter, minimum.
 - f. Insulation Material: High density polyethylene.
 - g. Insulation Thickness: 0.030 inches, minimum.
- 3. Ground Rod: 3/8 inch diameter, 60 inch steel rod uniformly coated with metallically bonded electrolytic copper.
- 4. Ground-rod Clamp: High-strength, corrosion-resistant copper alloy.
- 5. Splice Kit: Inline resin splice kit with split bolt (1 kV and 5 kV) for use with single conductor and unshielded cable splices in direct bury and submersible applications.
- 6. Tracer Wire Station: Comply with the contract documents.

2.7 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connections:

- 1. Fire Department Connections shall comply with the local jurisdiction requirements.

2.8 POST INDICATOR VALVE

- A. Post Indicator Valve shall comply with local building codes and City of Conrad.
- B. Manufacturer's as approved by the City of Conrad or approved equal by the Engineer.

2.9 DISINFECTION AGENT – CHLORINE

- A. Liquid Chlorine complying with AWWA B300 and AWWA B301.
- B. Sodium Hypochlorite complying with AWWA B300.
- C. Calcium Hypochlorite complying with AWWA B300.
- D. All disinfecting agents to be NSF 60 certified. Supply and store in the original container.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. General:
- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
- C. Do not use flanges or unions for underground piping.
- D. Flanges, unions, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

3.3 VALVE APPLICATIONS

- A. General Application: Use mechanical-joint-end valves for NPS 3 (DN 80) and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 (DN 50) and smaller installation.

- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Underground Valves, NPS 4 (DN 100) and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. See Division 22 Section "Common Work Results for Plumbing" for piping-system common requirements.

3.5 PIPING INSTALLATION

- A. General:
 - 1. Do not use deformed, defective, gouged, or otherwise damaged pipes or fittings.
 - 2. Keep trench free of water. Clean pipe interior prior to placement in the trench.
 - 3. Install pipe with fittings and valves to the lines and grades specified in the contract documents.
 - 4. Clean joint surfaces thoroughly and apply lubricant approved for use with potable water and recommended by the manufacturer.
 - 5. Push pipe joint to the indication line on the spigot end of the pipe before making any joint deflections.
 - 6. Limit joint deflections to one degree less than pipe manufacturer's recommended maximum limit.
 - 7. Tighten bolts in a joint evenly around the pipe.
 - 8. Install concrete thrust blocks on all fittings.
 - 9. Keep exposed pipe ends closed with rodent-proof end gates at all times when pipe installation is not occurring.
 - 10. Close the ends of the installed pipe with watertight plugs during nights and non-working days.
 - 11. Do not allow any water from the new pipeline to enter the existing distribution system piping until testing and disinfection are successfully completed.
 - 12. Trenched:
 - a. Excavate trench and place pipe bedding and backfill material as specified in Section 312000.
 - b. Provide uniform bearing along the full length of the pipe barrel. Provide bell holes.
 - 13. Apply polyethylene wrap to all iron pipe, valves, and fittings.
 - 14. Set tops of valve boxes to finished grade, unless otherwise directed by the Engineer.
 - 15. Check the working order of all valves by opening and closing through entire range. Before opening the valves, check with the Jurisdiction on operating requirements.
- B. Additional Requirements for DIP installation.
 - 1. Utilize full-length gauged pipe for field cuts. Alternatively, field-gauge pipe selected for cutting to verify the outside diameter is within allowable tolerances.
 - 2. Cut the pipe perpendicular to the pipe barrel. Do not damage the cement lining. Bevel cut the ends for push-on joints according to the manufacturer's recommendations.
 - 3. Encase all pipe, valves, and fittings with polyethylene wrap.
- C. Additional Requirements for PVC installation.
 - 1. Cut the pipe perpendicular to the pipe barrel. Deburr and bevel cut spigot end of the pipe barrel to match factory bevel. Re-mark the insertion line.

2. When connecting to shallow-depth bells, such as on some cast iron fittings or valves, cut the spigot end square to remove factory bevel. Deburr the end and form a partial bevel on the end.
- D. Polyethylene encasement installation.
1. Apply polyethylene encasement to buried ductile iron pipe and to buried fittings, fire hydrants, and appurtenances. The polyethylene encasement is used to prevent contact between the pipe and the bedding material, but need not be airtight or watertight.
 2. Install polyethylene encasement according to AWWA C105, using tubes or flat sheets, and pipe manufacturer's recommendations.
 3. Do not expose the polyethylene encasement to sunlight for long periods before installation.
 4. Remove all lumps of clay, mud, cinders, etc. on the pipe surface before encasing the pipe. Take care to prevent soil or bedding material from becoming trapped between the pipe and polyethylene.
 5. Lift polyethylene-encased pipe with a fabric-type sling or padded cable.
 6. Secure and repair encasement material using polyethylene tape, or replace as necessary.
- E. Water Service
1. Install water service pipe according to local Jurisdiction requirements.
 2. Install 1 inch and smaller corporation valves tapped at 45 degrees above horizontal at a minimum distance of 18 inches from pipe bell or other corporation. Install 1 1/2 inch and 2 inch corporation valves tapped horizontal a minimum distance of 24 inches from pipe bell or other corporation.
 3. Construct trench and place backfill material according to Section 312000.
- F. Conflicts
1. Provide temporary support for existing water, sewer, gas, telephone, power, or other utilities or services that cross the trench.
 2. Compact backfill material under existing utility crossing as specified in Section 312000, or construct utility line supports where specified in the contract documents or as directed by the Engineer.
 3. The following separation information is derived from Iowa DNR's Iowa Wastewater Facilities Design Standards, Chapter 12, Section 12.5.8
 - a. Horizontal Separation of Gravity Sewers from Water Mains:
 - 1) Separate gravity sewer mains from water mains by a horizontal distance of at least 10 feet unless:
 - a) The top of a sewer main is at least 18 inches below the bottom of the water main, and
 - b) The sewer is placed in a separate trench or in the same trench on a bench of undisturbed earth at a minimum horizontal separation of 3 feet from the water main.
 - 2) When it is impossible to obtain the required horizontal clearance of 3 feet and a vertical clearance of 18 inches between sewers and water mains, the sewers must be constructed of water main materials meeting the requirements of this Section. However, provide a linear separation of at least 2 feet.
 - b. Separation of Sewer Force Mains from Water Mains: Separate sewer force mains and water mains by a horizontal distance of at least 4 linear feet.
 - c. Separation of Sewer and Water Main Crossovers:

- 1) Vertical separation of sanitary sewers crossing under any water main should be at least 18 inches when measured from the top of the sewer to the bottom of the water main. If physical conditions prohibit the separation, the sewer may be placed not closer than 6 inches below a water main or 18 inches above a water main. Maintain the maximum feasible separation distance in all cases.
- 2) Where the sewer crosses over or less than 18 inches below a water main, locate one full length of sewer pipe of water main material so both joints are as far as possible from the water main. The sewer and water pipes must be adequately supported and have watertight joints. Use a low permeability soil for backfill material within 10 feet of the point of crossing.

G. Transitions in Piping Systems

1. Where the specified material of a piping system entering or exiting a structure changes, make the change at the outside of the structure wall, beyond any wall pipe or wall fitting required, unless otherwise specified.

H. Structure Penetrations

1. Wall Pipes:

- a. Install where pipes penetrate and terminate at a wall or floor surface of a concrete structure, or where the pipe protrudes through the concrete wall or floor and the protrusion is otherwise unsupported.
- b. Provide a waterstop flange near the center of the embedment length. The waterstop is to be cast integrally with the wall pipe, or fully welded to it around the pipe circumference.

2. Wall Sleeves:

- a. Install where a pipe passes through a structure wall.
- b. Sleeves in concrete walls are to be supplied with a waterstop collar, fully welded, and cast-in-place in the concrete.

3.6 JOINT CONSTRUCTION

- A. See Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.
- B. Make pipe joints according to the following:
 1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
 2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
 3. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
 4. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
 5. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
 6. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.7 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

- C. MSS Valves: Install as component of connected piping system.

3.8 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. See Division 22 Section "Common Work Results for Plumbing" for piping connections to valves and equipment.
- C. Connect water-distribution piping to existing water main.
- D. Connect water-distribution piping to interior domestic water and fire-suppression piping.

3.9 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
 - 1. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig (0 kPa). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- C. Prepare reports of testing activities.

3.10 TESTING AND DISINFECTION

- A. Sequence of Testing and Disinfection
 - 1. Perform operations according to AWWA C651 in the sequence below. Successfully complete each operation before continuing to the next operation. The Jurisdiction will provide reasonable quantities of water for flushing and testing.
 - 2. Continuous-Feed or Slug Method (After Water Main Installation): The sequence of testing and disinfection may be modified with approval of the Engineer.
 - a. Perform initial flush.
 - b. Perform disinfection.
 - c. Flush after disinfection.
 - d. Perform pressure and leak testing.
 - e. Tablet Method (Concurrent with Water Main Installation): Is not acceptable.
- B. Initial Flushing
 - 1. Flushing:
 - a. Coordinate flushing with the Jurisdiction.
 - b. Flush pipe prior to disinfection using potable water.
 - c. Measure flushing velocity.
 - d. Obtain a minimum flushing velocity of 2.5 feet per second in the pipe to be disinfected.
 - 2. Minimum Flushing Rate: According to AWWA C651, Table 3, based on 40 psi residual pressure (see table below).

Minimum Flushing Rate					
Pipe Diameter (inches)	Flow Rate for Flushing (gpm)	Number of Taps ²			Number of 2 ½" Fire Hydrant Outlets ¹
		1"	1½"	2"	

4	100	1	-	-	1
6	200	-	1	-	1
8	400	-	2	1	1
10	600	-	3	2	1
12	900	-	-	2	2
16	1,600	-	-	4	2

¹With a 40 psi pressure in the main with the fire hydrant flowing to atmosphere, a 2 1/2 inch fire hydrant outlet will discharge approximately 1,000 gpm; and a 4 1/2 inch fire hydrant outlet will discharge approximately 2,500 gpm.

²Number of taps on pipe based on discharge through 5 feet of galvanized iron pipe with one 90° elbow.

3. Property Protection: Protect public and private property from damage during flushing operations.

C. Disinfection

1. General:

- a. Disinfect according to AWWA C651. The tablet method contained in AWWA C651 is not to be used unless approved by the Engineer.
- b. Keep piping to be chlorinated isolated from lines in service and from points of use.
- c. Obtain and test water samples, unless otherwise provided by the Engineer.

2. Procedure:

- a. Induce a flow of potable water through the pipe.
- b. Introduce highly chlorinated water to the pipe at a point within 5 pipe diameters of the pipe's connection to an existing potable system, or within 5 pipe diameters of a closed end, if there is no connection to an existing system.
- c. Introduce water containing a minimum of 25 mg/L free chlorine until the entire new pipe contains a minimum of 25 mg/L free chlorine.
- d. Retain chlorinated water in the pipe for at least 24 hours and no more than 48 hours.

D. Final Flushing

1. Flush pipe using potable water until chlorine residual equals that of the existing potable water system.
2. Dispose of chlorinated water to prevent damage to the environment. Dechlorinate highly chlorinated water from testing before releasing into the ground or sewers. Obtain Jurisdiction approval prior to flushing activities.
 - a. Check with the local sewer department for the conditions of disposal to the sanitary sewer.
 - b. Chlorine residual of water being disposed will be neutralized by treating with one of the chemicals listed in the following table.

Residual Chlorine Concentration mg/L	Sulfur Dioxide (SO ₂) lb	Sodium Bisulfite (NaHSO ₃) lb	Sodium Sulfite (Na ₂ SO ₃) lb	Sodium Thiosulfate (Na ₂ S ₂ O ₃ + 5H ₂ O) lb	Ascorbic Acid (C ₆ O ₈ H ₆) lb
1	0.8	1.2	1.4	1.2	2.1

2	1.7	2.5	2.9	2.4	4.2
10	8.3	12.5	14.6	12.0	20.9
50	41.7	62.6	73.0	60.0	104

c.

E. Pressure and Leak Testing

1. Remove debris from within the pipe. Clean and swab out pipe, if required.
2. Secure unrestrained pipe ends against uncontrolled movement.
3. Isolate new piping from the existing water system.
4. Fill and flush all new piping with potable water. Ensure all trapped air is removed.
5. Pressurize the new pipe to the test pressure at the highest point in the isolated system. Do not pressurize to more than 5 psi over the test pressure at the highest point in the isolated system.
6. Test and monitor the completed piping system at 1.5 times the system working pressure or 150 psi, whichever is greater, for 2 continuous hours.
7. If at any time during the test the pressure drops to 5 psi below the test pressure, repressurize the pipe by pumping in potable water in sufficient quantity to bring the pressure back to the original test pressure.
8. Accurately measure the amount of water required to repressurize the system to the test pressure.
9. Maximum allowable leakage rate according to AWWA C600:

$$L = \frac{(N)(D)(P)^{0.5}}{7,400}$$

Where:

L = allowable leakage, in gallons per hour.

N = number of pipe joints in test section.

D = nominal pipe diameter, in inches.

P = average test pressure, in pounds per square inch.

The following table assumes an average test pressure (P) of 150 psi, number of pipe joints (N) per 1,000 feet of test section based on 18 foot pipe lengths and no fittings

Maximum Allowable Leakage Rate	
Pipe Diameter (inches)	Allowable Leakage Rate (gallons/hour/1,000 feet of pipe)
4	0.37
6	0.55
8	0.74
10	0.92
12	1.10
14	1.29
16	1.47
18	1.66

20	1.84
24	2.21
30	2.76
36	3.31

10. If the average measured leakage per hour exceeds the maximum allowable leakage rate, repair and retest the water main.
11. If the measured pressure loss does not exceed 5 psi, the test will be considered acceptable.
12. Repair all visible leaks regardless of the amount of leakage.

F. Bacteria Sampling

1. Test water mains according to AWWA C651. If the initial disinfection procedure fails to produce satisfactory bacteriological results or if other water quality is affected, repeat the disinfection procedure.

END OF SECTION