

PROJECT MANUAL

PROJECT NAME:

DPS DSM New Fleet Building Renovations

PROJECT ADDRESS:

50 Forest Ave and 1333 Ohio St
Des Moines, Iowa 50319

PROJECT DATE: December 20, 2024

-
OWNER:

Iowa Department of Administrative Services
109 Southeast 13th Street
Des Moines, Iowa 50319



OWNER PROJECT NUMBER: 9414.00

OWNER REQUEST FOR BID NUMBER: RFB 941400-01

-
CONSTRUCTION MANAGER:

DCI Group
220 SE 6th Street - Suite 200
Des Moines, Iowa 50309



CONSTRUCTION MANAGER PROJECT NUMBER: 24-018

-
ARCHITECT:

Savage-Ver Ploeg & Assoc
1466 28th St, Suite 200
West Des Moines, IA 50266



ARCHITECT PROJECT NUMBER: 24042

SECTION 00 0107

SEALS PAGE

I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge.

Discipline: Architect

Stamp:

Company Name: SVPA Architects Inc.

Address: 1466 28th St. Suite 200

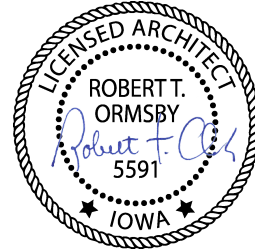
West Des Moines, IA 50266

Telephone: (515) 280-2409

Name: Robert T. Ormsby

Responsibility: Division 2-14, 32 3113.56

License#: 5591



I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge.

Discipline: Structural Engineer

Stamp:

Company Name: IMEG

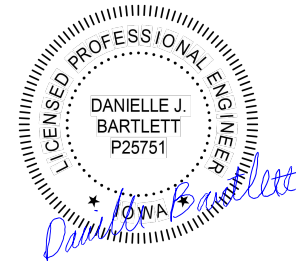
Address: 2882 106th St. Suite 100
Urbandale, IA 50322

Telephone: (515) 336-9906

Name: Danielle Bartlett, PE

Responsibility: Division 05 4000

License#: P25751



I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge.

Discipline: Mechanical Engineer

Stamp:

Company Name: IMEG

Address: 2882 106th St. Suite 100
Urbandale, IA 50322

Telephone: (515) 334-9906

Name: Nathaniel K. Jacques

Responsibility: Divisions 21, 22, 23

License#: 21686



I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge.

Discipline: Electrical Engineer

Stamp:

Company Name: IMEG

Address: 2882 106th St. Suite 100
Urbandale, IA 50322

Telephone: (515) 334-9906

Name: Kristen L. Spina

Responsibility: Divisions 26, 27, 28

License#: P21081



END OF SECTION

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- H. F 400 FIRE PROTECTION DETAILS & SCHEDULES

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- E. T 203A OHIO – FLOOR PLAN AREA A – TECHNOLOGY
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- G. T 300 TECHNOLOGY ENLARGED PLANS
- H. T 400 TECHNOLOGY DETAILS AND DIAGRAMS
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END OF SECTION

SECTION 00 0116

BID SUBMITTAL CHECKLIST

PART 1 - GENERAL

1.01 BID SUBMITTAL CHECKLIST

- A. The Bidder is responsible to see that the bid is submitted online at [IMPACS Electronic Procurement System](#) on or before the due date and time specified. Late bids shall not be accepted.
- B. Bids shall be typewritten or in ink. All information requested shall accompany the bid. All blocks shall be completed. Errors shall be lined out and initialed.
- C. The right is reserved to reject any or all bids. The State may waive minor deficiencies or informalities in the best interest of the State of Iowa.
- D. A properly prepared and submitted bid document is the bidder's responsibility.
- E. Bids cannot be changed after the bid opening.
- F. In all cases, no verbal communications by any party will override written communications from the issuing office.
- G. The Bid Form shall be completed in full and signed and submitted by an officer of the bidder with authority to bind in a contract.
- H. If a Bid Bond is called for, it shall accompany the Bid submission.
- I. If Non-discrimination Clause information is called for, it shall accompany the Bid submission.
- J. If Targeted Small Business Pre-Bid Contact information is called for, it shall accompany the Bid submission.
- K. If Certificate of Site Visit form is called for, it shall accompany the Bid submission.

END OF SECTION

SECTION 00 1113
NOTICE TO BIDDERS
RFB #941400-01

The Iowa Department of Administrative Services will be receiving bids for (New Fleet Building Renovations) at Department of Public Safety, 50 Forest Ave. and 1333 Ohio St. Des Moines, Iowa 50319.

The Iowa Department of Administrative Services anticipates construction to begin on **February 10, 2025**, and end on **August 20, 2025**.

Bids must be received no later than **2:00pm, Tuesday, January 21, 2025**. Late bids will not be considered. Bids shall be submitted on [IMPACS Electronic Procurement System](#). The Bid shall be accompanied by a Bid Security as set forth in the Instructions to Bidders in the amount of 5% of the total bid amount. Each bid shall be accompanied by a bid bond, cashier's check or a certified check drawn upon a solvent bank chartered under the laws of the United States of America.

Bid Opening

The time and place of bid opening will be held at [Join with Google Meet](#) and teleconference number +1 803-574-3735 Pin: 990 263 798# at **3:00pm on January 21, 2025**.

The Iowa Department of Administrative Services reserves the right to reject any and all bids, and to waive irregularities and to accept a bid that is deemed in the best interest of the State of Iowa.

Bidders must comply with all affirmative action/equal employment opportunity provisions of the State of Iowa and the Federal Government.

This project is exempt from Iowa Sales Tax. Davis Bacon Wages **will not** apply to this project.

Questions must be submitted by **4:00pm, January 14, 2024**, to the Issuing Officer.

Bidding documents may stipulate a specific product. Substitute product will be considered if a written request is received by **4:00pm, January 14, 2024**, prior to bid opening. Substitution requests will be considered for all products per Section 01 2500 Substitution Procedures, even if the specification does not include a statement such as "or equal," "equal to," "equivalent to," or "basis of design," unless otherwise noted.

An **optional** Pre-Bid meeting will be held on **Thursday, January 9, 2025, at 1:00pm** at 1333 Ohio St, Des Moines, IA 50314. This meeting is not mandatory but is highly recommended.

Bidding Documents, including drawing sheets bearing the project name DPS DSM New Fleet Building Renovations, Dated 12/20/2024 and the Project Manual prepared by AE dated 12/20/2024, may be obtained from Beeline and Blue by visiting www.beelineandblue.com or by calling (515) 244-1611 on **Thursday, December 26, 2024**.

For further information regarding this project contact:

Katelyn Howells – Issuing Officer

Phone: (515) 721-7856

E-Mail: construction.procurement@iowa.gov

END OF SECTION

SECTION 00 2113
INSTRUCTIONS TO BIDDERS
RFB #941400-01

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Project Description
- B. Owner
- C. State Agency Representatives and Contacts
- D. Proposal Form and Submissions
- E. Taxes
- F. Alternate Bids
- G. Drawings
- H. Bid Security
- I. Due Date and Time for Receipt of Bids
- J. Commencement and Completion Date
- K. Site Visit
- L. Pre-bid Meeting
- M. Questions
- N. Addenda and Interpretations of the Contract Documents
- O. Substitutions
- P. Obligation of Bidder
- Q. Public Records and Requests for Confidential Treatment
- R. Withdrawal of Bid
- S. Bid Closing
- T. Basis of Bids
- U. Informalities/Rejection of Bids
- V. Consideration of Bids
- W. Preference
- X. Qualifications
- Y. Insurance
- Z. Form of Agreement between Owner and Contractor
- AA. Execution of Contract
- BB. Laws and Regulations
- CC. Contract Documents and Order of Precedence
- DD. Conditions of the Work
- EE. Subcontracts
- FF. Project Manual/Drawings

1.02 PROJECT DESCRIPTION

- A. Project Description: New Fleet Building Renovations.

1.03 OWNER

- A. State of Iowa, Department of Administrative Services, 109 SE 13th St, Des Moines, IA 50319

1.04 STATE AGENCY REPRESENTATIVES AND CONTACTS

- A. PURCHASING AGENT: Katelyn Howells – Issuing Officer, State of Iowa, Department of Administrative Services, Hoover State Office Building, 3rd floor, 1305 East Walnut Street, Des Moines, Iowa 50319-0105, Phone: 515-721-7856; email: construction.procurement@iowa.gov

- B. OWNER REPRESENTATIVE: Brandon Adams, State of Iowa, Department of Administrative Services, 109 SE 13th Street, Des Moines, Iowa 50319, Phone: 515-201-2197; email: brandon.adams@iowa.gov
- C. ON-SITE COORDINATOR: Jim Wittenwyler, Director, 215 E 7th St. Des Moines, Iowa 50319, Phone: 515-725-6048; email: wittenwy@dps.state.ia.us
- A. CONSTRUCTION MANAGER CONTACT: Jarrad Boever, DCI Group, 220 SE 6th St. Suite 200 Des Moines, Iowa 50309, Phone: 515-480-8280; email: jarradb@dcigroup-us.com
- D. DESIGN PROFESSIONAL CONTACT: Robert Ormsby, SVPA Architects, 1466 28th St, Suite 200 West Des Moines, Iowa 50266, Phone: 515-327-5990 email: b-ormsby@svpa-architects.com

PART 2 - EXECUTION

3.01 PROPOSAL FORM AND SUBMISSION

- A. A properly prepared and submitted bid is the bidder's responsibility. Bids are to be made in accordance with these Instructions to Bidders and items included on the Bid submission. Failure to comply may be cause for rejection.
- B. The Bid is to consist of the required Bid information, together with the other information specified below to be submitted with the Bid, in which copies are included with these Bidding Documents.
 - 1. The total bid package submitted is required to include the following:
 - a. An online submission including:
 - 1) Required Bid Form (To be uploaded online)
 - 2) Required Non-discrimination Clause Information
 - 3) Required Targeted Small Business Pre-bid Contact Information
 - 4) Bid Security (documentation provided by Bidder) (To be uploaded online) (Required)
 - 5) Certification of Site Visit (To be uploaded online if Pre-Bid is Mandatory)
- C. Include the amount for performing all work described in the drawings and specifications for Base Bid and for each Alternate Bid requested.
- D. Acknowledge receipt of all Addenda issued, where so indicated on the Bid Form
- E. All required information to be submitted, by an officer of the company having authority to bind the company in a contract.
- F. Commencement of the work of the contract shall begin with the Contractor's receipt of a fully executed contract (signed by both parties).
- G. The Owner reserves the right to award a contract for Base Bid only, or for Base Bid in combination with any, or all, identified Alternate Bids. The Owner reserves the right to award a contract for individual Bid Packages, or any combination of Bid Packages. Each Bidder must comply with all of the General Requirements of the project and any requirements of the Project manual that apply to their scope of work.
- H. The company's Federal I.D. Number and the Iowa Contractors Registration Number shall be included in the Bid Form.
- I. Unless indicated otherwise, the Bid shall be for a single responsibility contract for all work as indicated on the Drawings and specified in the Project Manual, and shall be a lump sum amount. If no change in the Base Bid amount is required with respect to consideration of a particular Alternate Bid, enter "No Change" in the blank for that Alternate Bid.
- J. Where so requested, provide Unit Prices for the designated types of work and in the units specified, in which the Unit Prices would be used as adjustments to the quantities described in the instructions as the basis for the Base Bid and any Alternate Bid work. A Unit Price would be applicable in the event the Owner should request additional work of that type beyond the extent and quantity that has been established as the scope of the work by graphic delineation and notations on the Drawings, or by otherwise stipulating in the Bidding Documents a numerical quantity of the work, for the Bidder's use in determining the lump sum bid amount for the Base Bid and any requested Alternate Bid containing such work. The Unit Prices shall also be used to adjust the Contract Amount for actual quantities of work involved when the work subject to Unit

- Price adjustment differs by being less in quantity than that contemplated by the original scope of work for the respective Base Bid or Alternate Bid.
- K. Completed State of Iowa Nondiscrimination Clause information and Subcontractor Targeted Small Business Enterprise Pre-Bid Contact Information, included in these Bidding Documents, are to accompany the Bid submission. Bidders shall comply with all affirmative action/equal opportunity provisions of State and Federal laws. The Owner seeks to provide opportunities for Targeted Small Businesses in accordance with the provisions of Chapter 73 of the Code of Iowa.
 - L. All Bid information is to be submitted online. Any required Bid Security shall be provided, in the form and amount specified elsewhere in these Instructions to Bidders, at the time of submission of the Bid. When a site visit is mandatory as specified elsewhere in these Instructions to Bidders, and a Certificate of Site Visit is required to be submitted with the Bid as evidence of such visit having occurred for purposes of observing the conditions of the site and the work proposed therein, the Certificate shall be uploaded with the bid submission.

3.02 TAXES

- A. In accordance with Section 423 of the Code of Iowa and 701-19 of the Iowa Administrative Rules, Iowa Construction Sales Tax Exemption Certificates for this project will be issued. Do not include Iowa sales tax or use tax, or any local option sales tax, on construction materials in determining your bid prices. The successful Contractor will be required to notify the Department of Administrative Services project manager of all Subcontractors within forty-eight (48) hours after the published date and time by which bids must be submitted. Information on the Contractor and each Subcontractor shall include the firms' name, address, contact person, federal tax identification number, and the Iowa contractor registration number. For the Contractor and each Subcontractor, designate the type of trade or category of work that is to be provided on the project. The Construction Manager for the Department of Administrative Services must be informed when any Subcontractor is added to the project. Following receipt of the information, the Construction Manager for the Department of Administrative Services will arrange to have an authorization letter and certificate (please see sample, included in the Project Manual) issued on behalf of the Contractor and each Subcontractor and will forward the documents to the Contractor for distribution and use by each in purchasing construction materials for this project. Certificates issued for this project shall be used for tax-exempt purchasing construction materials for this project only.

3.03 ALTERNATE BIDS

- A. Bidders are to bid all Alternates requested on the Bid Form. Alternates quoted will be reviewed and accepted or rejected at the option of the Department of Administrative Services. Accepted Alternates will be identified in the Owner-Contractor agreement. Indicate the price for Alternates described, as shown on the Drawings and specified in the Project Manual, and identify in the correct location on the Bid Form.

3.04 DRAWINGS AND PROJECT MANUAL

- A. Drawings and Project Manual are specified in the Notice to Bidders or any extension thereof made by Addendum.

3.05 BID SECURITY

- A. Each Bid shall be accompanied by Bid Security.
- B. The Bid Security shall be in the form of a Bid Bond, Certified check, or Cashier's check in an amount not less than five percent (5%) of the maximum value of the Bid, including any additive Alternates. NOTE: Checks other than Certified checks and Cashier's checks will not be accepted. Bonds shall be issued by a bonding company licensed to transact business in the State of Iowa. The Attorney in Fact who signs the Bond shall file with the Bond a certified and effectively dated copy of their Power of Attorney. The Bid Security shall be made payable to the Iowa Department of Administrative Services, and shall accompany the Bid. If a Bid Bond is not

used, copies of Certified checks or Cashier's checks must be uploaded and hand delivered, in a sealed envelope, or mailed upon request. The Bid Security shall serve as a guarantee that a Bidder who is offered a contract will enter into an Agreement with the State of Iowa and will file an approved surety company's Performance Bond, Payment Bond and the Insurance Certificates as evidence of the required Insurance prior to execution of the contract. Upon failure to comply, the Bid Security shall be forfeited as liquidated damages. The governmental entity shall retain the bid security furnished by the successful bidder until the approved contract form has been fully executed, a bond has been filed by the bidder guaranteeing the performance of the contract, and the contract and bond have been approved by the governmental entity. The provisions of chapter 573, where applicable, apply to contracts awarded under this chapter. The governmental entity shall promptly return the checks or bidder's bonds of unsuccessful bidders to the bidders once the Notice of Intent to Award is issued.

3.06 DUE DATE AND TIME FOR RECEIPT OF BIDS

- A. Properly completed Bids shall be submitted online through [IMPACS Electronic Procurement System](#), no later than the time and date specified in the Notice to Bidder or any extension thereof made by Addendum. Written, emailed, oral or telephonic Bids are invalid, and will not receive consideration. The Bidder shall assume full responsibility for the timely online submission of the Bid. Late bids will not be accepted.

3.07 COMMENCEMENT AND COMPLETION DATES

- A. Commencement of the Work of the Contract shall be the day of receipt by the selected Contractor of the fully-executed contract. Final completion of the Work of the contract shall be acknowledged as a part of the Contractor's proposal.

3.08 SITE VISIT

- A. A site visit by the prospective bidder is highly recommended at the time of the Pre-Bid Meeting of this project.

3.09 PRE-BID MEETING

- A. Pre-Bid Meeting will be specified in the Notice to Bidders or any extension thereof made by Addendum.

3.010 QUESTIONS

- A. Questions on this project may be raised and discussed at the time of the Pre-Bid Meeting or by submitting in writing to the issuing officer as specified in the Notice to Bidders or any extension thereof made by Addendum.

3.011 ADDENDA AND INTERPRETATIONS OF THE CONTRACT DOCUMENTS

- A. Any person contemplating submitting a proposal for the proposed Contract, who is in doubt as to the true meaning of any part of the Bidding Documents, shall submit a written request for an interpretation thereof. The person submitting a request will be responsible for its prompt delivery. Every request for such interpretation should reference the Bid Number specified in the Bidding Documents, and shall be made in writing (email preferred). Questions shall be submitted to the previously identified Purchasing Agent for the Department of Administrative Services. To be given consideration, requests shall be received as specified in the Notice to Bidders or any extension thereof made by Addendum. Replies, which revise or correct the Bidding Documents, or provide necessary clarifications, will be issued in the form of a written Addendum to the Bidding Documents. Interpretations, corrections or changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon such interpretations, corrections, or changes. The Bidder is to include any resultant cost changes in the Bid Sum.

Addenda will be posted electronically at the respective bid site where the bid is initially posted. Acknowledgment by the Bidder of each issued Addendum shall be noted in the location so indicated on the Bid. All Addenda issued shall become part of the Contract Documents.

3.012 SUBSTITUTIONS

- A. Where the Bidding Documents stipulate a specific product be provided by naming one or more manufacturer and model, a substitute product will be considered when a written request is received as specified in the Notice to Bidders or any extension thereof made by Addendum prior to bid opening. Substitution requests will be considered for all products per Section 01 2500 Substitution Procedures, even if the specification does not include a statement such as “or equal,” “equal to,” “equivalent to,” or “basis of design,” unless otherwise noted. Substitution requests shall be emailed to the Issuing Officer at the email address provided in Instructions to Bidders Section 1.04.

3.013 OBLIGATION OF BIDDER

- A. It shall be the responsibility of each Bidder contemplating the submission of a Bid for the proposed Contract to fully acquaint himself/herself with conditions at the work site, project requirements, and to become acquainted thoroughly with the work, and all conditions that may be related to it. No considerations or revision in the contract price or scope of the project will be considered by the Owner for any item that could have been revealed by a thorough on-site inspection and examination.
- B. By submission of a Bid, it shall be understood that the Bidder assures that he/she has reviewed and is thoroughly familiar with the project requirements, contract conditions and supplementary conditions, the drawings, specifications, addenda, and that the bidder is aware of the conditions existing at the site that may relate to the work of this project. Failure of any Bidder to examine any form, document, or other instrument shall in no way relieve the Bidder from any obligation in respect to his/her Bid.

3.014 PUBLIC RECORDS AND REQUESTS FOR CONFIDENTIAL TREATMENT

- A. The Agency’s release of public records is governed by Iowa Code chapter 22. Contractors are encouraged to familiarize themselves with Chapter 22 before submitting a Proposal. The Agency will copy and produce public records upon request as required to comply with Chapter 22 and will treat all information submitted by a Contractor as non-confidential records unless Contractor requests specific parts of the Proposal be treated as confidential at the time of the submission as set forth herein AND the information is confidential under Iowa or other applicable law.
- B. A Contractor requesting confidential treatment of specific information must: (1) fully complete Form 22 (Available at <https://das.iowa.gov/sites/default/files/procurement/pdf/Form%2022-ConfidentialityRequest-RFB.pdf>), (2) identify the request in the transmittal letter with the Contractor’s Proposal, (3) conspicuously mark the outside of its Proposal as containing confidential information, (4) mark each page upon which confidential information appears, and (5) submit a “Public Copy” from which the confidential information has been excised.
- C. Form 22 will not be considered fully complete unless, for each confidentiality request, the Contractor: (1) enumerates the specific grounds in Iowa Code chapter 22 or other applicable law that supports treatment of the material as confidential, (2) justifies why the material should be maintained in confidence, (3) explains why disclosure of the material would not be in the best interest of the public, and (4) sets forth the name, address, telephone, and e-mail for the person authorized by Contractor to respond to inquiries by the Agency concerning the confidential status of such material.
- D. The Public Copy from which confidential information has been excised is in addition to the number of copies requested in Section 3 of this RFP. The confidential material must be excised in such a way as to allow the public to determine the general nature of the material removed and to retain as much of the Proposal as possible.
- E. **Failure to request information be treated as confidential as specified herein shall relieve Agency and State personnel from any responsibility for maintaining the information in**

confidence. Contractors may not request confidential treatment with respect to pricing information and transmittal letters. A contractor's request for confidentiality that does not comply with this section or a contractor's request for confidentiality on information or material that cannot be held in confidence as set forth herein are grounds for rejecting contractor's Proposal as non-responsive. Requests to maintain an entire Proposal as confidential will be rejected as non-responsive.

- F. If Agency receives a request for information that Contractor has marked as confidential and if a judicial or administrative proceeding is initiated to compel the release of such material, Contractor shall, at its sole expense, appear in such action and defend its request for confidentiality. If Contractor fails to do so, Agency may release the information or material with or without providing advance notice to Contractor and with or without affording Contractor the opportunity to obtain an order restraining its release from a court possessing competent jurisdiction. Additionally, if Contractor fails to comply with the request process set forth herein, if Contractor's request for confidentiality is unreasonable, or if Contractor rescinds its request for confidential treatment, Agency may release such information or material with or without providing advance notice to Contractor and with or without affording Contractor the opportunity to obtain an order restraining its release from a court possessing competent jurisdiction.

3.015 WITHDRAWAL OF BID

- A. A Bid may be modified or withdrawn only before the time and date for receipt of Bids. Said request for modification or withdrawal of a bid must be completed online through [IMPACS Electronic Procurement System](#). A Bid shall remain valid for consideration by the Owner for the following period(s) of time after the date specified for receipt of Bids, or until such time following that period that the apparent low bidder requests in writing that the Bid be withdrawn, after which the Bid may be withdrawn without forfeiture of any required Bid Security. The Bid shall be valid for not less than thirty (30) calendar days after the date Bids are specified to be due. With the approval of the Department of Administrative Services, a bid may be withdrawn after opening, but only if the bidder provides prompt written notification that adequately documents the commission of an honest error that may cause undue financial loss.

3.016 BID OPENING

- A. All bids received on or before the due date and time specified in the Notice to Bidder or any extension thereof made by Addendum will be opened and the name of the Bidder and the amount of their Bid will be announced.

3.017 BASIS OF BIDS

- A. The Bidder shall include all additional documents or appendices that are requested to be submitted concurrent with the Bid submission; failure to comply may be cause for rejection.
- B. In accordance with Iowa law, Section 8A.311: A bidder, to be considered for an award of a state construction contract, shall disclose to the state agency awarding the contract the names of all subcontractors and suppliers who will work on the project being bid, within forty-eight (48) hours after the published date and time by which bids must be submitted. A bidder shall not replace a subcontractor or supplier disclosed without the approval of the state agency awarding the contract.
1. A bidder, prior to an award or who is awarded a state construction contract, shall disclose all of the following, as applicable:
- If a subcontractor or supplier disclosed (under the preceding) by a bidder is replaced, the reason for replacement and the name of the new subcontractor or supplier;
 - If the cost of work to be done by a subcontractor or supplier is changed or if the replacement of a subcontractor or supplier results in a change in the cost, the amount of the change in cost.
 - Any reduction in subcontractor or supplier price as a result of the change, if the change is approved by the Owner, shall be deducted from the Trade Contract via a deductive

Change Order. Any such changes, if approved by the Owner, which result in an increase in the Trade Contract Price shall be borne by the Trade Contractor.

- C. The Bidder is specifically advised that any person, firm or other party to whom it is proposed to award a subcontract under this contract must:
 - 1. Be registered in the State of Iowa and have an Iowa Contractor's Registration number, and
 - 2. Be acceptable to the Owner.

3.018 INFORMALITIES/ REJECTION OF BIDS

- A. The Iowa Department of Administrative Services reserves the right to waive any irregularities or informalities and to enter into a Contract with a Bidder, or to reject any or all bids as it deems to be in the best interest of the State, without penalty.

3.019 CONSIDERATION OF BIDS

- A. It is the intent of the Department of Administrative Services to award a Contract to the lowest responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and is determined to be compliant with all Bidding Requirements, and does not exceed the funds available for construction.
- B. Bidder is to bid on each Alternate Bid requested. Failure to do so may result in disqualification of the bid. The Department of Administrative Services reserves the right to accept any, or no, Alternate Bid. Alternate Bids may be considered in any order or combination, and the low successful Bidder will be determined on the basis of the sum of the Base Bid and the Alternate(s) accepted at the time of the Contract award.
- C. In evaluating Bids, any proposal offered by a Bidder for an alternate design, or for materials other than those shown or specified for the Base Bid or for Alternate Bid construction under the proposed Construction Documents or called for by any issued Addenda to those Construction Documents, will not be considered in determining the low successful Bidder. However, the Department of Administrative Services reserves the right to consider any such Bidder-proposed (Contractor's Alternate) alternate designs or materials with the low successful Bidder, after the low successful Bidder is determined in the manner described above (A and B).
- D. Notice of Intent to Award the Bid(s) will be sent to all Respondents submitting a timely Bid and may be posted at the website shown on the RFB cover sheet. Negotiation and execution of the Contract(s) shall be completed no later than fifteen (15) days from the date of the Notice of Intent to Award or such other time as designated by Agency. If the successful Bidder fails to negotiate and deliver an executed Contract, including all required documents such as payment and performance bonds and insurance certificate, by that date, the Agency, in its sole discretion, may cancel the award and award the Contract to the remaining Bidder the Agency believes will provide the best value to the State.

3.020 PREFERENCE

- A. By virtue of statutory authority, a preference shall be given to Iowa domestic labor, products produced and provisions grown within the state of Iowa, in accordance with the provisions of Chapter 73, Code of Iowa and any amendments thereto.
- B. Enforcement of reciprocal resident bidder preference and resident labor force preference codified at Iowa Code Section 73A.21.
 - 1. NOTICE: Failure on the part of the bidder to carefully read the following paragraphs and to provide the information requested below may make the bidder's bid materially nonresponsive and therefore ineligible for contract award. Violations of Iowa Code Section 73A.21 may, among other things, result in civil penalties assessed by the Commissioner of the Division of Labor of Iowa Workforce Development. The bidder should seek out the advice of an attorney if he or she has questions about Iowa Code Section 73A.21. As a part of the competitive procurement of contracts for Public Improvements that must be awarded to the low bidder (if the bid is responsive and the bidder is deemed responsible), Public Bodies shall allow a preference to Resident Bidders if a Nonresident Bidder places a bid for the contract for the

Public Improvement and that Nonresident Bidder's state or foreign country gives resident bidders of that state or foreign country a preference (including a labor force preference or any type of preferential treatment). The preference allowed, or reciprocally applied, shall be equal to the preference given or required by the state or foreign country in which the Nonresident Bidder is a resident bidder.

"Public Body" means the State of Iowa (and its agencies) and any of its political subdivisions, including school districts, public utilities, and the state board of regents.

"Public Improvement" means a building or other construction work to be paid for in whole or in part by the use of funds of the State of Iowa, its agencies, and any of its political subdivisions and includes road construction, reconstruction, and maintenance projects.

"Resident Bidder" means a person or entity authorized to transact business in of the State of Iowa and having a place of business for transacting business within the State of Iowa at which it is conducting and has conducted business for at least three years prior to the date of the first advertisement for the public improvement. Note, however, that if a nonresident bidder's state or foreign country has a more stringent definition of a resident bidder, the more stringent definition is applicable as to bidders from that state or foreign country.

"Nonresident Bidder" means a person or entity who does not meet the definition of a resident bidder.

- C. Nonresident bidders shall be required to certify on the Bid submission, where so indicated, the state or foreign country in which the firm is a resident, and if that state or foreign country uses a percentage for in-state bidders and the amount of the preference.
- D. If it is determined that this may cause denial of federal funds which would otherwise be available, or would otherwise be inconsistent with requirements of federal law, this section shall be suspended, but only to the extent necessary to prevent denial of the funds or to eliminate the inconsistency with federal requirements.

3.021 QUALIFICATIONS

- A. In accordance with Iowa Code 26.9(2) and 26.16, no potential bidder shall be required to provide confidential or proprietary information or meet any class requirements as a precondition to submitting a responsive bid. However, as noted in Iowa Code 26.9(2), the lowest responsive bidder may be required to provide additional information to verify responsibility prior to and as a condition of obtaining final award of the contract. Any qualification requirements contained in any bid document indicates only preferred qualifications, not a precondition to bid, and the lowest responsive bidder's qualifications will be evaluated individually based on all information provided.
- B. The Owner may make such investigations as he or she deems necessary to determine the ability of the awarded Bidder to perform the required work, and the awarded Bidder shall furnish to the Owner all such information and data for this purpose. The Owner reserves the right to rescind any awarded Bid if the evidence submitted by, or in investigation of, such Bidder fails to satisfy the Owner that the Bidder is properly qualified to carry-out the obligations of the Contract and to complete the Work contemplated therein.
- C. Bidders shall be registered as a Construction Contractor with the Labor Commissioner, Iowa Workforce Development Department, as required by Chapter 91C of the Code of Iowa. Bidder's Iowa Contractor Registration Number shall be included in the location provided in the Bid Form.
- D. Non-resident corporations submitting bids must be in compliance with Section 490.1501 of the Code of Iowa and legally authorized thereby to carry-on such business in the State of Iowa as is required by the Contract Documents.
- E. An out-of-state Bidder, if awarded a contract, will be required to submit evidence of authorization to do business in the State of Iowa.

3.022 INSURANCE

- A. Insurance Requirements
 - 1. The Contractor shall maintain in effect, with insurance companies of recognized responsibility, at its expense, insurance covering its work of the type and in amounts required by this Contract. The Contractor's insurance shall, among other things, insure against any loss or damage resulting from the Contractor's performance of this Contract. All such

insurance policies shall remain in full force and effect for the entire life of this Contract and shall not be canceled or changed except after thirty (30) days written notice to the Owner.

2. **Amounts of Insurance Required – Refer to ConsensusDOCS 802 (see template in Project Manual)**
- B. Certificates of Coverage
 1. Certificates of the insurance described above shall be submitted to the Owner before starting any construction activities and shall be subject to approval by the Owner. The Contractor shall provide certificates for the insurance required. The insurer shall state in the certificate that no cancellation of the insurance will be made without at least thirty (30) days prior written notice to the Contractor. Upon receipt of any notice of cancellation or alteration, Contractor shall within ten (10) days procure other policies of insurance, similar in all respects to the policy or policies, about to be canceled or altered, and, if the Contractor fails to provide, procure, and deliver acceptable policies of insurance, or satisfactory evidence thereof, in accordance with the terms hereof then, at the Owner's option, Owner may obtain such insurance at the cost and expense of Contractor, without the need of any notice to Contractor.
- C. No Limitation of Liability
 1. Acceptance of the insurance certificates by the Owner shall not act to relieve the Contractor of any obligation under this Contract. All insurance policies and certificates shall be issued only by companies authorized to transact business in the State of Iowa. It shall be the responsibility of the Contractor to keep the respective insurance policies and coverage's current and in force during the life of this agreement.
 2. A Sample Certificate of Insurance is attached for reference following this Section.

3.023 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

- A. The Agreement for the Work will be written on ConsensusDOCS 802 Form of Agreement between Owner and Contractor (sample of the document with modifications incorporated is bound in this Project Manual).

3.024 EXECUTION OF CONTRACT

- A. Contract documents shall mean and include the following:
 1. Contract: ConsensusDOCS 802
 2. Performance and Payment Bonds
 3. Project Manual
 4. Drawings
 5. Numbered Addenda issued after initial publication of Bid Documents
 6. Numbered Modifications (Change Orders) issued after Contract is signed

3.025 LAWS AND REGULATIONS

- A. The Bidder's attention is directed to the fact that all applicable laws and regulations of Federal and State agencies having jurisdiction over the construction of this project shall apply to any contract resulting from this proposal, and it shall be deemed that those rules and regulations are made a part of such contract the same as if set forth in their entirety therein. By submitting a Bid, the Bidder confirms that he/she is familiar with and understands the Contractor's responsibility under all Federal and State of Iowa laws and regulations with respect to the Work described by the proposed Contract Documents.

3.026 CONTRACT DOCUMENTS AND ORDER OF PRECEDENCE

- A. Where an irreconcilable conflict exists among Applicable Legal Requirements, this Contract, the specifications in the Materials and the Drawings, the earliest item mentioned in this sentence involving a conflict shall control over any later mentioned item or items subject to such conflict unless doing so would result in reducing the Bidder's duty of care or obligations under this

Contract, in which case the terms resulting in the highest requirements for Bidder performance shall control.

3.027 CONDITIONS OF THE WORK

- A. Each bidder must fully inform him/herself of the conditions under which the work is to be performed at the site of the work, the obstacles which may be encountered, and all other relevant matters concerning the work to be performed. Failure to do so will not relieve a successful bidder of the obligation to furnish all material and labor necessary to carry out the provisions of the contract. When a site visit is required by provisions located elsewhere in these Instructions to Bidders, as a site tour in conjunction with a mandatory Pre-Bid Meeting, it shall be the Bidder's responsibility to fulfill this obligation as a condition of bidding the Work described in the Bidding Documents.
- B. No allowance will be made for any additional compensation by reason of any matter or condition with which the bidder might have fully informed him/herself, but failed to do so prior to bidding. Insofar as possible, the Contractor and all subcontractors shall employ such methods or means in carrying out the work so as not to cause any interruption of, or interference with, the work of any other subcontractor or trade.

3.028 SUBCONTRACTS

- A. The Prime Contractor shall be responsible for notifying all subcontractors and suppliers and informing them that they are bound in each case by all applicable provisions of the bidding information and those of the proposed Form of Agreements as defined in the Contract Documents.

END OF SECTION

SECTION 00 2113.01

IMPACS Public Construction Bidders User Guide

Public construction bids must be submitted on-line at [IMPACS Electronic Procurement System](#).

Bidders must be registered in IMPACS to submit a Bid.

To create an account, enter your email address and click on “Next” and click “Create Account”. Bidder must enter all fields noted with * including legal company name, contact first and last name, phone number, confirm email address, password, re-enter password, select account recovery question including answer, confirm answer, select box accepting websites use terms and conditions and select security check box “I’m not a robot”.

On the [IMPACS Electronic Procurement System](#) Customer Portal Home page, Bidder selects “View Event” in the Sourcing Events section.

Sourcing Events ?

Show Opening or Closing Soon ▾ [Go to Public Opportunities](#)

Event Number	Status	Event Title	Dates	Action
RFB923700-02	Open	Hoover East Side Pavers	Open: 4/27/2022 12:00:00 PM CDT Close: 5/5/2022 12:00:00 PM CDT	View Event ▾

Bidders can view event details including description, prerequisites, buyer attachments, questions and answers.

To submit a Bid, Bidder must select “**Yes, I intend to Bid**”. Bidder must complete the following sections.

Prerequisites - Bidder must complete all prerequisites.

- Bidder must upload a file of the Bid Security/Bond for 5% of total Bid Amount and certify that if they are awarded the construction contract, they will enter into the contract at the Bid Amount submitted.
- Bidder must upload the completed and signed Bid Form.
NOTE: Bids are to be entered on the Bid Form only; not in the IMPACS. As a result, IMPACS will display a bid amount of \$0.

Questions - Bidder must complete all questions.

Review & Submit - Bidder must select the certification box certifying that the statements and information in response are true and correct to the best of their knowledge and belief.

SECTION 00 3113

PRELIMINARY SCHEDULE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Preliminary Construction Schedule
- B. Schedule Durations

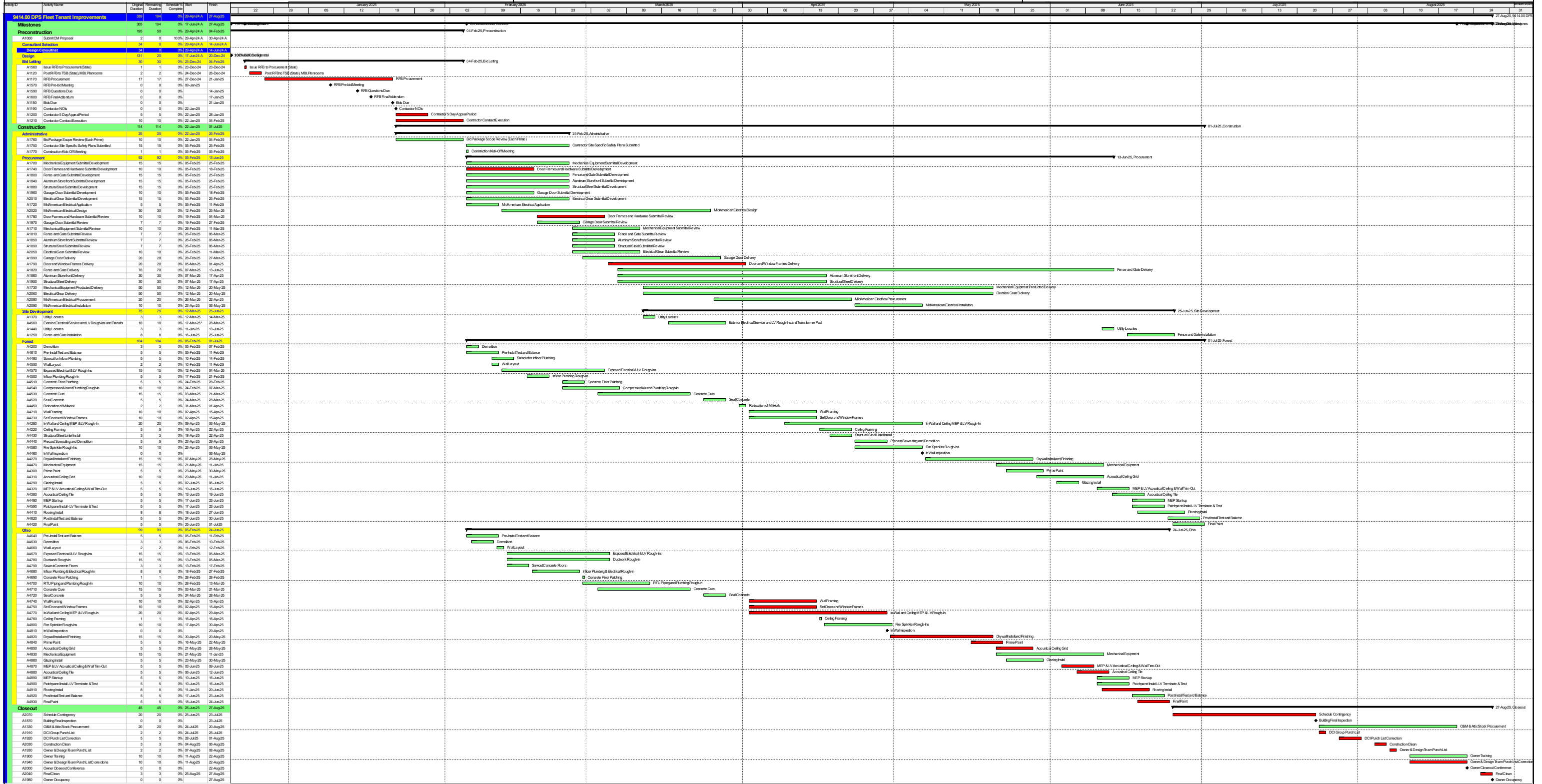
1.02 PRELIMINARY SCHEDULE

- A. A preliminary schedule has been identified by the Owner for the implementation of the Project. Refer to the schedule following this Section for references to anticipated milestones and construction duration.
- B. Each step of the Preliminary Schedule is subject to receipt of acceptable bids, Owner's decision process and date of commencement.
- C. A proposed construction schedule shall be submitted by all Trade Contractors to the Construction Manager no later than 48 hours prior to the pre-construction meeting. A revised Construction Schedule will be submitted by the Construction Manager once all preliminary schedules are reviewed and approved by the Owner.
- D. The final construction schedule will be established post award of bids with the cooperation of all contractors.

1.03 SCHEDULE DURATIONS

- A. Anticipated Notice of Intent to Award – 01/24/2025
- B. Anticipated Date of Commencement – 02/10/2025
- C. Substantial Completion by – 06/24/2025

END OF SECTION



■ Actual Work
 ■ Critical Remaining Work
 Summary
■ Remaining Work
 ◆ Milestone

SECTION 00 3126

EXISTING HAZARDOUS MATERIAL INFORMATION

PART 1 - GENERAL

1.01 EXISTING HAZARDOUS MATERIAL INFORMATION

1. Hazardous materials testing has not been completed at this time. It is the State of Iowa's intention to get hazardous materials testing completed once the owners take possession of the building on December 30, 2024.
2. Once hazardous materials testing has been completed the state will take care of any abatement needed based off the hazardous materials report. Report will be shared with via addendum.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 00 3143

PERMIT APPLICATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Permit Application Information
- B. Licenses, Permits, and Related Inspections

1.02 PERMIT APPLICATION INFORMATION

- A. State Building Code Plan Review: The plan review and inspections for this project have been applied for by the Architect. Please contact your inspector prior to construction and occupancy.
- B. Other Applicable inspections: Trade Contractor is responsible for any other applicable project specific permits and inspections.

1.03 LICENSES, PERMITS, AND RELATED INSPECTIONS

- A. The Bidder shall comply with all codes, laws, ordinances, rules and regulations of any public authority having jurisdiction that bears on the performance of its work. All construction, materials and methods shall comply with the State Building Codes, except where plans and specifications establish a higher standard.

END OF SECTION

SECTION 00 4116

BID FORM

The Bid Form must be submitted online through the State's [IMPACS Electronic Procurement System](#).

RFB #941400-01

BID FORM for CONSTRUCTION CONTRACT
for
New Fleet Building Renovations
50 Forest Ave and 1333 Ohio Street
Des Moines, Iowa 50319
Project 9414.00

Iowa Department of Administrative Services
Hoover State Office Building, Level 3
1305 East Walnut Street
Des Moines, Iowa 50319-0105

The following information is to be completed and submitted with your bid..

1. Bid Form - Completed and Signed (to be uploaded with bid submission)
2. Non-Discrimination Clause Information
3. Contractor Targeted Small Business Enterprise Pre-Bid Contract Information
4. Bid Security – 5% of total Bid amount (to be uploaded with bid submission)

Authorized Representative:

The undersigned Bidder, in response to your Request for Bid for construction of the above project, having examined the Drawings, Specifications, and other Bidding Documents dated November 22, 2024, and Addenda issued and acknowledged below as received and being familiar with all the conditions surrounding the construction of the proposed project including the availability of materials and labor, hereby proposes to furnish all labor, materials, equipment and supplies to perform all work to construct the project in strict accordance with the proposed Contract Documents, within the time and at the prices stated below. Prices are to cover all expenses incurred in performing the work required under the proposed Contract Documents, of which this bid is a part.

Bidder acknowledges receipt of the following Addenda which are a part of the Bidding Documents and for which any effect on cost of the Work is included in the bid amounts indicated:

Number _____ _____ _____ _____ _____

Dated _____ _____ _____ _____ _____

Note that the State of Iowa is exempt from State and Local sales and use taxes (including local option and school option) for this project. Taxes on construction materials shall NOT be included in the bid amounts.

Amounts shall be indicated in both words and figures. In case of discrepancy, the amount indicated in words shall govern.

BID PACKAGES:

BP 01

Description: General Construction

Bidder proposes and agrees to perform all work as described in the Construction Documents for the sum of:

_____ Dollars
(\$_____).

BP 02

Description: Mechanical and Plumbing

Bidder proposes and agrees to perform all work as described in the Construction Documents for the sum of:

_____ Dollars
(\$_____).

BP 03

Description: Fire Suppression

Bidder proposes and agrees to perform all work as described in the Construction Documents for the sum of:

_____ Dollars
(\$_____).

BP 04

Description: Electrical and Low Voltage

Bidder proposes and agrees to perform all work as described in the Construction Documents for the sum of:

_____ Dollars
(\$_____).

ALTERNATES:

ALT 01

Description: Ohio Building: Provide Demolition of existing Office O112 and Restroom O113 and replace with new construction/reconfiguration for Office O112 and Restroom O113.

Bidder proposes and agrees to perform all work as described in the Construction Documents for the sum of:

_____ Dollars
(\$_____).

ALT 02

Description: Ohio Building: New construction of Conference Room O108, Interview O109, Interview O110 and Hallway O111.

Bidder proposes and agrees to perform all work as described in the Construction Documents for the sum of:

_____ Dollars
(\$_____).

ALT 03

Description: Ohio Building: Demolition of existing construction and new construction of Training Room O116.

Bidder proposes and agrees to perform all work as described in the Construction Documents for the sum of:

_____ Dollars
(\$_____).

ALT 04

Description: Ohio Building: New construction of Evidence Storage Room O115.

Bidder proposes and agrees to perform all work as described in the Construction Documents for the sum of:

_____ Dollars
(\$_____).

ALT 05

Description: Forest Building: New construction of Cold Storage Room F118 and Office F117.

Bidder proposes and agrees to perform all work as described in the Construction Documents for the sum of:

_____ Dollars
(\$_____).

ALT 06

Description: Forest Building: New construction of DNR Storage F110.

Bidder proposes and agrees to perform all work as described in the Construction Documents for the sum of:

_____ Dollars
(\$_____).

Bidder hereby certifies that:

1. This bid is genuine and is not made in the interest of or on behalf of any undisclosed person, firm or corporation;
2. Bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid; Bidder has not solicited or induced any person, firm or corporation to refrain from bidding; and Bidder has not sought by collusion to obtain any advantage over any other bidder or over the Owner.
3. Bidder hereby certifies that the Bidder is registered with the Iowa Labor Commissioner as a Contractor as required by Chapter 91C, Code of Iowa.
4. Bidder agrees to comply with all Federal and State Affirmative Action/Equal Employment Opportunity requirements concerning fair employment and will not discriminate between or among them by reason of race, color, religion, sex, national origin or physical handicap.
5. All construction under this Contract shall conform to the requirements of the *Iowa State Building Code*.
6. Bidder agrees that this bid shall remain valid and shall not be withdrawn for a period of thirty (30) calendar days after the date for receipt of bids.
7. Bidder agrees that if written notice of acceptance of this bid is mailed, emailed, or delivered to the undersigned within thirty (30) days after the date in which bids are due, or at any time thereafter before it is withdrawn, the undersigned will sign and return the Contract Agreement, prepared in accord with the Bidding Documents and this bid as accepted; and will also provide proof of insurance coverage and required surety bonds.
8. Bidder understands that the Owner reserves the right to reject any and all bids, and to waive irregularities or informalities and enter into a contract for the work, as the Owner deems to be in the best interest of the State.
9. Bidder understands that the Owner reserves the right to accept any, or no, Alternate Bid, if requested, and that the Alternate Bids may be considered in any order or combination, and the low Bidder shall be determined on the basis of the sum of the base bid and any Alternate(s) accepted.

Subcontractors:

The Trade Contractor must identify all Subcontractors and Suppliers within 48 hours of the published date and time for which bids must be submitted, in accordance with Iowa Code Section 8A311, as amended by House File 646 in 2011. Subcontractors and suppliers may not be changed without the approval of the Owner. Requests for changing a Subcontractor or supplier must identify the reason for the proposed change, the name of the new Subcontractor or supplier, and the change in the subcontractor or supplier price as a result of the change. Any reduction in subcontractor or supplier price as a result of the change, if the change is approved by the Owner, shall be deducted from the Trade Contract Price via a deductive Change Order. Any such changes, if approved by the Owner, which result in an increase in the Trade Contract Price shall be borne by the Trade Contractor.

Enforcement of Reciprocal Resident Bidder Preference, per Iowa Code 73A.21.

All bidders shall either check the box next to "Resident Bidder" or check the box next to "Nonresident Bidder" and by doing so and signing thereafter certifies and attests to the same. All information requested must be provided. Seek out the advice of an attorney if you have questions.

"Resident Bidder" means a person or entity authorized to transact business in of the State of Iowa and having a place of business for transacting business within the State of Iowa at which it is conducting and has conducted business for at least three years prior to the date of the first advertisement for the public improvement. Note, however, that if a nonresident bidder's state or foreign country has a more stringent definition of a resident bidder, the more stringent definition is applicable as to bidders from that state or foreign country.

Resident Bidder

Name of Resident Bidder: _____

By: _____
Authorized Agent and Signatory of Resident Bidder

OR:

Nonresident Bidder

Name of Nonresident Bidder: _____

Name of State or Foreign Country of Nonresident Bidder: _____

Particularly identify and describe any preference, labor preference, or any other type of preferential treatment, in effect in the nonresident bidder's state or foreign country at the time of this bid:

NOTICE: Nonresident Bidders domiciled in a state or country with a resident labor force preference shall make and keep, for a period of not less than three years, accurate records of all workers employed on the public improvement. The records shall include each worker's name, address, telephone number when available, social security number, trade classification, and the starting ending time of employment.

By: _____
Authorized Agent and Signatory of Nonresident Bidder

Bid Form shall be signed by an officer of the company with authority to bind in a contract. Notice of acceptance of this bid, or request for additional information by the Department of Administrative Services, may be addressed to the undersigned at the address set forth below:

Legal Name of Firm: _____

Date: _____

Signature of Bidder: _____

Title: _____

Typed Name of Signatory: _____

Email: _____

Business Address:

Telephone Number: _____ Fax Number: _____

Federal Tax Identification Number: _____

Iowa Contractor Registration Number: _____

Bidder Safety Manager Name: _____

For an out-of-state Bidder, Bidder certifies that the Resident Preference given by the State or Foreign Country of Bidder's residence, _____, is _____ %.

END OF SECTION

SECTION 00 4116.01

NON-DISCRIMINATION CLAUSE

This Section is for informational purposes only. All information will be submitted online through the State's [IMPACS Electronic Procurement System](#).

PART 1 - GENERAL

All contractors, subcontractors, vendors and suppliers of goods and services doing business with the State of Iowa and value of said business equals or exceeds \$10,000 annually, agree as stated below.

1.01 NONDISCRIMINATION CLAUSE

- A. The contractor, subcontractor, vendor and supplier of goods and services will not discriminate against an employee or applicant for employment because of race, creed, color, sex, national origin, ancestry, religion, economic status, age, disability, political opinion, or affiliations of an applicant or employee based upon the nature of the job occupation. The contractor, subcontractor, vendor and supplier will develop an Affirmative Action Program to insure that applicants are employed and that employees are treated during employment without regard to their race, creed, color, sex, national origin, ancestry, religion, economic status, age, disability, political opinions or affiliations. Such action shall include, but not be limited to the following:
 - 1. Employment.
 - 2. Upgrading.
 - 3. Demotion or transfer.
 - 4. Recruitment and advertising.
 - 5. Layoff or termination.
 - 6. Rates of pay or other forms of compensation.
 - 7. Selection for training, including apprenticeship.
- B. The contractor, subcontractor, vendor and supplier of goods and services will, in all solicitations or advertisements for employees, state that all qualified applicants will receive consideration for employment without regard to race, creed, color, sex, national origin, ancestry, religion, economic status, age, disability, political opinion or affiliations.
- C. The contractor, subcontractor, vendor and supplier or their collective bargaining representative will send to each labor union or representative or workers with which they have a collective bargaining agreement or other contract or understanding, a notice advising the said labor union or workers' representative of the contractor's commitments under this section.
- D. The contractor, subcontractor, vendor and supplier of goods and services will comply with all published rules, regulations, directives and orders of the State of Iowa Affirmative Action Program Contract Compliance Provisions.
- E. The contractor, subcontractor, vendor and supplier of goods and services will furnish and file compliance reports within such time and upon such forms as provided by the Equal Employment Opportunity Officer, said forms may elicit information as to the policies, procedures, patterns, and practices of each subcontractor as state as the contractor themselves and said contractor, subcontractor, vendor and supplier will permit access to their employment books, records and accounts to the State's Equal Employment Opportunity Officer, for the purpose of investigation to ascertain compliance with this Contract and with rules regulations of the State's Affirmative Action Program.
- F. In the event of the contractor's noncompliance with the nondiscrimination clauses of this Contract or with any of such rules, regulations and orders; this Contract may be canceled, terminated or suspended in whole or in part and the Contractor may be declared ineligible for further contracts in accordance with procedures authorized by the State of Iowa.

- G. The contractor, subcontractor, vendor and supplier of goods and services will include, or incorporate by reference, the provisions of the nondiscrimination clause in every contract, subcontract or purchase order unless exempted by the rules, regulations or orders of the State's Affirmative Action Program, and will provide in every subcontract or purchase order that said provisions will be binding upon each contractor, subcontractor or seller.
- H. The parties agree to comply with "Compliance with the Law; Nondiscrimination in Employment" of the current Terms and Conditions at the award of this contract. Current Terms and Conditions may be found on the following web site and are, by this reference, made a part of this Agreement. <https://das.iowa.gov/procurement/terms-and-conditions>
- I. We certify and recognize that we are morally and legally committed to nondiscrimination in employment. Any person who applies for employment with our company will not be discriminated against because of race, creed, color, sex, national origin, ancestry, religion, economic status, age or disabilities, unless disabilities are based upon the nature of the job occupation.

END OF SECTION

SECTION 00 4116.02

TARGETED SMALL BUSINESS INFORMATION

This Section is for informational purposes only. All information will be submitted online through the State's [IMPACS Electronic Procurement System](#).

PART 1 - GENERAL

1.01 TARGETED SMALL BUSINESS INFORMATION

- A. Subcontractor Targeted Small Business Enterprise Pre-Bid Contact Information, including subcontractor and dollar amount to be subcontracted, is to accompany the Bid submission. Bidders shall comply with all affirmative action/equal opportunity provisions of State and Federal laws. The Owner seeks to provide opportunities for Targeted Small Businesses in accordance with the provisions of Chapter 73 of the Code of Iowa.

- B. [Search the Targeted Small Business Directory](#) for certified State of Iowa Targeted Small Businesses.

END OF SECTION

IOWA DEPARTMENT OF ADMINISTRATIVE SERVICES
 SUBCONTRACTOR
 TARGETED SMALL BUSINESS ENTERPRISE
 PRE-BID CONTRACT INFORMATION

CONTRACTOR	BID NO.
CONTRACTOR	PAGE #

(to be completed by bidder)

You are requested to provide the information on this form showing your targeted Small Business enterprises contacts made prior to your bid submission. This information is subject to verification and confirmation. NOTE: The Department of General Services will not regard your acceptance or use of a low quote or bid from a non-targeted Small Business Enterprise on any subcontract item as evidence itself of any lack of good faith effort to solicit targeted Small Business Enterprise subcontractors on this project. However, every effort shall be made to solicit quotes or bids on as many subcontractable items as necessary to evidence affirmative action in contracting.

TABLE OF INFORMATION SHOWING BIDDER'S PRE-BID TARGETED SMALL BUSINESS ENTERPRISE CONTACTS

SUBCONTRACTOR	TSB	DATES CONTACTED	QUOTES RECEIVED		QUOTATION USED IN BID	
			YES/NO	DATES	YES/NO	DOLLAR AMOUNT PROPOSED TO BE SUBCONTRACTED

Total dollar amount proposed to be subcontracted to TSB on this project \$ _____
 List items to be subcontracted. (if more space is needed, use reverse side.)

SECTION 00 4313

BID SECURITY FORMS

PART 1 - GENERAL

1.01 BID SECURITY FORMS

- A. A Bid Bond form will be required on this project. An amended ConsensusDocs 262 is attached for reference following this page. ConsensusDocs bid bond form is not required (other standard forms are acceptable to the State of Iowa).

END OF SECTION



**CONSENSUSDOCS 262
 BID BOND
 (AMENDED BY STATE OF IOWA)**

This document was developed through a collaborative effort of organizations representing a wide cross-section of the design and construction industry. The organizations endorsing this document believe it represents a fair allocation of risk and responsibilities for all project participants.

Endorsing organizations recognize that this document must be reviewed and adapted to meet specific needs and applicable laws. This document has important legal and insurance consequences. You are encouraged to consult legal, insurance and surety advisors before completing or modifying this document. The software includes a notes section indicating where information is to be inserted to complete this document. Further information and endorsing organizations' perspectives are available at www.consensusdocs.org/guidebook.

For Use with ConsensusDOCS 200, Standard Form of Agreement and General Conditions Between Owner and Constructor (Where the Contract Price is a Lump Sum) and ConsensusDOCS 500, Standard Agreement and General Conditions Between Owner and Construction Manager.

The Trade Contractor, _____ (the "Trade Contractor") has submitted a Bid to the Owner, _____ (the "Owner") for the _____ (the "Project") in accordance with the Bidding Documents, including Drawings and Specifications prepared by _____ (the "Design Professional").

IMPORTANT: A vertical line in the margin indicates a change has been made to the original text. Prior to signing, recipients may wish to request from the party producing the document a "redlined" version indicating changes to the original text. Consultation with legal and insurance counsel and careful review of the entire document are strongly encouraged.
 ConsensusDOCS 262 • BID BOND Copyright © 2007, Revised 2009 and 2011, ConsensusDOCS LLC. AN INDIVIDUAL PURCHASE OF THIS DOCUMENT PERMITS THE USER TO PRINT ONE CONTRACT FOR ONE PROJECT ONLY. YOU MAY ONLY MAKE COPIES OF A COMPLETED DOCUMENT FOR DISTRIBUTION TO PARTIES IN DIRECT CONNECTION WITH THE SPECIFIC CONSTRUCTION PROJECT. ANY OTHER USES, INCLUDING COPYING THE DOCUMENT, ARE STRICTLY PROHIBITED.

By virtue of this Bid Bond (the "Bond"), the Constructor as Principal and _____ as Surety ("Surety"), are bound to the Owner as Oblige in the maximum amount _____, Dollars (\$_____) (the "Bond Sum"). The Constructor and Surety hereby bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein.

1. If the Oblige shall accept the bid of the Constructor, the Constructor shall enter into an Agreement with the Oblige in accordance with the terms of such Bid.
2. Constructor shall procure such bond or bonds as are specified in the Contract Documents for the faithful performance of the Work and for the prompt payment of labor and materials furnished in the performance of the Work.
3. If the Constructor fails to enter such Agreement and give such bonds, the Constructor shall pay to the Oblige the difference between the amount of Constructor's bid and the amount of such agreement the Oblige in good faith executes with another Party to perform the Work covered by Constructor's Bid, not to exceed the Bond Sum stated above.
4. If the Constructor shall fulfill its obligation under Articles 1 through 3, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

This Bond is entered into as of _____ (date)

SURETY: _____ (seal)

BY:

Print Name: _____

Print Title: _____ (Attach Power of Attorney)

Witness:

(Additional signatures, if any, appear on attached page)

Constructor: _____ (seal)

BY:

Print Name: _____

Print Title: _____

Witness:

(Additional signatures, if any, appear on attached page)

IMPORTANT: A vertical line in the margin indicates a change has been made to the original text. Prior to signing, recipients may wish to request from the party producing the document a "redlined" version indicating changes to the original text. Consultation with legal and insurance counsel and careful review of the entire document are strongly encouraged.

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SECTION 00 5200

AGREEMENT FORM

PART 1 - GENERAL

1.01 AGREEMENT FORM

- A. The Form of Agreement to be used on this project is a modified ConsensusDocs 802. A sample is attached following this page.

END OF SECTION

ConsensusDocs 802

STANDARD FORM OF AGREEMENT BETWEEN OWNER AND TRADE CONTRACTOR

(Where the Construction Manager Is the Owner's Agent)



TABLE OF ARTICLES

1. AGREEMENT
2. GENERAL PROVISIONS
3. TRADE CONTRACTOR'S OBLIGATIONS
4. OWNER'S RESPONSIBILITIES
5. SUBCONTRACTS
6. TRADE CONTRACT TIME
7. TRADE CONTRACT PRICE
8. CHANGES
9. PAYMENT
10. INDEMNITY, INSURANCE, WAIVERS AND BONDS
11. SUSPENSION, NOTICE TO CURE AND TERMINATION OF AGREEMENT
12. DISPUTE MITIGATION AND RESOLUTION
13. MISCELLANEOUS PROVISIONS
14. TRADE CONTRACT DOCUMENTS

This Agreement has important legal and insurance consequences. Consultations with an attorney and with insurance and surety consultants are encouraged with respect to its completion or modification. Notes indicate where information is to be inserted to complete this Agreement.



ARTICLE 1 AGREEMENT

This Trade Contractor Agreement is made effective as of the XX day of Month, Year , by and between the

OWNER

State of Iowa - DAS, Department of Administrative Services ("DAS"). DAS's principal office is located: 109 SE 13th Street, Des Moines, IA 50319-0120.

and the

TRADE CONTRACTOR

Contractor Name

Address

City, State, Zip

for work in connection with the following

PROJECT

XXXX.XX - Project Name

The CONSTRUCTION MANAGER is

Construction Manager Name

Address

City, State, Zip

The DESIGN PROFESSIONAL for the Project is

Designer Name

Address

City, State, Zip

Notice to the Parties shall be given at the above addresses.

ARTICLE 2 GENERAL PROVISIONS

2.1 RELATIONSHIP OF PARTIES The Owner and the Trade Contractor agree to proceed with this Agreement on the basis of mutual trust, good faith and fair dealing and shall cooperate with each other and with the Construction Manager and Design Professional in furthering the Owner's interests. The Trade Contractor shall use its diligent efforts to perform the work in an expeditious manner consistent with the Trade Contract Documents. The Owner and the Trade Contractor will endeavor to promote harmony and cooperation among all Project participants.

2.1.1 The Owner and the Trade Contractor shall perform their obligations with integrity, ensuring at a minimum that

2.1.1.1 conflicts of interest shall be avoided or disclosed promptly to the other Party; and

2.1.1.2 the Trade Contractor and the Owner warrant that they have not and shall not pay nor receive any contingent fees or gratuities to or from the other Party, including its agents, officers and employees, Subcontractors or others for whom they may be liable, to secure preferential



treatment.

2.2 PROJECT ORGANIZATION This Agreement is for the performance of work described herein in connection with the construction of the Project. The Owner also may enter into separate agreements with other trade contractors for other portions of the Project. The Owner has entered or will enter into a Construction Management Agreement with the Construction Manager, and a design agreement with the Design Professional.

2.3 INDEPENDENT CONTRACTOR The Trade Contractor represents that it is an independent contractor and that its performance of the Trade Contract Work it shall act as an independent contractor. Neither Trade Contractor nor any of its agents or employees shall act on behalf of the Owner except as provided in this Agreement or unless authorized in writing by the Owner.

2.4 CONSTRUCTION MANAGER IS OWNER'S AGENT The Construction Manager will represent the Owner as its agent in the administration and management of this Agreement. Any instructions, reviews, approvals, orders or directions given to the Trade Contractor by the Construction Manager will be given on behalf of and as agent for the Owner. The Trade Contractor shall be obligated to respond or perform as if the same were given directly by the Owner. The Trade Contractor shall communicate and provide all requests and concerns regarding the Trade Contract Work to the Construction Manager. The Trade Contractor shall provide copies to the Construction Manager of all notices to the Owner required by and regarding this Agreement.

2.5 CONSTRUCTION MANAGER NOT IN PRIVITY WITH TRADE CONTRACTOR This Agreement shall not give the Trade Contractor any claim or right of action against the Construction Manager. The Trade Contractor and its subcontractors shall not be beneficiaries of any obligations of the Construction Manager. This Agreement shall not create a contractual relationship between any parties except the Owner and the Trade Contractor.

2.5A NO THIRD-PARTY BENEFICIARY There are no third-party beneficiaries of this Agreement.

2.6 DESIGN PROFESSIONAL The Owner, through its Design Professional, shall provide all architectural and engineering design services necessary for the completion of the Work, except the following:

No exceptions

The Trade Contractor shall not be required to provide professional services which constitute the practice of architecture or engineering except as otherwise provided in section 3.15.

2.6.1 The Owner shall obtain from the Design Professional either a license for Trade Contractor and Subcontractors to use the design documents prepared by the Design Professional or ownership of the copyrights for such design documents, and shall defend, indemnify and hold harmless the Trade Contractor against any suits or claims of infringement of any copyrights or licenses arising out of the use of the design documents. To the extent portions of this paragraph are in conflict with SF 396 (codified at Iowa Code Section 537A.5) said portions are void and unenforceable.

2.7 EXTENT OF AGREEMENT This Agreement is solely for the benefit of the Parties, represents the entire integrated agreement between the Parties, and supersedes all prior negotiations, representations and agreements, either written or oral. This Agreement and each and every provision is for the exclusive benefit of the Owner and the Trade Contractor and not for the benefit of any third party except to the extent expressly provided in this Agreement. In the event of conflict between this Agreement and any of the Exhibits or any other documents incorporated into this Agreement, the terms and provisions of this Agreement shall control.

2.8 DEFINITIONS



2.8.1 Agreement means this ConsensusDocs 802 Standard Form of Agreement Between Owner and Trade Contractor (Where the Construction Manager is the Owner's Agent), as modified by the Parties, and Exhibits and Attachments made part of this Agreement upon its execution.

2.8.2 Design Professional means the Architect, Design Professional or Engineer identified in ARTICLE 1 and its consultants, retained by Owner to perform design services for the Project, and licensed in the State in which the Project is located. The use of the term Design Professional in this Agreement is for convenience and is not intended to imply or infer that the individual or entity named in ARTICLE 1 will provide design professional services in a discipline in which it is not licensed.

2.8.3 Construction Manager means the Construction Manager identified in ARTICLE 1 and its authorized representative.

2.8.4 The Construction Schedule is the document initially prepared by and updated by the Construction Manager and approved by the Owner that indicates proposed activity sequences, durations, or milestone dates for such activities as receipt and approval of pertinent information, issuance of the Construction Documents, the preparation and processing of shop drawings and samples, delivery of materials or equipment requiring long-lead-time procurement, Owner's occupancy requirements and estimated dates of Substantial Completion and Final Completion of the Project.

2.8.5 The term Day shall mean calendar day unless otherwise specifically defined.

2.8.6 Final Completion occurs on the date when the Trade Contractor's obligations under this Agreement are complete and accepted by the Owner and final payment becomes due and payable, as established in ARTICLE 6. This date shall be confirmed by a Certificate of Final Completion signed by the Owner and the Trade Contractor.

2.8.7 A Hazardous Material is any substance or material identified now or in the future as toxic or hazardous under any federal, state or local law or regulation, or any other substance or material which may be considered hazardous or otherwise subject to statutory or regulatory requirements governing handling, disposal or clean-up.

2.8.8 A Material Supplier is a person or entity retained by the Trade Contractor to provide material or equipment for the Trade Contract Work. This definition is not intended to, and shall not be interpreted to, expand or modify the definition(s) of materials or material suppliers contained in Iowa Code Chapter 573.

2.8.9 Others means other contractors, material suppliers, and persons at the Worksite who are not employed by the Trade Contractor or Subcontractors.

2.8.10 The term Overhead shall mean a) payroll costs and other compensation of Trade Contractor employees in the Trade Contractor's principal and branch offices; b) general and administrative expenses of the Trade Contractor's principal and branch offices including deductibles paid on any insurance policy and c) the Trade Contractor's capital expenses, including interest on capital used for the Work.

2.8.11 Owner is the person or entity identified in ARTICLE 1 as Owner, and includes the Owner's representative.

2.8.12 The Project, as identified in ARTICLE 1, is the building, facility or other improvements for which the Trade Contractor is to perform the Trade Contract Work.

2.8.13 A Subcontractor is a person or entity retained by the Trade Contractor as an independent contractor to provide the labor, materials, equipment or services necessary to complete a specific



portion of the Work. This definition is not intended to, and shall not be interpreted to, expand or modify the definition(s) of materials or material suppliers contained in Iowa Code Chapter 573.

2.8.14 Per Iowa Code Section 26.13, "substantially completed" means the first date on which any of the following occurs: (1) Completion of the Project (or Trade Contract Work, in the case of the multiple Trade Contractors) or when the Project (or Trade Contract Work in the case of multiple Trade Contractors) has been substantially completed in general accordance with the terms and provisions of the contract. (2) The work on the Project (or Trade Contract Work in the case of multiple Trade Contractors) or on the designated portion is substantially completed in general accordance with the terms of the contract so that the State Iowa can occupy or utilize the Project or designated portion of the Project for its intended purpose. (3) The Project (or Trade Contract Work in the case of multiple Trade Contractors) is certified as having been substantially completed by either of the following: (a) the architect or engineer authorized to make such certification (which is defined in this Agreement as the Design Professional). (b) The authorized contract representative (which is defined in this Agreement as the Owner's Representative). (4) The State of Iowa is occupying or utilizing the Project (or Trade Contract Work in the case of multiple Trade Contractors) for its intended purpose. This subparagraph shall not apply to highway, bridge, or culvert projects.

2.8.15 Terrorism means a violent act, or an act that is dangerous to human life, property or infrastructure, that is committed by an individual or individuals and that appears to be part of an effort to coerce a civilian population or to influence the policy or affect the conduct of any government by coercion. Terrorism includes, but is not limited to, any act certified by the United States government as an act of terrorism pursuant to the Terrorism Risk Insurance Act, as amended.

2.8.16 A Trade Contract Change Order is a written order signed by the Owner and the Trade Contractor after execution of this Agreement, indicating changes in the scope of the Trade Contract Work, the Trade Contract Price or Trade Contract Time, including substitutions proposed by the Trade Contractor and accepted by the Owner. Trade Contract Change Orders shall be executed using the ConsensusDOCS 813 Trade Contract Change Order (CM as Owner's Agent) form document with exhibits attached as necessary.

2.8.17 The Trade Contract Documents consist of this Agreement (as modified), the drawings, specifications, addenda issued prior to execution of this Agreement, approved submittals, information furnished by the Owner under subsection 4.1.3, the bid documents, other documents listed in this Agreement and any modifications issued after execution.

2.8.18 The Trade Contract Price is the amount indicated in section 7.1 of this Agreement.

2.8.19 The Trade Contract Time is the period between the Date of Commencement and Final Completion.

2.8.20 Trade Contract Work means the construction and services provided by the Trade Contractor.

2.8.20.1 Changed Work means work that is different from the original scope of Trade Contract Work; or work that changes the Trade Contract Price or Trade Contract Time.

2.8.20.2 Defective Work is any portion of the Trade Contract Work that is not in conformance with the Trade Contract Documents.

2.8.21 The Trade Contractor is the person or entity identified in ARTICLE 1 and includes the Trade Contractor's Representative.

2.8.22 The term Work means the construction and services necessary or incidental to fulfill the Trade



Contractors' obligations for the Project. The Work may refer to the whole Project or only a part of the Project.

2.8.23 Worksite means the geographical area at the location of the Project as identified in ARTICLE 1 where the Trade Contract Work is to be performed.

ARTICLE 3 TRADE CONTRACTOR'S OBLIGATIONS

3.1 GENERAL RESPONSIBILITIES

3.1.1 RESPONSIBILITIES The Trade Contractor shall provide all of the labor, materials, equipment and services necessary to complete the Trade Contract Work, all of which shall be provided in full accord with or as reasonably inferable from the Trade Contract Documents as being necessary to produce the indicated results.

3.1.2 The Trade Contractor shall be responsible for the supervision and coordination of the Trade Contract Work, including the construction means, methods, techniques, sequences and procedures utilized, unless the Trade Contract Documents give other specific instructions. In such case, the Trade Contractor shall not be liable to the Owner for damages resulting from compliance with such instructions unless the Trade Contractor recognized and failed to timely report to the Owner any error, inconsistency, omission or unsafe practice that it discovered in the specified construction means, methods, techniques, safety, sequences or procedures.

3.1.3 The Trade Contractor shall perform Trade Contract Work only within locations allowed by the Trade Contract Documents, applicable permits and applicable local law.

3.2 COOPERATION WITH WORK OF OWNER AND OTHERS

3.2.1 The Owner may perform work at the Worksite directly or by Others. Any agreements with Others to perform construction or operations related to the Project shall include provisions pertaining to insurance, indemnification, waiver of subrogation, coordination, interference, clean up and safety which are substantively the same as the corresponding provisions of this Agreement.

3.2.2 In the event that the Owner elects to perform work at the Worksite directly or by Others, the Trade Contractor and the Owner shall, with the assistance of the Construction Manager, coordinate the activities of all forces at the Worksite and agree upon fair and reasonable schedules and operational procedures for Worksite activities. The Owner shall require each separate contractor to cooperate with the Trade Contractor and assist with the coordination of activities and the review of construction schedules and operations. The Trade Contract Price and Trade Contract Time shall be equitably adjusted, as mutually agreed by the Parties, for subsequent changes made necessary by the coordination of construction activities, and the Trade Contractor's construction schedule and the Construction Schedule shall be revised accordingly. The Trade Contractor, Owner and Others shall adhere to the revised Construction Schedule until it may subsequently be revised.

3.2.3 With regard to the work of the Owner and Others, the Trade Contractor shall (a) proceed with the Trade Contract Work in a manner which does not hinder, delay or interfere with the work of the Owner or Others or cause the work of the Owner or Others to become defective, (b) afford the Owner or Others reasonable access for introduction and storage of their materials and equipment and performance of their activities, and (c) coordinate the Trade Contractor's construction and operations with theirs as required by this section.

3.2.4 Before proceeding with any portion of the Trade Contract Work affected by the construction or operations of the Owner or Others, the Trade Contractor shall give the Owner and Construction



Manager prompt written notification of any defects the Trade Contractor discovers in their work which will prevent the proper execution of the Trade Contract Work. The Trade Contractor's obligations in this section do not create a responsibility for the work of the Owner or Others, but are for the purpose of facilitating the Trade Contract Work. If the Trade Contractor does not notify the Owner and Construction Manager of patent defects interfering with the performance of the Trade Contract Work, the Trade Contractor acknowledges that the work of the Owner or Others is not defective and is acceptable for the proper execution of the Trade Contract Work. Following receipt of written notice from the Trade Contractor of defects, the Owner, through the Construction Manager, shall promptly inform the Trade Contractor what action, if any, the Trade Contractor shall take with regard to the defects.

3.3 RESPONSIBILITY FOR PERFORMANCE

3.3.1 In order to facilitate its responsibilities for completion of the Work in accordance with and as reasonably inferable from the Trade Contract Documents, prior to commencing the Work the Trade Contractor shall examine and compare the drawings and specifications with information furnished by the Owner pursuant to subsection 4.1.3, relevant field measurements made by the Trade Contractor and any visible conditions at the Worksite affecting the Trade Contract Work.

3.3.2 If in the course of the performance of the obligations in subsection 3.3.1 the Trade Contractor discovers any errors, omissions or inconsistencies in the Contract Documents, the Trade Contractor shall promptly report them to the Owner and Construction Manager. It is recognized, however, that the Trade Contractor is not acting in the capacity of a licensed design professional, and that the Trade Contractor's examination is to facilitate construction and does not create an affirmative responsibility to detect errors, omissions or inconsistencies or to ascertain compliance with applicable laws, building codes or regulations. Following receipt of written notice from the Trade Contractor of defects, the Owner shall promptly inform the Trade Contractor what action, if any, the Trade Contractor shall take with regard to the defects.

3.3.3 The Trade Contractor shall have no liability for errors, omissions or inconsistencies discovered under subsections 3.3.1 and 3.3.2 unless the Trade Contractor fails to report a recognized problem to the Owner and Construction Manager.

3.3.4 The Trade Contractor may be entitled to additional costs or time if there are changes in the scope of the Trade Contract Work that increase the cost of the Work or increase the number of days required to perform the Work, respectively, because of clarifications or instructions arising out of the Trade Contractor's reports described in the three preceding Subsections.

3.4 CONSTRUCTION PERSONNEL AND SUPERVISION

3.4.1 The Trade Contractor shall provide competent supervision for the performance of the Trade Contract Work. Before commencing the Trade Contract Work, Trade Contractor shall notify Owner and Construction Manager in writing of the name and qualifications of its proposed superintendent(s) and project manager so Owner and Construction Manager may review the individual's qualifications. If, for reasonable cause, the Owner or Construction Manager refuses to approve the individual, or withdraws its approval after once giving it, Trade Contractor shall name a different superintendent or project manager for Owner's and Construction Manager's review. Any disapproved superintendent shall not perform in that capacity thereafter at the Worksite.

3.4.2 The Trade Contractor shall be responsible to the Owner for acts or omissions of parties or entities performing portions of the Trade Contract Work for or on behalf of the Trade Contractor or any of its Subcontractors.

3.4.3 The Trade Contractor shall permit only qualified persons to perform the Trade Contract Work. The



Trade Contractor shall enforce safety procedures, strict discipline and good order among persons performing the Trade Contract Work. If the Owner or Construction Manager determines that a particular person does not follow safety procedures, or is unfit or unskilled for the assigned work, the Trade Contractor shall immediately reassign the person on receipt of the Owner's or Construction Manager's written notice to do so.

3.4.4 TRADE CONTRACTOR'S REPRESENTATIVE The Trade Contractor's authorized representative is . The Trade Contractor's representative shall possess full authority to receive instructions from the Owner and to act on those instructions. The Trade Contractor shall notify the Owner and the Construction Manager in writing of a change in the designation of the Trade Contractor's representative. The Trade Contractor's representative is also authorized to bind the Trade Contractor in all matters relating to this Agreement including, without limitation, all matters requiring the Trade Contractor's approval, authorization, or written notice. The Trade Contractor's representative is also authorized to resolve disputes in accordance with Section 12.2 of this Agreement.

3.5 MATERIALS FURNISHED BY THE OWNER OR OTHERS

3.5.1 In the event the Trade Contract Work includes installation of materials or equipment furnished by the Owner or Others, it shall be the responsibility of the Trade Contractor to examine the items so provided and thereupon handle, store and install the items, unless otherwise provided in the Trade Contract Documents, with such skill and care as to provide a satisfactory and proper installation. Loss or damage due to acts or omissions of the Trade Contractor shall be the responsibility of the Trade Contractor and may be deducted from any amounts due or to become due the Trade Contractor. Any defects discovered in such materials or equipment shall be reported at once to the Owner and Construction Manager. Following receipt of written notice from the Trade Contractor of defects, the Owner shall promptly inform the Trade Contractor what action, if any, the Trade Contractor shall take with regard to the defects.

3.6 TESTS AND INSPECTIONS

3.6.1 The Trade Contractor shall schedule all required tests, approvals and inspections of the Trade Contract Work or portions thereof at appropriate times so as not to delay the progress of the Trade Contract Work or other work related to the Project. The Trade Contractor shall give proper notice to the Construction Manager and to all required parties of such tests, approvals and inspections. If feasible, the Owner and Others may timely observe the tests at the normal place of testing. Except as provided in subsection 3.6.3, the Owner shall bear all expenses associated with tests, inspections and approvals required by the Trade Contract Documents, which, unless otherwise agreed to, shall be conducted by an independent testing laboratory or entity retained by the Owner. Unless otherwise required by the Trade Contract Documents, required certificates of testing, approval or inspection shall be secured by the Trade Contractor and promptly delivered to the Owner and Construction Manager.

3.6.2 If the Owner, Construction Manager or appropriate authorities determine that tests, inspections or approvals in addition to those required by the Trade Contract Documents will be necessary, the Trade Contractor shall arrange for the procedures and give timely notice to the Owner, Construction Manager and Others who may observe the procedures. Costs of the additional tests, inspections or approvals are at the Owner's expense except as provided in subsection 3.6.3.

3.6.3 If the procedures described in subsections 3.6.1 and 3.6.2 indicate that portions of the Trade Contract Work fail to comply with the Trade Contract Documents, the Trade Contractor shall be responsible for costs of correction and retesting.

3.7 WARRANTY



3.7.1 The Trade Contract Work shall be executed in accordance with the Trade Contract Documents in a workmanlike manner. The Trade Contractor warrants that all materials and equipment shall be furnished in sufficient quantities to facilitate the proper and expeditious execution of the Trade Contract Work and shall be new unless otherwise specified, of good quality, in conformance with the Trade Contract Documents, and free from defective workmanship and materials. At the Owner's or Construction Manager's request, the Trade Contractor shall furnish satisfactory evidence of the quality and type of materials and equipment furnished. The Trade Contractor further warrants that the Trade Contract Work shall be free from material defects not intrinsic in the design or materials required in the Trade Contract Documents. The Trade Contractor's warranty does not include remedies for defects or damages caused by normal wear and tear during normal usage, use for a purpose for which the Project was not intended, improper or insufficient maintenance, modifications performed by the Owner or Others, or abuse. The Trade Contractor's warranty pursuant to this section shall commence on the Date of Substantial Completion.

3.7.2 The Trade Contractor shall obtain from its Subcontractors and material suppliers any special or extended warranties required by the Trade Contract Documents. All such warranties shall be listed in an attached Exhibit to this Agreement.

3.8 CORRECTION OF TRADE CONTRACT WORK WITHIN ONE YEAR

3.8.1 If, prior to Substantial Completion and within one year after the date of Substantial Completion of the Trade Contract Work, any Defective Work is found, the Owner shall promptly notify the Trade Contractor in writing. Unless the Owner provides written acceptance of the condition, the Trade Contractor shall promptly correct the Defective Work at its own cost and time and bear the expense of additional services required for correction of any Defective Work for which it is responsible. If within the one-year correction period the Owner discovers and does not promptly notify the Trade Contractor or give the Trade Contractor an opportunity to test or correct Defective Work as reasonably requested by the Trade Contractor, the Owner waives the Trade Contractor's obligation to correct that Defective Work as well as the Owner's right to claim a breach of the warranty with respect to that Defective Work.

3.8.2 With respect to any portion of Trade Contract Work first performed after Substantial Completion, the one-year correction period shall be extended by the period of time between Substantial Completion and the actual performance of the later Trade Contract Work. Correction periods shall not be extended by corrective work performed by the Trade Contractor.

3.8.3 If the Trade Contractor fails to correct Defective Work within a reasonable time after receipt of written notice from the Owner prior to final payment, the Owner may correct it in accordance with the Owner's right to carry out the Trade Contract Work in section 11.2. In such case, an appropriate Trade Contract Change Order shall be issued deducting the cost of correcting such deficiencies from payments then or thereafter due the Trade Contractor. If payments then or thereafter due Trade Contractor are not sufficient to cover such amounts, the Trade Contractor shall pay the difference to the Owner.

3.8.4 If after the one-year correction period but before the applicable limitation period the Owner discovers any Defective Work, the Owner shall, unless the Defective Work requires emergency correction, promptly notify the Trade Contractor. If the Trade Contractor elects to correct the Defective Work, it shall provide written notice of such intent within fourteen (14) Days of its receipt of notice from the Owner. The Trade Contractor shall complete the correction of Defective Work within a time frame mutually agreed upon by the Trade Contractor and the Owner. If the Trade Contractor does not elect to correct the Defective Work, the Owner may have the Defective Work corrected by itself or Others and charge the Trade Contractor for the reasonable cost of the correction and other directly related



expenses. Owner shall provide Trade Contractor with an accounting of correction costs it incurs.

3.8.5 If the Trade Contractor's correction or removal of Defective Work causes damage to or destroys other completed or partially completed Work or existing buildings, the Trade Contractor shall be responsible for the cost of correcting the destroyed or damaged property.

3.8.6 The one-year period for correction of Defective Work does not constitute a limitation period with respect to the enforcement of the Trade Contractor's other obligations under the Trade Contract Documents.

3.8.7 Prior to final payment, at the Owner's option and with the Trade Contractor's agreement, the Owner may elect to accept Defective Work rather than require its removal and correction. In such case the Contract Price shall be equitably adjusted for any diminution in the value of the Project caused by such Defective Work. Before the Owner accepts any such change it must be documented in writing with a Change Order signed by both the Trade Contractor and Owner.

3.9 CORRECTION OF COVERED TRADE CONTRACT WORK

3.9.1 On request of the Owner or Construction Manager, Trade Contract Work that has been covered without a requirement that it be inspected prior to being covered may be uncovered for the Owner's or Construction Manager's inspection. The Owner shall pay for the costs of uncovering and replacement if the Work proves to be in conformance with the Trade Contract Documents, or if the defective condition was caused by the Owner or Others. If the uncovered Trade Contract Work proves to be defective, the Trade Contractor shall pay the costs of uncovering and replacement.

3.9.2 If contrary to specific requirements in the Trade Contract Documents or contrary to a specific request from the Owner or Construction Manager, a portion of the Trade Contract Work is covered, the Owner or Construction Manager, by written request, may require the Trade Contractor to uncover the Trade Contract Work for the Owner's or Construction Manager's observation. In this circumstance the Trade Contract Work shall be uncovered and recovered at the Trade Contractor's expense and with no adjustment to the Trade Contract Time. Costs incurred by the Owner as a direct result of the above shall be deducted from the Trade Contract Price.

3.10 SAFETY OF PERSONS AND PROPERTY

3.10.1 SAFETY PRECAUTIONS AND PROGRAMS The Trade Contractor shall have overall responsibility for safety precautions and programs in the performance of the Trade Contract Work. While this section establishes the responsibility for safety between the Owner and Trade Contractor, it does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with the provisions of applicable laws and regulations.

3.10.2 The Trade Contractor shall seek to avoid injury, loss or damage to persons or property by taking reasonable steps to protect:

3.10.2.1 its employees and other persons at the Worksite;

3.10.2.2 materials and equipment stored at on-site or off-site locations for use in the Trade Contract Work; and

3.10.2.3 property located at the site and adjacent to Trade Contract Work areas, whether or not the property is part of the Trade Contract Work.

3.10.3 TRADE CONTRACTOR'S SAFETY REPRESENTATIVE The Trade Contractor's Worksite Safety Representative is who shall act as the Trade Contractor's authorized safety representative with a duty



to prevent accidents in accordance with subsection 3.10.2 If no individual is identified in this section, the authorized safety representative shall be the Trade Contractor's Representative. The Trade Contractor shall report immediately in writing to the Owner and Construction Manager all recordable accidents and injuries occurring at the Worksite. When the Trade Contractor is required to file an accident report with a public authority, the Trade Contractor shall furnish a copy of the report to the Owner and Construction Manager.

3.10.4 The Trade Contractor shall provide the Owner and Construction Manager with copies of all notices required of the Trade Contractor by law or regulation. The Trade Contractor's safety program shall comply with the requirements of governmental and quasi-governmental authorities having jurisdiction.

3.10.5 Damage or loss not insured under property insurance which may arise from the Trade Contract Work, to the extent caused by the negligent acts or omissions of the Trade Contractor, or anyone for whose acts the Trade Contractor may be liable, shall be promptly remedied by the Trade Contractor.

3.10.6 If the Owner or Construction Manager deems any part of the Trade Contract Work or Worksite unsafe, the Owner or Construction Manager, without assuming responsibility for the Trade Contractor's safety program, may require the Trade Contractor to stop performance of the Trade Contract Work or take corrective measures satisfactory to the Owner, or both. If the Trade Contractor does not adopt corrective measures, the Owner may perform them and deduct their cost from the Trade Contract Price. The Trade Contractor agrees to make no claim for damages, for an increase in the Trade Contract Price or for a change in the Trade Contract Time based on the Trade Contractor's compliance with the Owner's or Construction Manager's reasonable request.

3.11 EMERGENCIES

3.11.1 In an emergency, the Trade Contractor shall act in a reasonable manner to prevent personal injury or property damage. Any change in the Trade Contract Price or Trade Contract Time resulting from the actions of the Trade Contractor in an emergency situation shall be determined as provided in ARTICLE 8.

3.12 HAZARDOUS MATERIALS

3.12.1 The Trade Contractor shall not be obligated to commence or continue Trade Contract Work until any Hazardous Material discovered at the Worksite has been removed, rendered or determined to be harmless by the Owner as certified by an independent testing laboratory and approved by the appropriate government agency.

3.12.2 If after the commencement of the Trade Contract Work a Hazardous Material is discovered at the Worksite, the Trade Contractor shall be entitled to immediately stop Trade Contract Work in the affected area. The Trade Contractor shall report the condition to the Owner, the Construction Manager, and, if required, the government agency with jurisdiction.

3.12.3 The Trade Contractor shall not be required to perform any Trade Contract Work relating to or in the area of Hazardous Material without written mutual agreement.

3.12.4 The Owner shall be responsible for retaining an independent testing laboratory to determine the nature of the Hazardous Material encountered and whether the material requires corrective measures or remedial action. Such measures shall be the sole responsibility of the Owner, and shall be performed in a manner minimizing any adverse effects upon the Trade Contract Work. The Trade Contractor shall resume Trade Contract Work in the area affected by any Hazardous Material only upon written agreement between the Parties after the Hazardous Material has been removed or rendered harmless



and only after approval, if necessary, of the governmental agency with jurisdiction.

3.12.5 If the Trade Contractor incurs additional costs or is delayed due to the presence or remediation of Hazardous Material, the Trade Contractor shall be entitled to an equitable adjustment in the Trade Contract Price or the Trade Contract Time.

3.12.6 To the extent not caused by the negligent acts or omissions of the Trade Contractor, its Subcontractors and Sub-subcontractors, and the agents, officers, directors and employees of each of them, the Owner shall defend, indemnify and hold harmless the Trade Contractor, its Subcontractors and Sub-subcontractors, and the agents, officers, directors and employees of each of them, from and against any and all direct claims, damages, losses, costs and expenses, including but not limited to attorney's fees, costs and expenses incurred in connection with any dispute resolution process, to the extent permitted pursuant to section 6.6, arising out of or relating to the performance of the Trade Contract Work in any area affected by Hazardous Material. To the extent portions of this paragraph are in conflict with SF 396 (codified at Iowa Code Section 537A.5) said portions are void and unenforceable.

3.12.7 MATERIALS BROUGHT TO THE WORKSITE

3.12.7.1 Material Safety Data (MSD) sheets as required by law and pertaining to materials or substances used or consumed in the performance of the Trade Contract Work, whether obtained by the Trade Contractor, Subcontractors, the Owner or Others, shall be maintained at the Worksite by the Trade Contractor and made available to the Owner, Construction Manager, Subcontractors and Others.

3.12.7.2 The Trade Contractor shall be responsible for the proper delivery, handling, application, storage, removal and disposal of all materials and substances brought to the Worksite by the Trade Contractor in accordance with the Trade Contract Documents and used or consumed in the performance of the Trade Contract Work.

3.12.7.3 The Trade Contractor shall indemnify and hold harmless the Owner, Construction Manager, their agents, officers, directors and employees, from and against any and all claims, damages, losses, costs and expenses, including but not limited to attorney's fees, costs and expenses incurred in connection with any dispute resolution procedure, arising out of or relating to the delivery, handling, application, storage, removal and disposal of all materials and substances brought to the Worksite by the Trade Contractor in accordance or not in accordance with the Trade Contract Documents. To the extent portions of this paragraph are in conflict with SF 396 (codified at Iowa Code Section 537A.5) said portions are void and unenforceable.

3.12.8 The terms of this section shall survive the completion of the Trade Work or any termination of this Agreement.

3.13 SUBMITTALS

3.13.1 The Trade Contractor shall submit to the Construction Manager, and the Design Professional, for review and approval all shop drawings, samples, product data and similar submittals required by the Trade Contract Documents. Submittals may be submitted in electronic form if required in accordance with ConsensusDocs 200.2 and subsection 4.4.1. The Trade Contractor shall be responsible to the Owner for the accuracy and conformity of its submittals to the Trade Contract Documents. The Trade Contractor shall prepare and deliver its submittals in a manner consistent with the Construction Schedule and in such time and sequence so as not to delay the performance of the Trade Contract Work or the work of the Owner and Others. When the Trade Contractor delivers its submittals the Trade Contractor shall identify in writing for each submittal all changes, deviations or substitutions from the requirements of the Trade Contract Documents. The review and approval of any Trade Contractor



submittal shall not be deemed to authorize changes, deviations or substitutions from the requirements of the Trade Contract Documents unless express written approval is obtained from the Owner specifically authorizing such deviation, substitution or change. To the extent a change, deviation or substitution causes an impact to the Contract Price or Contract Time, such approval shall be promptly memorialized in a Change Order. Further, the Construction Manager and Design Professional shall not make any change, deviation or substitution through the submittal process without specifically identifying and authorizing such deviation to the Trade Contractor. In the event that the Trade Contract Documents do not contain submittal requirements pertaining to the Trade Contract Work, the Trade Contractor agrees upon request to submit in a timely fashion to the Construction Manager and the Design Professional for review and approval any shop drawings, samples, product data, manufacturers' literature or similar submittals as may reasonably be required by the Owner, Construction Manager, or Design Professional.

3.13.2 The Owner shall be responsible for review and approval of submittals with reasonable promptness to avoid causing delay.

3.13.3 The Trade Contractor shall perform all Trade Contract Work strictly in accordance with approved submittals. Approval of shop drawings is not authorization to Trade Contractor to perform Changed Work, unless the procedures of ARTICLE 8 are followed. Approval does not relieve the Trade Contractor from responsibility for Defective Work resulting from errors or omissions of any kind on the approved Shop Drawings.

3.13.4 Record copies of the following, incorporating field changes and selections made during construction, shall be maintained by the Trade Contractor at the Project site and available to the Owner upon request: drawings, specifications, addenda, Trade Contract Change Order and other modifications, and required submittals including product data, samples and shop drawings.

3.13.5 No substitutions shall be made in the Trade Contract Work unless permitted in the Trade Contract Documents and then only after the Trade Contractor obtains approvals required under the Trade Contract Documents for substitutions. All such substitutions shall be promptly memorialized in a Change Order no later than seven (7) Days following approval by the Owner and, if applicable, provide for an adjustment in the Contract Price or Contract Time.

3.13.6 The Trade Contractor shall prepare and submit to the Construction Manager for submission to the Owner

(Check one only)

- final marked up as-built drawings
- updated electronic data, in accordance with ConsensusDocs 200.2 and section 4.4.1
- such documentation as defined by the Parties by attachment to this Agreement,

in general documenting how the various elements of the Trade Contract Work were actually constructed or installed.

3.14 PROFESSIONAL SERVICES

3.14.1 The Trade Contractor may be required to procure professional services in order to carry out its responsibilities for construction means, methods, techniques, sequences and procedures for such services specifically called for by the Contract Documents. The Trade Contractor shall obtain these professional services and any design certifications required from State of Iowa licensed design professionals. All drawings, specifications, calculations, certifications and submittals prepared by such



design professionals shall bear the signature and seal of such design professionals and the Owner and the Design Professional shall be entitled to rely upon the adequacy, accuracy and completeness of such design services. If professional services are specifically required by the Contract Documents, the Owner shall indicate all required performance and design criteria. The Trade Contractor shall not be responsible for the adequacy of such performance and design criteria. The Trade Contractor shall not be required to provide such services in violation of existing laws, rules and regulations in the jurisdiction where the Project is located.

3.15 WORKSITE CONDITIONS

3.15.1 WORKSITE VISIT The Trade Contractor acknowledges that it has visited, or has had the opportunity to visit, the Worksite to visually inspect the general and local conditions which could affect the Trade Contract Work.

3.15.2 CONCEALED OR UNKNOWN SITE CONDITIONS If the conditions at the Worksite are (a) subsurface or other concealed physical conditions which are materially different from those indicated in the Trade Contract Documents, or (b) unusual and unknown physical conditions which are materially different from conditions ordinarily encountered and generally recognized as inherent in Trade Contract Work provided for in the Trade Contract Documents, the Trade Contractor shall stop Trade Contract Work and give immediate written notice of the condition to the Owner, Construction Manager and the Design Professional. The Trade Contractor shall not be required to perform any work relating to the unknown condition without the written mutual agreement of the Parties. Any change in the Contract Price or the Contract Time as a result of the unknown condition shall be determined as provided in this article. The Trade Contractor shall provide the Owner and the Construction Manager with written notice of any claim as a result of unknown conditions within the time period set forth in section 8.4.

3.16 PERMITS AND TAXES

3.16.1 Trade Contractor shall give public authorities all notices required by law and, except for permits and fees which are the responsibility of the Owner pursuant to section 4.2, shall obtain and pay for all necessary permits, licenses and renewals pertaining to the Trade Contract Work. Trade Contractor shall provide to Owner copies of all notices, permits, licenses and renewals required under this Agreement.

3.16.2 Trade Contractor shall pay all applicable taxes legally enacted when bids are received or negotiations concluded for the Trade Contract Work provided by the Trade Contractor.

3.16.3 The Contract Price or Contract Time shall be equitably adjusted by Trade Contract Change Order for additional costs resulting from any changes in laws, ordinances, rules and regulations enacted after the date of this Agreement, including increased taxes.

3.16.3 (Deleted)

3.17 CUTTING, FITTING AND PATCHING

3.17.1 The Trade Contractor shall perform cutting, fitting and patching necessary to coordinate the various parts of the Trade Contract Work and to prepare its Trade Contract Work for the work of the Owner or Others.

3.17.2 Cutting, patching or altering the work of the Owner or Others shall be done with the prior written approval of the Owner. Such approval shall not be unreasonably withheld.

3.18 CLEANING UP

3.18.1 The Trade Contractor shall regularly remove debris and waste materials at the Worksite resulting



from the Trade Contract Work. Prior to discontinuing Trade Contract Work in an area, the Trade Contractor shall clean the area and remove all rubbish and its construction equipment, tools, machinery, waste and surplus materials. The Trade Contractor shall minimize and confine dust and debris resulting from construction activities. At the completion of the Trade Contract Work, the Trade Contractor shall remove from the Worksite all construction equipment, tools, surplus materials, waste materials and debris.

3.18.2 If the Trade Contractor fails to commence compliance with cleanup duties within two (2) business Days after written notification from the Owner or the Construction Manager of noncompliance, the Owner may implement appropriate cleanup measures without further notice and the cost shall be deducted from any amounts due or to become due the Trade Contractor in the next payment period.

3.19 ACCESS TO TRADE CONTRACT WORK The Trade Contractor shall facilitate the access of the Owner, Construction Manager, Design Professional and Others to Trade Contract Work in progress.

3.20 COST MONITORING The Trade Contractor shall provide the Construction Manager with cost monitoring information appropriate for the manner of Trade Contractor's compensation, to enable the Construction Manager to develop and track construction and project budgets, including amounts for work in progress, uncompleted work and proposed changes.

3.21 ROYALTIES, PATENTS AND COPYRIGHTS The Trade Contractor shall pay all royalties and license fees which may be due on the inclusion of any patented or copyrighted materials, methods or systems selected by the Trade Contractor and incorporated in the Trade Contract Work. The Trade Contractor shall defend, indemnify and hold the Owner harmless from all suits or claims for infringement of any patent rights or copyrights arising out of such selection. The Owner agrees to indemnify and hold the Trade Contractor harmless from any suits or claims of infringement of any patent rights or copyrights arising out of any patented or copyrighted materials, methods or systems specified by the Owner, Construction Manager and Design Professional. To the extent portions of this paragraph are in conflict with SF 396 (codified at Iowa Code Section 537A.5) said portions are void and unenforceable.

3.22 CONFIDENTIALITY The Owner shall treat as confidential information all of the Trade Contractor's estimating systems and historical and parameter cost data that may be disclosed to the Owner in connection with the performance of this Agreement if they are specified and marked as confidential and shall mark them. If a document is not marked as "Confidential" it will not be treated as such. Nothing contained herein, however, shall be interpreted in a manner that modifies or is in conflict with the purpose and application of the open records laws contained in the Code of Iowa.

ARTICLE 4 OWNER'S RESPONSIBILITIES

4.1 INFORMATION SERVICES

4.1.1 FULL INFORMATION Any information or services to be provided by the Owner shall be provided in a timely manner so as not to delay the Trade Contract Work.

4.1.2 FINANCIAL INFORMATION Upon the written request of the Trade Contractor, the Owner shall provide the Trade Contractor with evidence of Project financing. If requested in writing, evidence of such financing shall be a condition precedent to the Trade Contractor's commencing or continuing the Trade Contract Work. The Trade Contractor shall be notified by the Owner prior to any material change in Project financing.

4.1.3 WORKSITE INFORMATION Except to the extent that the Trade Contractor knows of any inaccuracy, the Trade Contractor is entitled to rely on Worksite information furnished by the Owner pursuant to this subsection. To the extent the Owner has obtained, or is required elsewhere in the



Trade Contract Documents to obtain, the following Worksite information, the Owner shall provide at the Owner's expense and with reasonable promptness:

4.1.3.1 information describing the physical characteristics of the site, including surveys, site evaluations, legal descriptions, data or drawings depicting existing conditions, subsurface conditions and environmental studies, reports and investigations;

4.1.3.2 tests, inspections and other reports dealing with environmental matters, Hazardous Material and other existing conditions, including structural, mechanical and chemical tests, required by the Trade Contract Documents or by law; and

4.1.3.3 any other information or services requested in writing by the Trade Contractor which are relevant to the Trade Contractor's performance of the Trade Contract Work and under the Owner's control. The information required by subsection 4.1.3 shall be provided in reasonable detail. Legal descriptions shall include easements, title restrictions, boundaries, and zoning restrictions. Worksite descriptions shall include existing buildings and other construction and all other pertinent site conditions. Adjacent property descriptions shall include structures, streets, sidewalks, alleys, and other features relevant to the Trade Contract Work. Utility details shall include available services, lines at the Worksite and adjacent and connection points. The information shall include public and private information, subsurface information, grades, contours, and elevations, drainage data, exact locations and dimensions, and benchmarks that can be used by the Trade Contractor in laying out the Trade Contract Work. The Trade Contractor shall in writing request from the Owner any information identified in Paragraph 4.1.3 that the Trade Contractor believes the Owner has obtained but has not provided to the Trade Contractor.

4.1.3.4 OWNER'S REPRESENTATIVE The Owner's representative is test. The Owner's representative shall have authority to bind the Owner in all matters relating to this Agreement including, without limitation, all matters requiring the Owner's approval, authorization or written notice. If the Owner changes its representative as listed above, the Owner shall notify the Trade Contractor in advance in writing. The Owner's Representative is also authorized to resolve disputes in accordance with Section 12.2 of this Agreement. The Construction Manager, while unauthorized to modify the Agreement or settle a dispute without the Owner's approval, however, does have the requisite authority to act as the Owner's agent throughout the construction of the Project in accordance with the contract between the Owner and the Construction Manager (ConsensusDOCS 801 as modified by the State of Iowa).

4.2 BUILDING PERMIT, FEES AND APPROVALS Except for those permits and fees related to the Trade Contract Work which are the responsibility of the Trade Contractor pursuant to subsection 3.16.1, the Owner shall secure and pay for all other permits, approvals, easements, assessments and fees required for the development, construction, use or occupancy of permanent structures or for permanent changes in existing facilities, including the building permit.

4.3 Deleted

4.4 TRADE CONTRACT DOCUMENTS Unless otherwise specified, Owner shall provide One (1) copies of the Trade Contract Documents to the Trade Contractor without cost. Additional copies will be provided to the Trade Contractor at cost. This paragraph is not intended to be in conflict with Iowa Code Section 26.3 requirement that a sufficient number of copies of the contract documents be made available to bidders without charge (but a deposit not to exceed \$250 per set may be required). If the Trade Contractor was required to make a deposit for a set of Trade Contract Documents for purposes of bidding then the Trade Contractor may elect to have the deposit returned instead of being provided with an additional copy.



4.4.1 DIGITIZED DOCUMENTS If the Owner requires that the Owner, Design Professional, Construction Manager and Trade Contractor exchange documents and data in electronic or digital form, prior to any such exchange, the Owner, Design Professional, Construction Manager and Trade Contractor shall agree on a written protocol governing all exchanges in ConsensusDocs 200.2 or a separate Agreement, which, at a minimum, shall specify: (a) the definition of documents and data to be accepted in electronic or digital form or to be transmitted electronically or digitally; (b) management and coordination responsibilities; (c) necessary equipment, software and services; (d) acceptable formats, transmission methods and verification procedures; (e) methods for maintaining version control; (f) privacy and security requirements; and (g) storage and retrieval requirements. Except as otherwise agreed to by the Parties in writing, the Parties shall each bear their own costs as identified in the protocol. In the absence of a written protocol, use of documents and data in electronic or digital form shall be at the sole risk of the recipient.

4.5 OWNER'S CUTTING AND PATCHING Cutting, patching or altering the Trade Contract Work by the Owner or Others shall be done with the prior written approval of the Trade Contractor, which approval shall not be unreasonably withheld.

4.6 OWNER'S RIGHT TO CLEAN UP In case of a dispute between the Trade Contractor and Others with regard to respective responsibilities for cleaning up at the Worksite, the Owner may implement appropriate cleanup measures after two (2) business Days' notice and allocate the cost among those responsible during the following pay period.

4.7 COST OF CORRECTING DAMAGED OR DESTROYED WORK With regard to damage or loss attributable to the acts or omissions of the Owner or Others and not to the Trade Contractor, the Owner may either (a) promptly remedy the damage or loss or (b) accept the damage or loss. If the Trade Contractor incurs additional costs or is delayed due to such loss or damage, the Trade Contractor shall be entitled to an equitable adjustment in the Trade Contract Price or Trade Contract Time.

ARTICLE 5 SUBCONTRACTS

5.1 SUBCONTRACTORS The Trade Contract Work not performed by the Trade Contractor with its own forces shall be performed by Subcontractors.

5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE TRADE CONTRACT WORK

5.2.0 The Trade Contractor must identify all Subcontractors and suppliers within 48 hours of the published date and time for which bids must be submitted, in accordance with Iowa Code Section 8A.311, as amended by House File 646 in 2011. Subcontractors and suppliers may not be changed without the approval of the Owner. Requests for changing a Subcontractor or supplier must identify the reason for the proposed change, the name of the new Subcontractor or supplier, and the change in the subcontractor or supplier price as a result of the change. Any reduction in subcontractor or supplier price as a result of the change, if the change is approved by the Owner, shall be deducted from the Trade Contract Price via a deductive Change Order. Any such changes, if approved by the Owner, which result in an increase in the Trade Contract Price shall be borne by the Trade Contractor.

5.2.1 If the Owner has a reasonable objection to any proposed subcontractor or material supplier, the Owner shall notify the Trade Contractor in writing.

5.2.2 If the Owner has reasonably and promptly objected as provided in subsection 5.2.1, the Trade Contractor shall not contract with the proposed subcontractor or material supplier, and the Trade Contractor shall propose another Subcontractor acceptable to the Owner. To the extent the substitution results in an increase or decrease in the Trade Contract Price or Trade Contract Time, an appropriate



Trade Contract Change Order shall be issued as provided in ARTICLE 8.

5.3 BINDING OF SUBCONTRACTORS The Trade Contractor agrees to bind every Subcontractor (and require every Subcontractor to so bind its subcontractors) to all the provisions of this Agreement and the Trade Contract Documents as they apply to the Subcontractor's portion of the Trade Contract Work.

5.4 Deleted

5.5 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

5.5.1 If this Agreement is terminated, each subcontract agreement shall be assigned by the Trade Contractor to the Owner, subject to the prior rights of any surety, provided that:

5.5.1.1 this Agreement is terminated by the Owner pursuant to sections 11.3 or 11.4; and

5.5.1.2 the Owner accepts such assignment after termination by notifying the Subcontractor and Trade Contractor in writing, and assumes all rights and obligations of the Contractor pursuant to each subcontract agreement.

5.5.2 If the Owner accepts such an assignment, and the Work has been suspended for more than thirty (30) consecutive Days, following termination, if appropriate, the Subcontractor's compensation shall be equitably adjusted as a result of the suspension.

ARTICLE 6 TRADE CONTRACT TIME

6.1 PERFORMANCE OF THE TRADE CONTRACT WORK

6.1.1 DATE OF COMMENCEMENT The Date of Commencement is the date of Owner's written notice to proceed unless otherwise set forth below:

6.1.2 TIME Substantial Completion of the Trade Contract Work shall be achieved in xxx (xx) Days from the Date of Commencement. Unless otherwise specified in the Certificate of Substantial Completion, the Trade Contractor shall achieve Final Completion within 30 Days after the date of Substantial Completion, subject to adjustments as provided for in the Trade Contract Documents.

6.1.3 Time limits stated above are of the essence of this Agreement.

6.1.4 Unless instructed by the Owner in writing, the Trade Contractor shall not knowingly commence the Trade Contract Work before the effective date of insurance to be provided by the Trade Contractor and Owner as required by the Trade Contract Documents.

6.2 CONSTRUCTION SCHEDULE Prior to the commencement of the construction of the Trade Contract Work, the Trade Contractor shall submit a copy of its critical path method (CPM) construction schedule showing the completion of the Trade Contract Work within the allowable number of days identified above. The Trade Contractor shall regularly update its CPM construction schedule for the Trade Contract Work and promptly furnish the Construction Manager on an ongoing basis scheduling information requested by the Construction Manager for the Trade Contract Work. In consultation with the Trade Contractor, the Construction Manager shall incorporate the Trade Contract Work and work of other trade contractors into an overall Construction Schedule for the entire Project. The Trade Contractor shall be bound by the Construction. Nothing in this Trade Contractor Agreement shall relieve the Trade Contractor of any liability for any unexcused failure to comply with its original schedule, the Construction Schedule, or any completion dates. The Construction Manager shall have the right to coordinate the Trade Contractors, including the right, if necessary, to change the time, order and priority in which the various portions of the Trade Contract Work and the other work associated with the Project shall be performed.



6.3 DELAYS AND EXTENSIONS OF TIME

6.3.1 If the Trade Contractor is delayed at any time in the commencement or progress of the Work by any cause beyond the control of the Trade Contractor, the Trade Contractor shall be entitled to an equitable extension of the Trade Contract Time if the Trade Contractor is able to show that the critical path of the Trade Contract Work was delayed by causes beyond the control of the Trade Contractor. Examples of causes beyond the control of the Trade Contractor include, but are not limited to, the following: acts or omissions of the Owner, the Design Professional, Construction Manager or Others; changes in the Work or the sequencing of the Work ordered by the Owner, or arising from decisions of the Owner that impact the time of performance of the Work; transportation delays not reasonably foreseeable; labor disputes not involving the Trade Contractor; general labor disputes impacting the Project but not specifically related to the Worksite; fire; terrorism, epidemics, adverse governmental actions, unavoidable accidents or circumstances; adverse weather conditions not reasonably anticipated; encountering Hazardous Materials; concealed or unknown conditions; delay authorized by the Owner pending dispute resolution; and suspension by the Owner under section 11.1. The Trade Contractor shall submit any requests for equitable extensions of Contract Time in accordance with the provisions of ARTICLE 8.

6.3.2 In addition, if the Trade Contractor is able to show that it incurred additional costs because the critical path of the Trade Contract Work was delayed by acts or omissions of the Owner, the Design Professional, Construction Manager or Others, changes in the Work or the sequencing of the Work ordered by the Owner, or arising from decisions of the Owner that impact the time of performance of the Work, encountering Hazardous Materials, or concealed or unknown conditions, delay authorized by the Owner pending dispute resolution or suspension by the Owner under section 11.1, then the Trade Contractor shall be entitled to an equitable adjustment in the Trade Contract Price subject to section 6.6.

6.3.3 NOTICE OF DELAYS In the event delays to the Trade Contract Work are encountered for any reason, the Trade Contractor shall provide prompt written notice to the Owner and the Construction Manager of the cause of such delays after Trade Contractor first recognizes the delay. The Owner and Trade Contractor agree to undertake reasonable steps to mitigate the effect of such delays.

6.4 NOTICE OF DELAY CLAIMS If the Trade Contractor believes it is due an equitable extension of Trade Contract Time or an equitable adjustment in Trade Contract Price as a result of a delay described in subsection 6.3.1, the Trade Contractor shall give the Owner and the Construction Manager written notice of the claim in accordance with section 8.4. If the Trade Contractor causes delay in the completion of the Trade Contract Work, the Owner shall be entitled to recover its additional costs subject to subsection 6.6. The Owner shall process any such claim against the Trade Contractor in accordance with ARTICLE 8.

6.5 LIQUIDATED DAMAGES

6.5.1 SUBSTANTIAL COMPLETION The Owner and the Trade Contractor agree that this Agreement shall / shall not (indicate one) provide for the imposition of liquidated damages based on the Date of Substantial Completion.

6.5.1.1 The Trade Contractor understands that if the Date of Substantial Completion established by this Agreement, as may be amended by subsequent Trade Change Order, is not attained, the Owner will suffer damages which are difficult to determine and accurately specify. The Trade Contractor agrees that if the Date of Substantial Completion is not attained the Trade Contractor shall pay the Owner Zero Dollars and No Cents (\$0.00) as liquidated damages and not as a penalty for each day that Substantial Completion extends beyond the Date of Substantial Completion. The liquidated damages provided herein shall be in lieu of all liability for any and all



extra costs, losses, expenses, claims, penalties and any other damages of whatsoever nature incurred by the Owner which are occasioned by any delay in achieving the Date of Substantial Completion.

6.5.2 FINAL COMPLETION The Owner and the Trade Contractor agree that this Agreement shall / shall not (indicate one) provide for the imposition of liquidated damages based on the Date of Final Completion.

6.5.2.1 The Trade Contractor understands that if the Date of Final Completion established by this Agreement, as may be amended by subsequent Trade Change Order is not attained, the Owner will suffer damages which are difficult to determine and accurately specify. The Trade Contractor agrees that if the Date of Final Completion is not attained the Trade Contractor shall pay the Owner Zero Dollars and No Cents (\$0.00) as liquidated damages and not as a penalty for each day that Final Completion extends beyond the Date of Final Completion. The liquidated damages provided herein shall be in lieu of all liability for any and all extra costs, losses, expenses, claims, penalties and any other damages of whatsoever nature incurred by the Owner which are occasioned by any delay in achieving the Date of Final Completion.

6.5.3 OTHER LIQUIDATED DAMAGES The Owner and the Trade Contractor may agree upon the imposition of liquidated damages based on other project milestones or performance requirements. Such agreement shall be included as an exhibit to this Agreement.

6.6 LIMITED MUTUAL WAIVER OF CONSEQUENTIAL DAMAGES Except for damages mutually agreed upon by the Parties as liquidated damages in Section 6.5 and excluding losses covered by insurance required by the Trade Contract Documents, the Owner and the Trade Contractor agree to waive all claims against each other for any consequential damages that may arise out of or relate to this Agreement, except for those specific items of damages excluded from this waiver as mutually agreed upon by the Parties and identified below. The Owner agrees to waive damages including but not limited to the Owner's loss of use of the Project, any rental expenses incurred, loss of income, profit or financing related to the Project, as well as the loss of business, loss of financing, principal office overhead and expenses, loss of profits not related to this Project, loss of reputation, or insolvency. The Trade Contractor agrees to waive damages including but not limited to loss of business, loss of financing, principal office overhead and expenses, loss of profits not related to this Project, loss of bonding capacity, loss of reputation, or insolvency. The provisions of this section shall also apply to the termination of this Agreement and shall survive such termination.

6.6.1 The following items of damages are excluded from this mutual waiver: The provisions of this section shall also apply to the termination of this Agreement and shall survive such termination. The Owner and the Trade Contractor shall require similar waivers in contracts with Subcontractors and Others retained for the Project.

ARTICLE 7 TRADE CONTRACT PRICE

7.1 LUMP SUM As full compensation for performance by the Trade Contractor of the Work in conformance with the Contract Documents, the Owner shall pay the Trade Contractor the lump sum price of: XX dollars and XX cents (\$XX.XX). The lump sum price is hereinafter referred to as the Trade Contract Price, which shall be subject to increase or decrease as provided in article 8.

Lump Sum Price includes Base Bid of \$X.XX and Alternate #XX for {alternate description} for \$X.XX for a total Lump Sum Price of \$X.XX.

7.2 ALLOWANCES

7.2.1 All allowances stated in the Trade Contract Documents shall be included in the Trade Contract Price. The Owner shall select allowance items in a timely manner so as not to delay the Trade Contract



Work.

7.2.2 Allowances shall include the costs of materials, supplies and equipment delivered to the Worksite, less applicable trade discounts and including requisite taxes, unloading and handling at the Worksite, and labor and installation, unless specifically stated otherwise. The Trade Contractor's Overhead and profit for the allowances shall be included in the Trade Contract Price, but not in the allowances. The Trade Contract Price shall be adjusted by Trade Contract Change Order to reflect the actual costs when they are greater than or less than the allowances.

ARTICLE 8 CHANGES

Changes in the Trade Contract Work that are within the general scope of this Agreement shall be accomplished, without invalidating this Agreement, by Trade Contract Change Order, and Trade Contract Interim Directed Change.

8.1 TRADE CHANGE ORDER

8.1.1 The Owner may order or the Trade Contractor may request changes in the Trade Contract Work or the timing or sequencing of the Trade Contract Work that impacts the Trade Contract Price or the Trade Contract Time. All such changes in the Trade Contract Work that affect Trade Contract Time or Trade Contract Price shall in the form of a Trade Contract Change Order. Any such requests for a change in the Trade Contract Price or the Trade Contract Time shall be processed in accordance with this article 8. Trade Contract Change Orders shall be executed on the ConsensusDOCS 813 - Trade Contract Change Order (CM as Owner's Agent) with attachments as necessary.

8.1.2 The Owner, with the assistance of the Construction Manager, and the Trade Contractor shall negotiate in good faith an appropriate adjustment to the Trade Contract Price or the Trade Contract Time and shall conclude these negotiations as expeditiously as possible. Acceptance of the Trade Contract Change Order and any adjustment in the Trade Contract Price or Trade Contract Time shall not be unreasonably withheld.

8.2 TRADE CONTRACT INTERIM DIRECTED CHANGE

8.2.1 The Construction Manager may issue a written Trade Contract Interim Directed Change signed by the Owner directing a change in the Trade Contract Work prior to reaching agreement with the Trade Contractor on the adjustment, if any, in the Trade Contract Price or the Trade Contract Time.

8.2.2 The Owner, with the assistance of the Construction Manager, and the Trade Contractor shall negotiate expeditiously and in good faith for appropriate adjustments, as applicable, to the Trade Contract Price or the Trade Contract Time arising out of a Trade Contract Interim Directed Change. As the Trade Contract Changed Work is performed, the Trade Contractor shall submit its costs for such work with its application for payment beginning with the next application for payment within thirty (30) Days of the issuance of the Trade Contract Interim Directed Change. If there is a dispute as to the cost to the Owner, the Trade Contractor shall continue to perform the Trade Contract Changed Work set forth in the Trade Contract Interim Directed Change and the Owner shall pay the requirements Trade Contractor the Cost of the Work, defined in 8.3.1.3 below upon receipt of an application for payment and the Owner's (and the Architect's and construction manager's) determination that the work has been completed. The Parties reserve their rights as to the disputed amount, subject to the requirements ARTICLE 12.

8.2.3 When the Owner and the Trade Contractor agree upon the adjustment in the Trade Contract Price or the Trade Contract Time, for a change in the Trade Contract Work directed by a Trade Contract Interim Directed Change, such agreement shall be the subject of a Trade Contract Change Order. The



Trade Contract Change Order shall include all outstanding Trade Contract Interim Directed Changes on which the Owner and Trade Contractor have reached agreement on Contract Price or Contract Time issued since the last Trade Contract Change Order.

8.3 DETERMINATION OF COST

8.3.1 An increase or decrease in the Trade Contract Price or the Trade Contract Time resulting from a change in the Trade Contract Work shall be determined by one or more of the following methods:

8.3.1.1 unit prices set forth in this Agreement or as subsequently agreed;

8.3.1.2 a mutually accepted, itemized lump sum;

8.3.1.3 COST OF THE WORK Cost of the Work as defined by this subsection plus 10.0 % for Overhead and 5.0 % for profit. "Cost of the Work" shall include the following costs reasonably incurred to perform a change in the Work

8.3.1.3.1 wages paid for labor in the direct employ of the Constructor in the performance of the Work;

8.3.1.3.2 salaries of the Trade Contractor's employees when stationed at the field office to the extent necessary to complete the applicable Work, employees engaged on the road expediting the production or transportation of material and equipment, and supervisory employees from the principal or branch office performing the functions listed below;

8.3.1.3.3 cost of applicable employee benefits and taxes, including but not limited to, workers' compensation, unemployment compensation, social security, health, welfare, retirement and other fringe benefits as required by law, labor agreements, or paid under the Trade Contractor's standard personnel policy, insofar as such costs are paid to employees of the Trade Contractor who are included in the Cost of the Work in subsections .1 and .2 immediately above;

8.3.1.3.4 reasonable transportation, travel, and hotel expenses of the Trade Contractor's personnel incurred in connection with the Work;

8.3.1.3.5 cost of all materials, supplies, and equipment incorporated in the Work, including costs of inspection and testing if not provided by the Owner, transportation, storage, and handling;

8.3.1.3.6 payments made by the Trade Contractor to Subcontractors for Work performed under this Agreement;

8.3.1.3.7 cost, including transportation and maintenance of all materials, supplies, equipment, temporary facilities, and hand tools not owned by the workers that are used or consumed in the performance of the Work, less salvage value or residual value; and cost less salvage value of such items used, but not consumed that remain the property of the Trade Contractor;

8.3.1.3.8 rental charges of all necessary machinery and equipment, exclusive of hand tools owned by workers, used at the Worksite, whether rented from the Trade Contractor or Others, including installation, repair and replacement, dismantling, removal, maintenance, transportation, and delivery costs. Rental from unrelated third parties shall be reimbursed at actual cost. Rentals from the Trade Contractor or its affiliates, subsidiaries, or related parties shall be reimbursed at the prevailing rates in the locality of the Worksite up to eighty-five percent (85%) of the value of the piece of equipment;

8.3.1.3.9 cost of the premiums for all insurance and surety bonds which the Trade Contractor is



required to procure or deems necessary, and approved by the Owner including any additional premium incurred as a result of any increase in the cost of the Work;

8.3.1.3.10 sales, use, gross receipts or other taxes, tariffs, or duties related to the Work for which the Trade Contractor is liable;

8.3.1.3.11 permits, fees, licenses, tests, and royalties;

8.3.1.3.12 reproduction costs, photographs, facsimile transmissions, long-distance telephone calls, data processing costs and services, postage, express delivery charges, data transmission, telephone service, and computer-related costs at the Worksite to the extent such items are used and consumed in the performance of the Work or are not capable of use after completion of the Work;

8.3.1.3.13 all water, power, and fuel costs necessary for the Work;

8.3.1.3.14 cost of removal of all nonhazardous substances, debris, and waste materials;

8.3.1.3.15 all costs directly incurred to perform a change in the Work which are reasonably inferable from the Contract Documents for the Changed Work;

8.3.1.3.16 DISCOUNTS All discounts for prompt payment shall accrue to the Owner to the extent such payments are made directly by the Owner. To the extent payments are made with funds of the Constructor, all cash discounts shall accrue to the Constructor. All trade discounts, rebates and refunds, and all returns from sale of surplus materials and equipment, shall be credited to the Cost of the Work;

8.3.1.3.17 COST REPORTING The Trade Contractor shall maintain in conformance with generally accepted accounting principles a complete and current set of records that are prepared or used by the Trade Contractor to calculate the Cost of Work. The Owner and Construction Manager shall be afforded access to the Trade Contractor's records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda and similar data relating to requested payment for Cost of the Work. The Trade Contractor shall preserve all such records for a period of three years after the final payment or longer where required by law;

8.3.1.3.18 COST AND SCHEDULE ESTIMATES The Trade Contractor shall use reasonable skill and judgment in the preparation of a cost estimate or schedule for a change to the Work, but does not warrant or guarantee their accuracy

8.3.1.4 If an increase or decrease cannot be agreed to as set forth in Clauses .1 through .3 above, and the Owner or the Construction Manager issues a Trade Contract Interim Directed Change, the cost of the change in the Trade Contract Work shall be determined by the reasonable actual expense and savings of the performance of the Work resulting from the change. If there is a net increase in the Trade Contract Price, the Trade Contractor's Fee shall be adjusted accordingly. In case of a net decrease in the Trade Contract Price, the Trade Contractor's Fee shall not be adjusted unless ten percent (10%) or more of the Project is deleted. The Trade Contractor shall maintain a documented, itemized accounting evidencing the expenses and savings.

8.3.2 If unit prices are set forth in the Trade Contract Documents or are subsequently agreed to by the Parties, but the character or quantity of such unit items as originally contemplated is so different in a proposed Trade Change Order that the original unit prices will cause substantial inequity to the Owner or the Trade Contractor, such unit prices shall be equitably adjusted.

8.4 CLAIMS FOR ADDITIONAL COST OR TIME Except as provided in subsection 6.3.2 and section 6.4 for



any claim for an increase in the Trade Contract Price or the Trade Contract Time, the Trade Contractor shall give the Owner and the Construction Manager written notice of the claim within fourteen (14) Days after the occurrence giving rise to the claim or within fourteen (14) Days after the Trade Contractor first recognizes (or should have recognized) the condition giving rise to the claim, whichever is later. Except in an emergency, notice shall be given before proceeding with the Trade Contract Work. Thereafter, the Trade Contractor shall submit written documentation of its claim, including appropriate supporting documentation, within twenty-one (21) Days after giving notice, unless the Parties mutually agree upon a period of time. The Owner or Construction Manager shall respond in writing denying or approving the Trade Contractor's claim no later than fourteen (14) Days after receipt of the Trade Contractor's claim. Any change in the Trade Contract Price or the Trade Contract Time resulting from such claim shall be authorized by Trade Contract Change Order.

ARTICLE 9 PAYMENT

9.1 GENERAL PROVISIONS Within fourteen (14) calendar Days from the date of execution of this Agreement, the Trade Contractor shall prepare and submit to the Construction Manager for approval a Schedule of Values apportioned to the various divisions or phases of the Trade Contract Work. Each line item contained in the Schedule of Values shall be assigned a monetary price such that the total of all such items shall equal the Trade Contract Price. The Schedule of Values shall be prepared in such detail and be supported by such documents and proof as may be required by the Construction Manager.

9.2 PROGRESS PAYMENTS

9.2.1 APPLICATIONS The Trade Contractor shall submit to the Construction Manager monthly notarized applications for payment. Trade Contractor's applications for payment shall be itemized and supported by the Trade Contractor's Schedule of Values and any other substantiating data as required by this Trade Contractor Agreement or requested by the Construction Manager or Design Professional. Payment applications may include payment requests on account of properly authorized Trade Contract Change Orders and Interim Directed Changes. The progress payment application shall include Trade Contract Work performed through the preceding calendar month. The Construction Manager will review the application and recommend to the Design professional and the Owner amounts payable by the Owner to the Trade Contractor. The Owner, in accordance with the determination of the Design Professional, shall pay the amount otherwise due on any payment application, less any amounts as set forth below, no later than thirty (30) calendar Days after the payment application, or portion thereof, is approved the Design Professional. The Owner may deduct, from any progress payment, such amounts as may be retained pursuant to subsection 9.2.4 below.

9.2.2 STORED MATERIALS AND EQUIPMENT Unless otherwise provided in the contract documents, applications for payment may include materials and equipment not yet incorporated into the Work but delivered to and suitably stored onsite or offsite including applicable insurance, storage and costs incurred transporting the materials to an offsite storage facility. Approval of payment applications for stored materials and equipment stored offsite shall be conditioned on submission by the Trade Contractor of bills of sale and proof of required insurance, or such other procedures satisfactory to the Owner to establish the proper valuation of the stored materials and equipment, the Owner's title to such materials and equipment, and to otherwise protect the Owner's interests therein, including transportation to the site.

9.2.3 CLAIM WAIVERS

9.2.3.1 PARTIAL CLAIMWAIVERS AND AFFIDAVITS As a prerequisite for payment, the Trade Contractor shall provide, in a form satisfactory to the Owner and the Construction Manager, partial claim waivers in the amount of the application for payment and affidavits from the Trade Contractor, and its Subcontractors, Material Suppliers for the completed Trade Contract Work.



Such waivers shall be effective upon payment. In no event shall the Trade Contractor be required to sign an unconditional waiver of claim, either partial or final, prior to receiving payment or in an amount in excess of what it has been paid.

9.2.4 **RETAINAGE** From each progress payment made to the Trade Contractor has the Owner shall retain FIVE (5) percent of the amount otherwise due after deduction of any amounts as provided in section 9.3 and in no event shall such percentage exceed any applicable statutory requirements of this Agreement. Retainage shall be withheld and administered in accordance with Iowa Code Chapter 572:

9.3 **ADJUSTMENT OF TRADE CONTRACTOR'S PAYMENT APPLICATION** The Owner or the Construction Manager, upon notification of the Design Professional, may reject or adjust a Trade Contractor payment application or nullify a previously approved Trade Contractor payment application, in whole or in part, as may reasonably be necessary to protect the Owner from loss or damage based upon the following, to the extent that the Trade Contractor is responsible therefor under this Trade Contractor Agreement:

9.3.1 the Trade Contractor's repeated failure to perform the Trade Contract Work as required by the Trade Contractor Agreement;

9.3.2 loss or damage arising out of or relating to the Trade Contractor Agreement and caused by the Trade Contractor to the Owner, or to the Construction Manager or others to whom the Owner may be liable;

9.3.3 the Trade Contractor's failure to properly pay for labor, materials, equipment or supplies furnished in connection with the Trade Contract Work;

9.3.4 nonconforming or defective Trade Contract Work which has not been corrected in a timely fashion;

9.3.5 reasonable evidence of delay in performance of the Trade Contract Work such that the work will not be completed within the Trade Contract Time, and that the unpaid balance of the Trade Contract Price is not sufficient to offset any liquidated damages or actual damages that may be sustained by the Owner as a result of the anticipated delay caused by the Trade Contractor;

9.3.6 reasonable evidence demonstrating that the unpaid balance of the Trade Contract Price is insufficient to cover the cost to complete the Trade Contract Work; and

9.3.7 third-party claims involving the Trade Contractor or reasonable evidence demonstrating that third-party claims are likely to be filed unless and until the Trade Contractor furnishes the Owner with adequate security in the form of a surety bond, letter of credit or other collateral or commitment which are sufficient to discharge such claims if established. No later than thirty (30) Days after receipt of an application for payment, the Owner or Construction Manager shall give written notice to the Trade Contractor, disapproving or nullifying it or a portion thereof, specifying the reasons for the disapproval or nullification. When the above reasons for disapproving or nullifying an application for payment are removed, payment will be made for amounts previously withheld.

9.4 **PAYMENT NOT ACCEPTANCE** Payment to the Trade Contractor does not constitute or imply acceptance of any portion of the Trade Contract Work.

9.5 **PAYMENT DELAY** If for any reason not the fault of the Trade Contractor, the Trade Contractor does not receive a progress payment from the Owner sixty (60) calendar Days after the time such payment is due, as defined in Subparagraph 9.2.1, then the Trade Contractor, upon giving within seven (7) calendar Days after written notice to the Owner, and without prejudice to and in addition to any other legal remedies, may stop its Trade Contract Work until payment of the full amount owing to the Trade Contractor has been received. The



Trade Contract Price and Trade Contract Time shall be equitably adjusted by a Trade Contract Change Order to reflect reasonable cost and delay resulting from shutdown, delay and start-up.

9.6 SUBSTANTIAL COMPLETION

9.6.1 The Trade Contractor shall notify the Owner, the Construction Manager and the Design Professional when it considers Substantial Completion of the Trade Contract Work or a designated portion to have been achieved. The Construction Manager and the Design Professional shall promptly conduct an inspection to determine whether the Trade Contract Work or designated portion can be occupied or utilized for its intended use by the Owner without excessive interference in completing any remaining unfinished Trade Contract Work by the Trade Contractor. If the Construction Manager and the Design Professional determine that the Trade Contract Work or designated portion has not reached Substantial Completion, the Design Professional, and the Construction Manager, shall promptly compile a list of items to be completed or corrected so the Owner may occupy or utilize the Trade Contract Work or designated portion for its intended use. The Trade Contractor shall promptly complete all items on the list.

9.6.2 When Substantial Completion of the Trade Contract Work or a designated portion is achieved, the Construction Manager and the Design Professional shall prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, and the respective responsibilities of the Owner and Trade Contractor for interim items such as security, maintenance, utilities, insurance and damage to the Trade Contract Work. The Owner shall assume all responsibilities for items such as security, maintenance, utilities, and insurance, and damage to the Work. The certificate shall also list the items to be completed or corrected, and establish the time for their completion or correction. The Certificate of Substantial Completion shall be submitted to the Trade Contractor for written acceptance of responsibilities assigned in the Certificate.

9.6.3 Unless otherwise provided in the Certificate of Substantial Completion, warranties required by the Trade Contract Documents shall commence on the date of Substantial Completion of the Trade Contract Work or a designated portion.

9.6.4 Uncompleted items shall be completed by the Trade Contractor by the Final Completion date set forth in the Agreement and/or Construction Schedule. The Trade Contractor may request early release of retainage in accordance with Iowa Code Section 26.13. Payment for completed work and retainage shall be made in accordance with Iowa Code Chapters 26 and 573.

9.7 PARTIAL OCCUPANCY OR USE The Owner may occupy or use completed or partially completed portions of the Trade Contract Work when (a) the portion of the Trade Contract Work is designated in a Certificate of Substantial Completion, (b) appropriate insurer(s) consent to the occupancy or use, and (c) appropriate public authorities authorize the occupancy or use. Such partial occupancy or use shall constitute Substantial Completion of that portion of the Trade Contract Work.

9.8 FINAL PAYMENT

9.8.1 APPLICATION Upon acceptance of the Trade Contract Work by the Construction Manager, and approval by the Design Professional, and upon the Trade Contractor furnishing evidence of fulfillment of the Trade Contractor's obligations in accordance with the Trade Contract Documents, the Trade Contractor shall submit its application for final payment. The Construction Manager will review the Trade Contractor's final payment application and recommend to the Design Professional and the Owner an amount payable by the Owner to the Trade Contractor. The Design Professional shall then recommend an amount to be paid by the Owner. Final payment shall be made in accordance with Iowa Code Chapters 26 and 573.



9.8.2 REQUIREMENTS Along with its application for final payment, the Trade Contractor shall furnish to the Construction Manager:

9.8.2.1 an affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the Trade Contract Work for which the Owner or its property or the Construction Manager or the Owner's surety might in any way be liable, have been paid or otherwise satisfied;

9.8.2.2 consent of the Trade Contractor's surety to final payment;

9.8.2.3 satisfaction of closeout procedures as may be required by the Trade Contractor Agreement;

9.8.2.4 certification (or other writing indicating) that insurance required by the Trade Contractor Agreement is and will remain effect beyond final payment pursuant to this Trade Contractor Agreement and

9.8.2.5 other data if required by the Owner or Construction Manager, such as receipts, releases, and waivers of liens effective upon payment to the extent and in such form as may be designated by the Owner or Construction Manager. Acceptance of final payment by the Trade Contractor shall constitute a waiver of all claims by the Trade Contractor except those previously made in writing and identified by the Trade Contractor as unsettled at the time of final application for payment.

9.8.3 TIME OF PAYMENT Final payment of the balance of the Trade Contract Price, less any amount retained pursuant to subsection 9.2.4 of this Agreement, and as required by Iowa Code Chapters 26 and 573, which among other things requires that twice the amount of an Iowa Code Chapter 573 subcontractor claim be withheld from final payment, shall be made to the Trade contractor within sixty (60) Days after the Trade Contractor has submitted a complete and accurate application for final payment.

9.8.4 LATE PAYMENT INTEREST Progress payments or final payment due and unpaid under this Trade Contractor Agreement shall bear interest from the date payment is due at the statutory rate prevailing at the place of the Project.

9.9 PAYMENT USE AND VERIFICATION The Trade Contractor is required to pay for all labor, materials and equipment used in the performance of the Trade Contract Work through the most current period applicable to progress payments received. Reasonable evidence, satisfactory to the Construction Manager, may be required to show that all obligations relating to the Trade Contract Work are current before releasing any payment due on the Trade Contract Work. If required by the Construction Manager, before final payment is made for the Trade Contract Work, the Trade Contractor shall submit evidence satisfactory to the Construction Manager that all payrolls, bills for materials and equipment, and all known indebtedness connected with the Trade Contract Work, have been paid or otherwise satisfied as set forth in subsection 9.8.2.

ARTICLE 10 INDEMNITY, INSURANCE, WAIVERS AND BONDS

10.1 INDEMNITY

10.1A To the extent portions of this Article are in conflict with SF 396 (codified at Iowa Code Section 573A.5) said portions are void and unenforceable.

10.1.1 TRADE CONTRACTOR'S INDEMNITY To the fullest extent permitted by law, the Trade Contractor shall indemnify and hold harmless the Owner, the Owner's officers, directors, members,



consultants, agents and employees, from all claims for bodily injury and property damage, other than to the Work itself and other property insured under subsection 10.3.1, including reasonable attorneys' fees, costs and expenses, that may arise from the performance of the Work, but only to the extent caused by the negligent acts or omissions of the Trade Contractor, Subcontractors or anyone employed directly or indirectly by any of them or by anyone for whose acts any of them may be liable. The Trade Contractor shall be entitled to reimbursement of any defense costs paid above the Trade Contractor's percentage of liability for the underlying claim to the extent provided for under subsection 10.1.2.

10.1.2 OWNER'S INDEMNITY To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Trade Contractor, its officers, directors, members, consultants, agents, and employees, from all claims for bodily injury and property damage, other than property insured under subsection 10.3.1, including reasonable attorneys' fees, costs and expenses, that may arise from the performance of work by Owner, Design Professional or Others, but only to the extent caused by the negligent acts or omissions of the Owner, Design Professional or Others. The Owner shall be entitled to reimbursement of any defense costs paid above Owner's percentage of liability for the underlying claim to the extent provided for under subsection 10.1.1.

10.1.3 CONSTRUCTION MANAGER AND DESIGN PROFESSIONAL INDEMNITY The Owner shall cause the Construction Manager and the Design Professional to agree to indemnify and hold harmless the Owner from all claims for bodily injury and property damage, other than to the Work itself and other property insured under section 10.3, that may arise from the Construction Manager's or the Design Professional's services, but only to the extent that such claims result from the negligent acts or omissions of the Construction Manager or the Design Professional, respectively, or anyone for whose acts or omissions the Construction Manager or Design Professional, respectively, is liable. Such provisions shall be in a form no less protective of the Parties than the Construction Manager's Indemnity provided in ConsensusDocs 801 (2011) or the Design Professional's indemnity provided in ConsensusDocs 803 (2011) respectively, and shall be reasonably satisfactory to the Owner and the Trade Contractor.

10.1.4 ADJACENT PROPERTY INDEMNIFICATION To the extent of the limits of Trade Contractor's Commercial General Liability Insurance specified in subsection 10.2.1 or Zero Dollars and No Cents (\$0.00) whichever is more, the Trade Contractor shall indemnify and hold harmless the Owner against any and all liability, claims, demands, damages, losses and expenses, including attorney's fees, in connection with or arising out of any damage or alleged damage to any of Owner's existing adjacent property that may arise from the performance of the Trade Contract Work, but only to the extent of the negligent acts or omissions of the Trade Contractor, Subcontractor or anyone employed directly or indirectly by any of them or by anyone for whose acts any of them may be liable.

10.1.5 NO LIMITATION ON LIABILITY In any and all claims against the Indemnitees by any employee of the Trade Contractor, anyone directly or indirectly employed by the Trade Contractor or anyone for whose acts the Trade Contractor may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Trade Contractor under Workers' Compensation acts, disability benefit acts or other employment benefit acts.

10.2 TRADE CONTRACTOR'S INSURANCE

10.2.1 Prior to the start of the Work, the Trade Contractor shall procure and maintain in force Workers Compensation/Employers' Liability Insurance, Business Automobile Liability Insurance, and Commercial General Liability Insurance (CGL). The CGL policy shall include coverage for liability arising from premises, operations, independent contractors, products-completed operations, personal injury and



advertising injury, contractual liability, and broad form property damage. The Trade Contractor's liability policies, as required in this Subparagraph 10.2.1, shall be written on an occurrence basis with at least the following limits of liability:

10.2.1.1 Workers' Compensation- amount required by the laws of Iowa

10.2.1.2 Employers' Liability Insurance - \$500,000 or an amount required by Iowa law, whichever is greater.

10.2.1.3 Business Automobile Liability Insurance

a. \$1,000,000 Each Accident

10.2.1.4 Commercial General Liability Insurance

a. \$1,000,000 Each Occurrence b. \$2,000,000 General Aggregate c. \$1,000,000 Products/Completed Operations Aggregate d. \$1,000,000 Personal and Advertising Injury Limit

10.2.2 The Trade Contractor Must also carry and maintain Excess or Umbrella Liability coverage for the policies in subsection 10.2.1 in the amounts as listed below:

Trade Contractor Contract Amount: <\$1,000,000 - \$2 Million Umbrella or more \$1,000,000 - \$5,000,000 - \$5 Million Umbrella or more >\$5,000,000 - \$10 Million Umbrella or more

10.2.3 The Trade Contractor shall maintain in effect all insurance coverage required under subsection 10.2.1 with insurance companies lawfully authorized to do business in Iowa. Such insurance companies shall have a minimum A.M. Best Rating of A-VI (Consult instructions and insurance advisor). If the Trade Contractor fails to obtain or maintain any insurance coverage required under this Agreement, the Owner may purchase such coverage and charge the expense to the Trade Contractor, or terminate this Agreement.

10.2.4 To the extent commercially available, the policies of insurance required under Subparagraph 10.2.1 shall contain a provision that the insurance company or its designee must give the Owner written notice transmitted in paper or electronic format: (a) 30 days before coverage is nonrenewed by the insurance company and (b) with 10 business days after cancelation of coverage by the insurance company. The Trade Contractor shall maintain completed operations liability insurance for one year after acceptance of the Contract Documents, whichever is longer. Prior to commencement of services, the Trade Contractor shall furnish the Owner with certificates evidencing the required coverages. In addition, if any insurance policy required under subsection 10.2.1 is not to be immediately replaced without a lapse in coverage when it expires, exhausts its limits, or is to be, cancelled, the Trade Contractor shall give Owner prompt written notice upon actual or constructive knowledge of such condition.

10.2.5 ADDITIONAL LIABILITY COVERAGE

10.2.5.1 The Owner shall / shall not (indicate one) require the Trade Contractor to purchase and maintain liability coverage, primary to the Owner's coverage under subsection 10.3.1.

10.2.5.2 If required by subsection 10.2.5.1, the additional liability coverage required of the Trade Contractor shall be:

1. Additional Insured Owner shall be named as an additional insured on Trade Contractor's Commercial General Liability Insurance specified for operations and completed operations,



but only with respect to liability for bodily injury, property damage or personal and advertising injury to the extent caused by the negligent acts or omissions of Trade Contractor, or those acting on Trade Contractor's behalf, in the performance of Trade Contractor's Work for.

2. OCP Trade Contractor shall provide an Owners' and Contractors' Protective Liability Insurance ("OCP") policy with limits equal to the limits on Commercial General Liability Insurance specified or limits as otherwise required by Owner.

Any documented additional cost in the form of a surcharge associated with procuring the additional liability coverage in accordance with this subsection shall be paid by the Owner directly or the costs may be reimbursed by the Owner to the Trade Contractor by increasing the Trade Contract Price to correspond to the actual cost required to purchase and maintain the additional liability coverage. Prior to commencement of the Work, the Trade Contractor shall obtain and furnish to the Owner a certificate evidencing that the additional liability coverages have been procured.

10.2.6 PROFESSIONAL LIABILITY INSURANCE To the extent the Trade Contractor is required to procure design services under this Agreement, in accordance with section 3.14, the Trade Contractor shall require the designers to obtain professional liability insurance for claims arising from the negligent performance of professional services under this Agreement, with a company reasonably satisfactory to the Owner, including coverage for all professional liability caused by any of the Designer's(s') consultants, written for not less than \$1,000,000 per claim and in the aggregate with the deductible not to exceed \$2,000,000. The deductible shall be paid by the Designer.

10.3 OWNER'S INSURANCE

10.3.1 Deleted.

10.3.2 Deleted.

10.4 PROPERTY INSURANCE

10.4.1 Before the start of Trade Contract Work, the Owner shall obtain and maintain Builder's Risk Policy insurance with minimum coverage limits equal to the full cost of replacement of the Project at the time of loss. This insurance shall also name the Trade Contractor, Subcontractors, Material Suppliers, Construction Manager and Design Professional as insureds. This insurance shall be written as a Builder's Risk Policy or equivalent form to cover all risks of physical loss except those specifically excluded by the policy, and shall insure at least against the perils of fire, lightning, explosion, windstorm, hail, smoke, aircraft and vehicles, riot and civil commotion, theft, vandalism, malicious mischief, debris removal, flood (subject to sublimits), earthquake (subject to sublimits), earth movement, water damage, wind damage, testing if applicable, collapse however caused, and shall include coverage for, material, or equipment stored offsite, onsite or in transit. This policy shall provide for a waiver of subrogation in favor of the Trade Contractor, Subcontractors, Material Suppliers, Construction Manager and Design Professional. This insurance shall remain in effect until the Substantial Completion of the Work, final payment has been made or until no person or entity other than the Owner has an insurable interest in the property to be covered by this insurance, whichever is sooner. Partial occupancy or use of the Work shall not commence until the Owner has secured the consent of the insurance company or companies providing the coverage required in this Subparagraph 10.4.1.

10.4.2 If the Owner does not intend to purchase the property insurance required by this Agreement, including all of the coverages and deductibles described herein, the Owner shall give written notice to the Trade Contractor, the Design Professional and the Construction Manager before the Trade Contract



Work is commenced. The Trade Contractor may then provide insurance to protect its interests and the interests of the Subcontractors, including the coverage of deductibles. The cost of this insurance shall be charged to the Owner in a Change Order. The Owner shall be responsible for all of Trade Contractor's costs reasonably attributed to the Owner's failure or neglect in purchasing or maintaining the coverage described above.

10.4.2.1 The Owner will not obtain insurance to cover the risk of physical loss resulting from Terrorism. The Construction Manager is not required to purchase this type of insurance but may purchase this type of insurance if it chooses. If purchased, the cost of this insurance shall be borne by the Construction manager.

10.4.3 POLICIES The Owner shall provide the Trade Contractor with a copy of all policies including all endorsements upon request.

10.5 PROPERTY INSURANCE LOSS ADJUSTMENT

10.5.1 LOSS ADJUSTMENT Any insured loss shall be adjusted with the Owner and the Trade Contractor and made payable to the Owner as trustee for the insureds, as their interests may appear.

10.5.2 DISTRIBUTION OF PROCEEDS Following the occurrence of an insured loss, monies received will be deposited in a separate account and the trustee shall make distribution in accordance with the agreement of the Parties in interest.

10.6 WAIVERS

10.6.1 PROPERTY DAMAGE The Owner and Trade Contractor waive all claims and other rights they may have against each other for loss of or damage to (a) the Project, (b) all materials, machinery, equipment and other items used in accomplishing the Trade Contract Work or services or to be incorporated into the Project, while the same are in transit, at the Project Site, during erection and otherwise, and (c) all property owned by or in the custody of Owner and its affiliates, however such loss or damage shall occur, to the extent such damage is covered by property insurance. The proceeds of such insurance shall be held by the Owner as trustee.

10.6.2 WAIVER OF SUBROGATION The Owner shall have its insurers waive all rights of subrogation they may have against the Construction Manager, Design Professional, Trade Contractors, and their Subcontractors and Material Suppliers on all policies carried by the Owner on the Project and adjacent properties, including, after final payment, those policies to be provided on the completed Project not intended to insure the Project during construction.

10.6.3 ENDORSEMENT If the policies of insurance referred to in this section require an endorsement to provide for continued coverage where there is a waiver of subrogation, the Owner will cause them to be so endorsed.

10.7 RISK OF LOSS Except to the extent a loss is covered by property insurance, carried by the owner, risk of loss or damage to the Work shall be upon the Trade Contractor until the Date of Final Completion, unless otherwise agreed to by the Parties.

10.8 BONDS Performance and Payment Bonds

are

are not

required of the Trade Contractor that meet the requirements of Iowa Code Chapter 573. A deposit in lieu of a



bond may be acceptable if it meets the requirements of Iowa Code Section 573.4. Such bonds shall be issued by a surety admitted in the State in which the Project is located and must be acceptable to the Owner. The Owner's acceptance shall not be withheld without reasonable cause. The penal sum of the Payment Bond and of the Performance Bond shall each be one hundred percent (100%) of the original Contract Price. Any increase in the Contract Price that exceeds ten percent (10%) in the aggregate shall require a rider to the Bonds increasing penal sums accordingly. Up to such ten percent (10%) amount, the penal sum of the Bond shall remain equal to one hundred percent (100%) of the Contract Price. The Trade Contractor shall endeavor to keep its surety advised of changes potentially impacting the Contract Time and Contract Price, though the Trade Contractor shall require that its surety waives any requirement to be notified of any alteration or extension of time. The Trade Contractor's Payment Bond for the Project, if any, shall be made available by the Owner for review and copying by the Subcontractor. Iowa Code Chapter 573 shall control and take precedence over any conflicting term or condition in this Agreement

ARTICLE 11 SUSPENSION, NOTICE TO CURE AND TERMINATION OF AGREEMENT

11.1 SUSPENSION BY OWNER FOR CONVENIENCE

11.1.1 OWNER SUSPENSION Should the Owner order the Trade Contractor in writing to suspend, delay, or interrupt the performance of the Trade Contract Work for such period of time as may be determined to be appropriate for the convenience of the Owner and not due to any act or omission of the Trade Contractor or any person or entity for whose acts or omissions the Trade Contractor may be liable, then the Trade Contractor shall immediately suspend, delay or interrupt that portion of the Trade Contract Work as ordered by the Owner. The Trade Contract Price and the Trade Contract Time shall be equitably adjusted by Trade Contract Change Order for the cost and delay resulting from any such suspension.

11.1.2 Any action taken by the Owner that is permitted by any other provision of the Trade Contract Documents and that results in a suspension of part or all of the Trade Contract Work does not constitute a suspension of Trade Contract Work under this section.

11.2 NOTICE TO CURE A DEFAULT If the Trade Contractor persistently refuses or fails to supply enough properly skilled workers, proper materials, or equipment to maintain the approved Construction Schedule in accordance with ARTICLE 6, or fails to make prompt payment to its workers, Subcontractors or Material Suppliers; disregards laws, ordinances, rules, regulations or orders of any public authority having jurisdiction; or is otherwise guilty of a material breach of a provision of this Agreement, the Trade Contractor may be deemed in default. If the Trade Contractor fails within seven (7) business Days after receipt of written notification to commence and continue satisfactory correction of such default with diligence and promptness, then the Owner shall give the Trade Contractor a second notice to correct the default within a three (3) Day period. If the Trade Contractor fails to promptly commence and continue satisfactory correction of the default following receipt of such second notice, the Owner without prejudice to any other rights or remedies may:

11.2.1 supply workers and materials, equipment and other facilities as the Owner or Construction Manager deems necessary for the satisfactory correction of the default, and charge the cost to the Trade Contractor, who shall be liable for the payment of same including reasonable Overhead, profit and attorneys' fees;

11.2.2 contract with Others to perform such part of the Trade Contract Work as the Owner or Construction Manager determines shall provide the most expeditious correction of the default, and charge the cost to the Trade Contractor;

11.2.3 withhold payment due the Trade Contractor in accordance with section 9.3; and

11.2.4 in the event of an emergency affecting the safety of persons or property, immediately commence



and continue satisfactory correction of such default as provided in subsections 11.2.1 and 11.2.2 without first giving written notice to the Trade Contractor, but shall give prompt written notice of such action to the Trade Contractor following commencement of the action.

11.3 OWNER'S RIGHT TO TERMINATE FOR DEFAULT

11.3.1 TERMINATION BY OWNER FOR DEFAULT If, within seven (7) Days of receipt of a notice to cure pursuant to section 11.2, the Trade Contractor fails to commence and satisfactorily continue correction of the default set forth in the notice to cure, the Owner may notify the Trade Contractor that it intends to terminate this Agreement for default absent appropriate corrective action within fourteen additional Days. After the expiration of the additional fourteen (14) Day period, the Owner may terminate this Agreement by written notice absent appropriate corrective action. Termination for default is in addition to any other remedies available to Owner under section 11.2. If the Owner's cost arising out of the Trade Contractor's failure to cure, including the cost of completing the Trade Contract Work and reasonable attorneys' fees, exceeds the unpaid Trade Contract Price, the Trade Contractor shall be liable to the Owner for such excess costs. If the Owner's costs are less than the unpaid Trade Contract Price, the Owner shall pay the difference to the Trade Contractor. In the event the Owner exercises its rights under this section, upon the request of the Trade Contractor the Owner shall furnish to the Trade Contractor a detailed accounting of the cost incurred by the Owner.

11.3.2 USE OF TRADE CONTRACTOR'S MATERIALS, SUPPLIES AND EQUIPMENT If the Owner or Others perform work under this section, the Owner shall have the right to take and use any materials, supplies and equipment belonging to the Trade Contractor and located at the Worksite for the purpose of completing any remaining Trade Contract Work. Immediately upon completion of the Work, any remaining materials, supplies or equipment not consumed or incorporated in the Trade Contract Work shall be returned to the Trade Contractor in substantially the same condition as when they were taken, reasonable wear and tear excepted.

11.3.3 If the Trade Contractor files a petition under the Bankruptcy Code, this Agreement may be terminated for cause at the may be terminated for cause at the Owner.

11.3.3 If the Trade Contractor files a petition under the Bankruptcy Code, this Agreement may be terminated for cause at the may be terminated for cause at the Owner.

11.3.4 The Owner shall make reasonable efforts to mitigate damages arising from Trade Contractor default, and shall promptly invoice the Trade Contractor for all amounts due pursuant to sections 11.2 and 11.3.

11.4 TERMINATION BY OWNER FOR CONVENIENCE

11.4.1 Upon written notice to the Trade Contractor, the Owner may, without cause, terminate this Agreement. The Trade Contractor shall immediately stop the Work, follow the Owner's or Construction Manager's instructions regarding shutdown and termination procedures, and strive to minimize any further costs.

11.4.2 If the Owner terminates this Agreement pursuant to this section, the Trade Contractor shall be paid:

11.4.2.1 for the Work performed to date including Overhead and profit; and

11.4.2.2 for all demobilization costs and costs incurred as a result of the termination but not including Overhead or profit on work not performed;

11.4.2A Upon written notice to the Trade Contractor the Owner has the right to terminate this



Agreement without penalty as a result of the following: 1) the legislature or governor fail to appropriate funds sufficient to allow the Owner to operate as required and fulfill its obligations under this Agreement, 2) funds are de-appropriated or not allocated, 3) the Owner's authorization to operate is withdrawn or there is a material alteration in the programs administered by the owner, or 4) the Owner's duties are substantially modified. If such a termination results then the Trade Contractor shall be paid in the manner set forth in subparagraph 11.4.2. If, however, an appropriation to cover the cost of this Agreement becomes available within sixty (60) days subsequent to termination under this paragraph then the Owner agrees to re-enter into a modified version of this Agreement that accounts for the termination and reinstatement.

11.4.3 If the Owner terminates this Agreement pursuant to sections 11.3 or 11.4, the Trade Contractor shall:

11.4.3 If the Owner terminates this Agreement pursuant to sections 11.3 or 11.4, the Trade Contractor shall:

11.4.3.1 execute and deliver to the Owner all papers and take all action required to assign, transfer and vest in the Owner the rights of the Trade Contractor to all materials, supplies and equipment for which payment has or will be made in accordance with the Trade Contract Documents and all subcontracts, orders and commitments which have been made in accordance with the Trade Contract Documents;

11.4.3.2 exert reasonable effort to reduce to a minimum the Owner's liability for subcontracts, orders and commitments that have not been fulfilled at the time of the termination;

11.4.3.3 cancel any subcontracts, orders and commitments as the Owner or Construction Manager directs; and

11.4.3.4 sell at prices approved by the Owner or Construction Manager any materials, supplies and equipment as the Owner or Construction Manager directs, with all proceeds paid or credited to the Owner.

11.5 TRADE CONTRACTOR'S RIGHT TO TERMINATE

11.5.1 Upon seven (7) Days' written notice to the Owner and Construction Manager, the Trade Contractor may terminate this Agreement if the Trade Contract Work has been stopped for a thirty (30) Day period through no fault of the Trade Contractor for any of the following reasons:

11.5.1.1 under court order or order of other governmental authorities having jurisdiction;

11.5.1.2 as a result of the declaration of a national emergency or other governmental act during which, through no act or fault of the Trade Contractor, materials are not available; or

11.5.1.3 suspension by the Owner for convenience pursuant to section 11.1

11.5.2 In addition, upon seven (7) Days' written notice to the Owner and Construction Manager, the Trade Contractor may terminate the Agreement if the Owner:

11.5.2.1 fails to furnish reasonable evidence pursuant to section 4.1.2 that sufficient funds are available and committed for Project financing, or

11.5.2.2 assigns this Agreement over the Trade Contractor's reasonable objection, or

11.5.2.3 fails to pay the Trade Contractor in accordance with this Agreement and the Trade Contractor has complied with the notice provisions of section 9.5, or



11.5.2.4 otherwise materially breaches this Agreement.

11.5.3 Upon termination by the Trade Contractor in accordance with this section, the Trade Contractor shall be entitled to recover from the Owner payment for all Trade Contract Work executed and for any proven loss, cost or expense in connection with the Trade Contract Work, including all demobilization costs plus reasonable Overhead and profit on work not performed.

11.6 OBLIGATIONS ARISING BEFORE TERMINATION Even after termination pursuant to ARTICLE 11, the provisions of this Agreement still apply to any Trade Contract Work performed, payments made, events occurring, costs charged or incurred or obligations arising before the termination date.

ARTICLE 12 DISPUTE MITIGATION AND RESOLUTION

12.1 WORK CONTINUANCE AND PAYMENT Unless otherwise agreed in writing, the Trade Contractor shall continue the Trade Contract Work and maintain the Construction Schedule during any dispute mitigation or resolution proceedings. If the Trade Contractor continues to perform, the Owner shall continue to make payments in accordance with this Agreement.

12.2 DIRECT DISCUSSIONS If the Parties cannot reach resolution on a matter relating to or arising out of the Agreement, the Parties shall endeavor to reach resolution through good faith direct discussions between the Parties' representatives, who shall possess the necessary authority to resolve such matter and who shall record the date of first discussions. The authorized representative for the Trade Contractor is identified in Paragraph 3.4 of the Agreement. The authorized representative for the Owner is identified in Paragraph 4.2 of the Agreement. The parties' authorized representative are, among other things, authorized to resolve matters of disagreement and disputes between the Parties. If the dispute remains unresolved after fifteen (15) Days from the date of first discussion, the Parties shall submit such matter to the dispute mitigation and dispute resolution procedures selected herein.

12.3 MITIGATION The Parties agree that dispute mitigation procedures provided in this Project. Disputes remaining unresolved after direct discussions shall be directed to the selected mitigation procedure immediately below. The dispute mitigation procedure shall result in nonbinding finding on the matter. This may be introduced as evidence at a subsequent binding adjudication of the matter, as designee on Paragraph 12.5. The Parties agree that the dispute mitigation procedure shall be

(Designate only one.)

Project Neutral

Dispute Review Board

12.3.1 MITIGATION PROCEDURES The Project Neutral/Dispute Review Board shall be mutually selected and appointed by the Parties and shall execute a retainer agreement with the Parties establishing the scope of the Project Neutral/Dispute Review Board's responsibilities. The costs and expenses of the Project Neutral/Dispute Review Board shall be shared equally by the Parties. The Project Neutral/Dispute Review Board shall be available to either Party, upon request, throughout the course of the Project, and shall make regular visits to the Project so as to maintain an up-to-date understanding of the Project progress and issues and to enable the Project Neutral/Dispute Review Board to address matters in dispute between the Parties promptly and knowledgeably. The Project Neutral/Dispute Review Board shall issue nonbinding findings within five (5) business Days of referral of the matter to the Project Neutral, unless good cause is shown.

12.3.2 If the matter remains unresolved following the issuance of the nonbinding finding by the mitigation procedure or if the Project Neutral/Dispute Review Board fails to issue nonbinding findings



within five (5) Days of the referral, the Parties shall submit the matter to the binding dispute resolution procedure designated in section 12.5.

12.4 MEDIATION If direct discussions pursuant to section 12.2 do not result in resolution of the matter and no dispute mitigation procedure is selected under section 12.3, the Parties shall endeavor to resolve the matter by mediation through the current Construction Industry Mediation Rules of the American Arbitration Association, or the Parties may mutually agree to select another set of mediation rules. The administration of the mediation shall be as mutually agreed by the Parties. The mediation shall be convened within thirty (30) business Days of the matter first being discussed and shall conclude within forty-five (45) business Days of the matter first being discussed. Either Party may terminate the mediation at any time after the first session, but the decision to terminate shall be delivered in person by the terminating Party to the non-terminating Party and to the mediator. The costs of the mediation shall be shared equally by the Parties.

12.5 BINDING DISPUTE RESOLUTION If the matter is unresolved after submission of the matter to a mitigation procedure or to mediation, the Parties shall submit the matter to the binding dispute resolution procedure designated herein.

(Designate only one.)

Arbitration using the current Construction Industry Arbitration Rules of the American Arbitration Association

Litigation in either the state or federal court having jurisdiction of the matter in the location of the Project.

12.5.1 The costs of any binding dispute resolution procedures shall be borne by the non-prevailing Party, as determined by the adjudicator of the dispute. However, the costs of binding dispute resolution does not include attorney fees. The Parties are each responsible for paying for their own attorney fees.

12.5.2 VENUE The venue of any binding dispute resolution procedure shall be Des Moines, Iowa.

12.6 MULTIPARTY PROCEEDING All parties necessary to resolve a claim shall be parties to the same dispute resolution proceeding. Appropriate provisions shall be included in all other contracts relating to the Work to provide for the joinder or consolidation of such dispute resolution procedures.

12.7 LIEN RIGHTS The Trade Contractor acknowledges that it has no mechanic's lien rights on this Project because it is a public improvement project.

ARTICLE 13 MISCELLANEOUS PROVISIONS

13.1 ASSIGNMENT Neither the Owner nor the Trade Contractor shall assign their interest in this Agreement without the written consent of the other except as to the assignment of proceeds. The terms and conditions of this Agreement shall be binding upon both Parties, their partners, successors, assigns and legal representatives. Neither Party to this Agreement shall assign the Agreement as a whole without written consent of the other. If either Party attempts to make such an assignment, that Party shall nevertheless remain legally responsible for all obligations under this Agreement, unless otherwise agreed by the other Party.

13.2 GOVERNING LAW This Agreement and all disputes arising there from shall be governed by the Iowa law.

13.3 SEVERABILITY The partial or complete invalidity of any one or more provisions of this Agreement shall not affect the validity or continuing force and effect of any other provision.



13.4 NO WAIVER OF PERFORMANCE The failure of either Party to insist, in any one or more instances, on the performance of any of the terms, covenants or conditions of this Agreement, or to exercise any of its rights, shall not be construed as a waiver or relinquishment of such term, covenant, condition or right with respect to further performance or any other term, covenant, condition or right.

13.5 TITLES AND GROUPINGS The titles given to the articles of this Agreement are for ease of reference only and shall not be relied upon or cited for any other purpose. The grouping of the articles in this Agreement and of the Owner's specifications under the various headings is solely for the purpose of convenient organization and in no event shall the grouping of provisions, the use of sections or the use of headings be construed to limit or alter the meaning of any provisions.

13.6 ASSISTANCE OF COUNSEL AND INTERPRETATION The Parties agree that they had the opportunity to obtain the assistance of counsel in reviewing the Agreement terms prior to execution. This Agreement shall be construed neither against nor in favor of either Party, but shall be construed in a neutral manner.

13.7 RIGHTS AND REMEDIES The Parties' rights, liabilities, responsibilities and remedies with respect to this Agreement, whether in contract, tort, negligence or otherwise, shall be exclusively those expressly set forth in this Agreement.

13.8 ADDITIONAL PROVISIONS (Insert here other provisions, if any, that pertain to this Agreement See Below.)

13.9 COMPLIANCE WITH LAW AND REGULATIONS The Trade Contractor shall comply with all applicable federal, state, and local laws, rules, ordinances, regulations and orders when performing services and/or performing work under this Agreement, including without limitation, all laws applicable to the prevention of discrimination in employment and the use of targeted small businesses as subcontractors or suppliers. The Trade Contractor declares that it has complied with all federal, state and local laws regarding business permits and licenses that may be required to provide the services and work required by this Agreement. The Trade Contractor further acknowledges that if this Project is a recipient of Federal financial assistance that it may be subject to requirements of Federal Acts and Executive Orders as mandated by Federal agencies having authority and jurisdiction to enforce and ensure compliance with such laws and regulations including, but not necessarily limited to, the Davis Bacon Act and other Federal Acts and Executive Orders.

13.10 EMPLOYMENT PRACTICES: It is the intent of the Iowa Department of Administrative Services to assure equal employment opportunity in all contract work as required by law. Vendors, are required to take affirmative action to ensure that applicants employed or seeking employment with them are treated equally as required by law. Vendors shall not illegally discriminate against any employee. During the course of the Project, the Vendor may be required to show compliance with the EEO and Affirmative Action requirements. Noncompliance with the provisions set forth at the time of contract award may result in termination or suspension of the Agreement in whole or in part. All vendors and service providers working under the terms of this Agreement are prohibited from engaging in discriminatory employment practices forbidden by Iowa law. Vendors shall complete and submit the Nondiscrimination Clause form for the Owner's approval.

13.11 RECIPROCAL BIDDER PREFERENCE In accordance with Iowa Code Section 73A.21, as amended in 2011 by HF 648, if the Trade Contractor is not a resident bidder of Iowa, as defined by law, then the Trade Contractor must specifically identify in writing with its bid any and all preferences or preferential treatment (including preferences related to labor) enforced by the state or foreign country in which the Trade Contractor is a resident. If the low bid Trade Contractor is not a resident bidder of Iowa and the Trade Contractor's foreign State of residence enforces such a preference then the Owner shall reciprocally enforce the preference in favor of a resident bidder of Iowa. Failure on the part of the Trade Contractor to completely and accurately abide by this legal requirement may, among other things, result in civil penalties and void this Agreement. The Trade Contractor should contact its attorney regarding this legal requirement if the Trade



Contractor has questions regarding its meaning or application.

13.12 LABOR RELATIONS The Trade Contractor shall comply with all Iowa and Federal labor laws. In accordance with Executive Order Number 69, issued by the Governor of Iowa on or about January 14, 2011, no project labor agreement (also known as a PLA), or similar, will be used on this Project. Iowa is a right to work state. No consultant, contractor, or employee shall be obligated to contract with or join any labor organization as a condition of performing work on this Project.

ARTICLE 14 TRADE CONTRACT DOCUMENTS

14.1 The Trade Contract Documents in existence at the time of execution of this Agreement are as follows:

RFBXXXXXXXXX Bid Package X

14.2 INTERPRETATION OF TRADE CONTRACT DOCUMENTS

14.2.1 The drawings and specifications are complementary. If Trade Contract Work is shown only on one but not on the other, the Trade Contractor shall perform the Trade Contract Work as though fully described on both consistent with the Trade Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

14.2.2 In case of conflicts between the drawings and specifications, the specifications shall govern. In any case of omissions or errors in figures, drawings or specifications, the Trade Contractor shall immediately submit the matter to the Owner for clarification. The Owner's clarifications are final and binding on all Parties, subject to an equitable adjustment in Trade Contract Time or Price pursuant to ARTICLE 6 and ARTICLE 7 or dispute resolution in accordance with ARTICLE 12.

14.2.3 Where figures are given, they shall be preferred to scaled dimensions.

14.2.4 Any terms that have well-known technical or trade meanings, unless otherwise specifically defined in this Agreement, shall be interpreted in accordance with their well-known meanings. This Agreement entered into as of the date entered in ARTICLE 1.

14.2.5 PRECEDENCE In case of any inconsistency, conflict or ambiguity among the Trade Contract Documents, the documents shall govern in the following order: (a) Trade Contract Change Orders and written amendments to this Agreement; (b) this Agreement; (c) subject to subsection 14.2.2 the drawings, specifications and addenda issued prior to the execution of this Agreement; (d) approved submittals; (e) information furnished by the Owner pursuant to subsection 4.1.3; (f) other documents listed in this Agreement. Among all the Trade Contract Documents, the term or provision that is most specific or includes the latest date shall control. Information identified in one Trade Contract Document and not identified in another shall not be considered to be a conflict or inconsistency.

This Agreement entered into as of the date entered in ARTICLE 1.

OWNER State of Iowa, Department of Administrative Services



Trade Contractor: *Contractor Name*

By: _____

(Authorized Representative)

Name:

Title:

Date:

Owner: State of Iowa - DAS

By: _____

(Authorized Representative)

Name:

Title:

Date:

END OF DOCUMENT.

DRAFT



SECTION 00 6000

PERFORMANCE AND PAYMENT BOND

PART 1 - GENERAL

1.01 PERFORMANCE AND PAYMENT BOND

- A. Performance and payment bonds to be used on this project, ConsensusDocs 260 and 261 are attached for reference following this page. ConsensusDocs performance and payment bonds are not required (other standard forms are acceptable to the State of Iowa).

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION



CONSENSUSDOCS 260 PERFORMANCE BOND

This document was developed through a collaborative effort of organizations representing a wide cross-section of the design and construction industry. The organizations endorsing this document believe it represents a fair allocation of risk and responsibilities for all project participants.

Endorsing organizations recognize that this document must be reviewed and adapted to meet specific needs and applicable laws. This document has important legal and insurance consequences. You are encouraged to consult legal, insurance and surety advisors before completing or modifying this document. The software includes a notes section indicating where information is to be inserted to complete this document. Further information and endorsing organizations' perspectives are available at www.consensusdocs.org/guidebook.

For Use with ConsensusDOCS 200, Standard Form of Agreement and General Conditions Between Owner and Constructor (Where the Contract Price is a Lump Sum) and ConsensusDOCS 500, Standard Agreement and General Conditions Between Owner and Construction Manager.

The Owner, _____, (the "Owner") and the Constructor, _____, (the "Constructor") have entered into a Contract (the "Contract") dated _____ for _____ (the "Project"). The Contract is incorporated by reference into this Performance Bond (the "Bond").

By virtue of this Bond, the Constructor as Principal and _____ as Surety ("Surety"), are bound to the Owner as Obligee in the maximum amount of _____ Dollars (\$ _____) (the "Bond Sum"). The Constructor and Surety hereby bind themselves, their heirs, executors,

IMPORTANT: A vertical line in the margin indicates a change has been made to the original text. Prior to signing, recipients may wish to request from the party producing the document a "redlined" version indicating changes to the original text. Consultation with legal and insurance counsel and careful review of the entire document are strongly encouraged.

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administrators, successors and assigns, jointly and severally, as provided herein.

1. GENERAL CONDITIONS It is the condition of this Bond that if the Constructor performs its Contract obligations (the "Work"), the Surety's obligations under this Bond are null and void, Otherwise the Surety's obligations shall remain in full force and effect. The Surety waives any requirement to be notified of alterations or extensions of time made by the Owner in the Contract. The Owner may not invoke the provisions of this Bond unless the Owner has performed its obligations pursuant to the Contract. Upon making demand on this Bond, the Owner shall make the Contract Balance (the total amount payable by the Owner to the Constructor pursuant to the Contract less amounts properly paid by the Owner to the Constructor) available to the Surety for completion of the Work.

2. SURETY OBLIGATIONS If the Constructor is in default pursuant to the Contract and the Owner has declared the Constructor in default, the Surety promptly may remedy the default or shall

- a. Complete the Work, with the consent of the Owner, through the Constructor or otherwise,
- b. Arrange for the completion of the Work by a Constructor acceptable to the Owner and secured by performance and payment bonds equivalent to those for the Contract issued by a qualified surety. The Surety shall make available as the Work progresses sufficient funds to pay the cost of completion of the Work less the Contract Balance up to the Bond Sum, or
- c. Waive its right to complete the Work and reimburse the Owner the amount of its reasonable costs, not to exceed the Bond Sum, to complete the Work less the Contract Balance.

3. DISPUTE RESOLUTION All disputes pursuant to this Bond shall be instituted in any court of competent jurisdiction in the location in which the Project is located and shall be commenced within two years after default of the Constructor or Substantial Completion of the Work, whichever occurs first. If this provision is prohibited by law, the minimum period of limitation available to sureties in the jurisdiction shall be applicable.

This Bond is entered into as of _____.

SURETY _____ (seal)

By:

Print Name: _____

Print Title: _____

(Attach Power of Attorney)

Witness:

CONSTRUCTOR _____ (seal)

By:

Print Name: _____

Print Title: _____

Witness:

(Additional signatures, if any, appear on attached page)

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**CONSENSUSDOCS 261
PAYMENT BOND**

This document was developed through a collaborative effort of organizations representing a wide cross-section of the design and construction industry. The organizations endorsing this document believe it represents a fair allocation of risk and responsibilities for all project participants.

Endorsing organizations recognize that this document must be reviewed and adapted to meet specific needs and applicable laws. This document has important legal and insurance consequences. You are encouraged to consult legal, insurance and surety advisors before completing or modifying this document. The software includes a notes section indicating where information is to be inserted to complete this document. Further information and endorsing organizations' perspectives are available at www.consensusdocs.org/guidebook.

For Use with ConsensusDOCS 200, Standard Form of Agreement and General Conditions Between Owner and Constructor (Where the Contract Price is a Lump Sum) and ConsensusDOCS 500, Standard Agreement and General Conditions Between Owner and Construction Manager.

The Owner, _____, (the "Owner")
and the Constructor, _____,
(the "Constructor") have entered into a Contract (the "Contract") dated _____ for
_____ (the "Project"). The Contract is
incorporated by reference into this Payment Bond (the "Bond").

By virtue of this Bond, the Constructor as Principal and _____ as
Surety ("Surety"), are bound to the Owner as Obligee in the maximum amount of
_____ Dollars (\$ _____) (the
"Bond Sum"). The Constructor and Surety hereby bind themselves, their heirs, executors,

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administrators, successors and assigns, jointly and severally, as provided herein.

1. GENERAL CONDITIONS It is the condition of this Bond that if the Constructor promptly makes payment of all sums for all labor, materials, and equipment furnished for use in the performance of the work required by the Contract, the Surety's obligations pursuant to this Bond are null and void. Otherwise the Surety's obligations shall remain in full force and effect. The Surety waives any requirement to be notified of alterations or extensions of time made by the Owner in the Contract.

2. SURETY OBLIGATION Every Claimant who has not been paid in full before the expiration of a period of ninety (90) Days after such Claimant provided or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, may have a right of action on this Bond. The Surety's obligation to the Claimant(s) shall not exceed the Bond Sum.

3. LIMITATION OF ACTION No suit or action shall be commenced on this Bond by any Claimant
a. Unless Claimant, other than one having a direct Contract with the Constructor, shall have given written notice to the Constructor, the Owner and the Surety within ninety (90) Days after the Claimant provided or performed the last of the work or labor, or furnished the last of the materials for which the claim is made, stating with substantial accuracy the amount claimed and the name of the Party to whom the materials were furnished, or for whom the work or labor was provided or performed. Such notice shall be served by any means which provides written third party verification of delivery to the Constructor at any place it maintains an office or conducts business, or served in any manner in which legal process may be served in the state in which the Project is located.
b. After the expiration of one (1) year from the date on which the Claimant last performed labor or furnished materials or equipment on the Project. If this provision is prohibited by law, the minimum period of limitation available to sureties in the jurisdiction shall be applicable.
c. Other than in any court of competent jurisdiction in the location in which the Project is located.

4. CLAIMANT A Claimant is defined as an individual or entity having a direct contract with the Constructor or having a contract with a subcontractor having a direct contract with the Constructor to furnish labor, materials or equipment for use in the performance of the Contract.

This Bond is entered into as of _____.

SURETY _____ (seal)

By:

Print Name: _____

Print Title: _____

(Attach Power of Attorney)

Witness:

CONSTRUCTOR _____ (seal)

By:

Print Name: _____

IMPORTANT: A vertical line in the margin indicates a change has been made to the original text. Prior to signing, recipients may wish to request from the party producing the document a "redlined" version indicating changes to the original text. Consultation with legal and insurance counsel and careful review of the entire document are strongly encouraged.

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Print Title: _____

Witness:

(Additional signatures, if any, appear on attached page)

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SECTION 01 1200

CONTRACT SUMMARY

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Project Information
- B. Project Summary
- C. Bid Scope Summary
- D. Work Hour Restrictions
- E. Access to Site
- F. Coordination with Occupants
- G. Rules for Construction Workers
- H. Bid Package Instructions

1.02 PROJECT INFORMATION

- A. Facility Name/Location: DPS DSM New Fleet Building 50 Forest Ave and 1333 Ohio Street Des Moines, Iowa 50319
- B. DAS Project #: 9414.00
- C. Owner: State of Iowa, Department of Administrative Services, Hoover State Office Building, Level 3, 1305 East Walnut Street, Des Moines, IA 50319
- D. Owner's Representative: Brandon Adams, Iowa Department of Administrative Services, 109 SE 13th Street, Des Moines, IA 50319
- E. Construction Manager: Jarrad Boever, DCI Group, 220 SE 6th St. Suite 200. Des Moines, Iowa 50309

1.03 PROJECT SUMMARY

- A. The project includes DPS DSM New Fleet Building Renovations.
- B. Target date to provide substantial completion is July 24, 2025.

1.04 BID SCOPE SUMMARY

- A. Scope Applicable to All Bid Packages:
 - 1. The Contractor's Work includes all labor, supervision, materials, equipment, services, supplies, tools, facilities, transportation, hoisting, storage, receiving, licenses, inspections, certifications, overhead, profit, or other items required or reasonably inferable to properly and timely perform and complete all work and services to be performed by the Contractor pursuant to this Agreement. Unless specifically stated otherwise, incidental work required to accomplish the work of this Bid Package shall be included the bid. This would include, but not be limited to, temporary facilities, protection of the work, security of equipment, materials, and work in progress, etc. Contractor's Work shall be performed in accordance with the Drawings, Specification Divisions 00 and 01, and Specification sections applicable to each Contractor's scope.
 - 2. Contractor is responsible for all labor and equipment to unload, account for all material delivered, stock, and delivery for this scope of work. Storage and delivery of materials and equipment at the Site shall be permitted only to the extent approved in advance by the Construction Manager, and if anything so stored obstructs the progress of any portion of the work, it shall be promptly removed or relocated by the Contractor without reimbursement.
 - 3. On site supervision by Prime Contractor at all times work by that contractor or their subcontractors/suppliers is taking place.

4. Provide all temporary facilities required for this scope of work including trailer, trailer power, telephone, secured storage, temporary power for work, temporary and task lighting for work, etc. as determined necessary by Contractor. Coordinate location of trailers, material storage and utility lines with Construction Manager. Limited space is available, and permission to bring any such facility or excess materials on to the site shall be approved by the Construction Manager.
5. Contractor shall provide all equipment and tools for Contractor's own cleanup. Clean up shall be done at end of every shift or more frequently if required for the Contractor to perform their work, for other Contractors to perform their work, as required by the Owner's operations, and at the discretion of the Construction Manager.
6. All turf, landscaping, and subgrade disturbances caused by equipment traffic or other activities related to the Contractor's scope shall be repaired or restored to proper conditions by the Contractor.
7. Protect adjacent existing building elements from damage from Scope of work. Repair existing building elements damaged during Contractor's Scope of work.
8. Contractor to participate in a page turn with design team, owner and construction manager before the start of any work.
9. All contractors will be responsible for verifying load requirements for attachments to joist and provide additional reinforcements as required for installations by this contractor. Refer to detail 3 on page S102 for additional requirements.
10. Prior to the start of demolition, all bid packages shall participate in a meeting with DCI Group, the State, and other bid packages to review existing systems to remain and systems that will remain live during demolition.

1.05 WORK HOUR RESTRICTIONS

- A. Work hours are from 7:00AM to 5:00PM, Monday through Friday unless arrangements are made in advance.

1.06 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings.
- B. Provide access to and from site as required by law and Owner:
 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 2. Do not obstruct roadways, sidewalks, or other public ways without permission of Owner and permit if required.

1.07 OWNER OCCUPANCY

- A. Buildings will be unoccupied during construction.

1.08 RULES FOR CONSTRUCTION WORKERS

- A. The staff of the State of Iowa has a responsibility to protect the public by providing a secure environment. All work site rules must be followed to the letter, at all times.
- B. All construction workers must have a background check completed prior to entering the campus to perform work.
- C. Hot Work Permit Processes and Fire Watch, when necessary, will be adhered to for this project.
- D. All State properties are tobacco free. No smoking will be permitted or tolerated on campus unless in designated areas.
- E. You are permitted access only to the work site and no other area of the institution.
- F. No drugs, alcohol, or firearms are allowed on the work site.
- G. Do not leave money, drugs, alcohol, or firearms in your personal vehicle.

- H. Company and personal vehicles are to be parked and locked in designated or authorized area of the work.
- I. Secure all tools at the end of the day.
- J. Maintain control of all tools, supplies, and debris at all times during the work.
- K. Contractors are responsible for verifying all dimensions before construction and ordering materials.
- L. Each contractor is responsible for damage caused by their actions to the walls, floor, ceilings, and roofs. The contractor whose work caused damage is responsible for patching to match original construction, fire rating and finish.

1.09 BID PACKAGE INSTRUCTIONS

- A. **Bid Package #01** – General Construction: Trade Contractor shall include all of the following, but not limited to, as part of the contract:
 - 1. Demolition
 - a. Any penetrations created by this contractor, whether from demolition of existing systems or installation of new, shall be sealed by this contractor to match adjacent surface and rating. This shall include penetrations that remain from the demolition activities.
 - b. Infill all openings, holes or spalls left by demolition of existing systems & equipment using similar materials. Finish to match adjacent where applicable. Floor plan notations represent larger infills required but does not represent all locations where infills will be needed.
 - c. This contractor shall, in cooperation with the Construction Manager, fully inspect and record existing conditions of existing construction to remain BEFORE demolition or removal begins. Documentation of existing conditions shall be submitted to the construction manager prior to the start of work. Any damage not previously identified and recorded will be replaced and/or repaired by this contractor at this contractor's expense.
 - d. The contractor shall coordinate with other Bid Package Contractors prior to the start of demolition to ensure salvaged items have been removed and the area has been de-energized.
 - e. This contractor shall be responsible for providing dumpster service for all bid packages.
 - f. Contractor to review intent of demolition at specific locations prior to removal. Verify any discrepancy between existing conditions and proposed work with the construction manager and design team.
 - g. Life safety, door and security systems are to remain operational during demolition and construction phases.
 - h. Field verify that all partitions scheduled for removal are not structural and contain no load bearing elements. If conflicts occur, contact the construction manager and design team immediately.
 - i. Surfaces adjacent to removal areas shall be patched and cleaned. Maintain all fire ratings as required.
 - j. Contractor is responsible for complete demolition scope per the contract documents including, but not limited to walls, drywall, doors, frames/accessories, operable partitions, specialties, flooring, base, ceilings, ceiling assemblies, swing gates, casework, cabinets, shelving, millwork, countertops, bulkheads, toilets, decorative woodwork, wall graphics, signage, and abandoned in wall rough-ins and devices., the following will be removed by others:
 - 1) Bid Package #02: Mechanical and Plumbing - duct, dampers, actuators, grilles, diffusers, saw cutting and patching concrete floors.
 - 2) Bid Package #03: Fire Suppression – Fire suppression plumbing.

- 3) Bid Package #04: Electrical and Low Voltage - electrical, data, and fire alarm equipment including devices, panels, circuits, transformers, wiring and conduits.
 - k. This contractor shall be responsible for precast removals. Prior to any removals, this contractor shall be responsible for procurement and installation of lintels.
 - l. Contractor shall be responsible for the removal, salvage, and turnover to the Owner, or for reinstallation, of non - electric, mechanical or plumbing items as identified in the project drawings. This shall include, but not be limited to: Millwork, countertops, cabinets, shelving, flooring, fire extinguishers / associated components, demountable wall systems.
 - m. Contractor will be responsible for cutting, removal, and patching of roofs, walls, and floors associated with Bid Package 02 - Mechanical and Plumbing. This shall include the removal and replacement of ceilings, ceiling tiles, and ceiling grids associated with the mechanical scope. This will include the reinstallation and finishing of these areas back to their original condition.
2. Temporary Construction
 - a. Provide dust control (to include temporary filters), floor protection and/or temporary partitions as required between construction and non-construction areas at all times.
 - b. Contractor is responsible for signage as needed to maintain life safety while temporary partitions are in place.
 - c. Provide safe passage through and/or around construction areas as required to maintain building exits.
 - d. Contractor shall provide portable fire extinguishers and cabinets as required by code, local authorities having jurisdiction, and as noted on drawings and project manual.
3. Framing, Insulation, Drywall and Finishes
 - a. This contractor shall be responsible for all new framing, mullion mate, insulation, drywall, control joints, bracing, and finishing. This includes above ceiling supports where necessary to adequately support walls that do not extend to the deck. The contractor shall install control joints in new walls at door frames on both sides.
 - b. Provide inwall blocking at all walls for all cabinets, shelving, and owner supplied equipment. Verify locations with the construction manager prior to install. Blocking in existing walls shall include drywall removal and patching.
 - c. All wood sheathing except when used for clocking at windows, doors and parapets must be fire retardant treated sheathing.
 - d. Provisions shall be made at full height nonbearing walls for potential vertical movement of building structure without transfer of compression loads to wall. Verify use of deflection track connections at top of wall with structural.
 - e. Contractor shall be responsible for all miscellaneous drywall repairs / patching.
 - f. Contractor shall anticipate patching where vinyl base has been removed to provide a smooth and consistent wall finish.
 - g. Contractor shall be responsible for installing acoustical sealant at the base and head of all interior walls, unless noted otherwise.
 - h. All penetrations through walls and floor scheduled to receive a fire resistive rating shall be sealed with fire stopping materials as required to achieve the respective fire-resistive rating and smoke stoppage.
 - i. Hold ½" clearance between floor and gypsum board. Fill gap between bottom edge of gypsum board and floor with (acoustic) sealant.
4. Casework
 - a. Contractor shall be responsible for the procurement and installation of all new casework and countertops.
5. Miscellaneous Metals
 - a. This contractor shall be responsible for all miscellaneous metal installations, including but not limited to, lintels, base plates, angles, and connections.

6. Doors and Hardware
 - a. This contractor is responsible for the complete door, frame and hardware scope to include accepting, unloading and installation of the frames.
 - b. This contractor shall coordinate a door hardware meeting with the door and hardware supplier, installer, DCI Group, Architects, and the State of Iowa during the submittal phase.
 - c. All door and frame dimensions must be verified before fabrication.
 - d. The contractor shall include one return visit during the 11-month warranty period, and at the Owner's request, to review all doors installed by this bid package and adjust any doors not closing or locking properly.
 - e. This contractor shall be responsible for providing and installing all door accessories. This shall include, but not be limited to, door stops, silencers, closers, door position switches, kickplates, request to exit sensors, door mounted coat hooks, and coordinators.
 - f. Contractor shall provide and install temporary frame spreaders. This Contractor will be responsible for anchoring wall framing to the hollow metal frames and verifying hollow metal frames remain plumb, level, and square after drywall is installed and before doors are installed.
 - g. Contractor shall be responsible for painting all door frames to include existing and new.
 - h. All hollow metal doors and frames to be galvanized, primed and painted.
 - i. All frames wider than 44" to have head stiffeners.
 - j. Contractor shall be responsible for providing glazing for all doors, and frames.
 - k. Bid all glazing as dimensioned. If areas exceed code for allowable areas, assume fire glazing will be required.
 - l. Contractor to review ADA actuator locations with owner, construction manager and architect before installation.
 - m. Hollow metal frames throat depth to match wall thickness at all metal-framed stud walls.
7. Flooring
 - a. This contractor is responsible for the complete flooring scope including, but not limited to, carpet, vinyl base, luxury vinyl tile and transitions. This contractor will also be responsible for including all floor preparation.
 - b. This contractor shall be responsible for ensuring all finish flooring slopes to floor drains.
 - c. This contractor shall be responsible for testing the substrate prior to installation of flooring finishes and notifying the architect and construction manager of any deficiencies prior to installation. Failure to notify will be considered acceptance of substrate conditions.
 - d. Provide Schluter transition strips at all tile transitions. All other transition strips to be submitted for approval.
 - e. Changes in flooring materials shall be located at the center line of the door leaf or as shown on the finish plan.
 - f. Precast walls will not receive base.
8. Painting and Joint Sealants
 - a. This contractor is responsible for the complete painting scope of work per the contract documents. This shall include, but not be limited to, drywall, door frames, paintable sealants, and casework reveals.
 - b. Contractor is responsible for all sealant at transitions between a painted surface and dissimilar material. This shall include, but not be limited to, door and window frames, casework, countertops, access panels, and fire extinguisher cabinets.
 - c. Provide all touch-ups of minor damage or marred surfaces.
 - d. Contractor shall anticipate multiple mobilizations into spaces to prime coat, 1st coat, and final coat walls and ceilings. The final coat shall not be applied until prior written approval by the Construction Manager.

- e. Contractor is to protect adjacent surfaces from one's work. This Contractor will be responsible for removing and cleaning any unintentional paint, stain, and finish from adjacent surfaces. This includes concrete floors.
 - f. Install acoustical accessories and sealants at drywall/stud/track intersections with deck, floors or walls where required.
 - g. Paint all exterior steel lintels with high performance coating.
 - h. Epoxy paint to be used in restrooms.
 - i. All gypsum board ceilings to be painted ceiling white unless noted otherwise.
 - j. All precast walls remain unpainted.
9. Ceilings
- a. This contractor shall be responsible for the installation of all ceilings, including acoustical ceilings, drywall lids, bulkheads, and soffits.
 - b. Contractor shall be responsible for the ceiling modifications to the existing ceilings to accommodate new construction. This shall include selective demolition and patching of the grid and new ceiling tiles to match existing all areas of work.
 - c. Provide all fasteners, trim pieces, and grid wires as required to complete this scope of work including support of light fixtures.
 - d. Perimeter grid to be tight to wall; if a gap exists, it is the responsibility of this Contractor to fill the gap, so as to be aesthetically pleasing.
 - e. Contractor shall remove all marks left by clamps on the ceiling grid or provide clamps that will not mark the grid.
 - f. Minimize laps in the grid and place in discrete locations on main runners.
 - g. Where equipment is installed on ceiling tiles, it will be the responsibility of the contractor installing the equipment to mount it in the ceiling tile. It shall be the responsibility of Bid Package #01 to provide ceiling tile to other trades for installation.
10. Signage
- a. This contractor shall provide and install signage per contract documents. Coordinate message with Owner during submittal process.
 - b. All code required signage shall be provided and installed by this bid package
- B. **Bid Package #02 – Mechanical and Plumbing:** Trade Contractor shall include all of the following, but not limited to, as part of the contract:
1. General
- a. Prior to the start of demolition, this bid package shall participate in a meeting with DCI Group, the State, and bid packages 1,3 and 4 to review existing systems to remain and systems that will remain live during demolition.
 - b. Any penetrations created by this contractor, whether from demolition of existing systems or installation of new, shall be sealed by this contractor to match adjacent surface and rating. This shall include penetrations that remain from the demolition of through floor or through wall piping, duct, or pathways.
 - c. All piping and duct to be installed as high above ceilings as possible. Access to all equipment must be maintained to allow for routine maintenance – i.e. access hatches and replacement of filters must be maintained with as little interference as possible.
 - d. Contractor shall be responsible for all core drilling / saw cutting required for this scope of work. Core drill locations shall be submitted to Architect/Engineer for approval prior to proceeding with work. This shall include exact dimensional locations as well as sizes.
 - e. Contractor shall be responsible for all mechanical equipment supports.
 - f. Contractor will be responsible for ground penetration to scan precast walls for openings less and 15" wide. Locate new penetrations to avoid rebar in the precast wall.
 - g. Contractor is to verify all dimensions on existing precast openings and to make modifications as needed for equipment.

- h. Contractor will be responsible for supplying and installing all lintels, angles, reinforcements, concrete pads, and framing wherever required for the scope of work of this package.
 - i. Contractor will be responsible for verifying existing conditions before starting work. Notify construction manager and designer of any conflicts.
 - j. Contractor must provide temporary connections to maintain existing systems in service during construction.
 - k. Maintain existing equipment in service until the new system is complete and ready for tie-in and switchover.
 - l. Where pipes and ducts are shown to penetrate floors, provide sleeved openings with the top edge raised above the floor surface in accordance with all relevant spec sections. Seal sleeve perimeter to be watertight.
2. Demolition
- a. This contractor is responsible for complete demolition/disconnect and removal of all mechanical and plumbing systems called to be removed or abandoned. Salvage equipment and turn it over to the owner wherever noted in the drawings.
 - b. It shall be the responsibility of this contractor to disconnect and make safe all mechanical and plumbing that may be impacted by demolition activities. Existing plumbing shall be drained of water prior to the start of demolition activities excluding utilities that must remain active to maintain existing systems to remain active or for life safety.
 - c. Utilities that must remain in place to serve systems to remain, required for construction, or required for life safety shall be clearly marked and reviewed with the demolition contractor prior to the start of demolition activities.
 - d. All utilities to be abandoned in place shall be clearly marked on the contractor's as-built documentation to be turned over at the end of the project.
 - e. All plumbing shall be capped either permanently or temporarily until ready for new connections.
 - f. Contractor shall seal any duct openings that are created during the removal of existing ductwork.
 - g. Disconnect and remove mechanical devices and equipment that has been removed.
 - h. Properly reclaim and dispose of all refrigerants in removed equipment/refrigerant piping. Reclaimed refrigerant shall have documentation as required by the authority having jurisdiction (AHJ).
 - i. Contractor shall be responsible for concrete removals and replacement to accommodate under floor plumbing. This shall include sealing of new concrete to match existing.
3. Mechanical
- a. This contractor is responsible for the complete mechanical scope of work on this project.
 - b. Contractor shall coordinate all work with other bid packages prior to installation to provide clearances required for operation, maintenance, code compliance, and to verify non-interference with other work.
 - c. Any changes required to eliminate conflicts or that result from a failure to coordinate shall be made by the contractor without additional cost or expense to others.
 - d. Each contractor is responsible for all costs associated with electrical changes required for equipment proposed that differs from the basis of design.
 - e. This Contractor is responsible for all connections to existing ductwork.
 - f. Contractor shall coordinate installation of ceiling diffusers with Bid Package #1.
 - g. This contractor shall be responsible for all mechanical insulation including repair of insulation damaged during removals.
 - h. In all systems that require filters, this contractor shall provide and install new filters at substantial completion.

- i. The Mechanical Contractor shall provide all integral disconnects/starters for Mechanical Equipment. Bid Package #04 shall wire all integral disconnects/starters for mechanical equipment.
4. Testing, Adjusting, and Balancing (TAB)
- a. This contractor shall be responsible for all testing and balancing.
 - b. Before demolition work has begun a complete air balance test shall be performed by the testing, adjusting and balancing (TAB) contractor on the following equipment:
 - 1) (5) Rooftop units in the Ohio Building. Equipment to be demolished does not require testing. Provide air balance testing only on equipment that will continue to be used to serve renovated areas after the construction phase is completed.
 - 2) TAB contractor shall compile and submit four copies of the final pre-demolition report within 10 working days after the field measurements are completed. Final TAB reports shall be submitted for review to the construction manager, architect and engineer. Testing shall include all items required in the specifications.
 - 3) Balancing contractor shall pre-balance all existing systems to remain per specifications section 23 05 93. Balance readings will be required at all air outlets and duct traverses to verify existing airflow to unaffected spaces.
 - c. After construction activities are complete, testing, adjusting, and Balancing (TAB) shall rebalance air handling units and exhaust fans as required to achieve the new airflow values show on the construction documents.
 - d. Areas served by this equipment which were not renovated shall be re-balanced to the airflow rates measure before the renovation occurred.
 - e. If duct traverse locations are marked on the drawings as inaccessible for measurement, the TAB contractor shall perform the traverse at an alternate location or shall take multiple duct traverses and/or grille readings as required to determine the flow rate.
 - f. A duct static pressure reading shall be taken at each location where a duct traverse reading was taken and shall be included in the final post-construction TAB report.
5. Plumbing
- a. This contractor is responsible for the complete plumbing scope of work to include but not limited to water, sewer, gas, condensate and compressed air. Fire sprinkler scope is excluded from this package.
 - b. This contractor shall be responsible for all plumbing insulation including repair of insulation damaged during removals.
 - c. All pipes shall be clearly labeled to identify their use.
 - d. Pipe drain lines from equipment to the nearest floor drain.
 - e. Contractor shall verify that fixtures supplied area approved per all applicable state, local, and governing authorities.
 - f. Contractor shall verify underground pipe sizes, invert elevations, and locations prior to beginning of any work.
 - g. Contractor shall be responsible for all plumbing insulation.
 - h. Contractor shall televise and record existing scoping of existing under floor sanitary and storm plumbing prior to new installation and at project completion to verify proper installation.
6. Ventilation
- a. Unless noted otherwise, the size of each branch duct to an air terminal shall match the inlet size.
 - b. Align temperature sensors with light switches and in close proximity to each other.
 - c. Provide access doors for all duct mounted equipment.
 - d. The contractor may reuse portions of existing duct provided sizes and classes are correct. Duct is to be thoroughly cleaned and free of defects, and all transverse

joints, longitudinal seams, and duct wall penetrations are sealed as specified for ductwork.

7. Controls
 - a. This bid package will be responsible for the entirety of the HVAC controls for the building automation system connection. This shall include but not limited to: All wiring, control components, devices, conduit runs, thermostats, transmitters, actuators, dampers, and programming shall be provided by this contractor.
 - b. All control components such as relays, switches, DDC controllers, ETC. shall be mounted in steel enclosures with steel mounting backplates per specification 23 09 00.
 - c. Each control panel shall have a laminated copy of the applicable sequences of operations and a control diagram indicating the points, components and operation of equipment associated with each panel.
 - d. Contractor shall provide power supply for all 24 VAC Power requirements to include, but not limited to controllers, dampers and valve actuators, building pressure sensors, and other control components and devices.
 - e. Contractor shall provide conduit runs as required for outdoor equipment and for equipment installed remotely from the main building that is being monitored or controlled by the FMCS.
 - f. Contractor shall provide thermostats for automatic control of equipment as required by the control drawings.
 - g. Coordinate DDC control panel emergency power supply requirements with electrical contractor. All controls associated with mechanical systems requiring emergency power shall be connected to the emergency power system.
 - h. Contractor shall provide their own ethernet communications network including all necessary ethernet hubs, switches, routers, wiring/cabling, conduit ETC. Required to enable ELCN communications between the BAS equipment within the building. Provide ethernet switch as the point of connection to the owners IT network to all for BAS WEB access from the owners network.

C. **Bid Package #03 – Fire Suppression:** Trade Contractor shall include all of the following, but not limited to, as part of the contract:

1. General
 - a. Prior to the start of demolition, this bid package shall participate in a meeting with DCI Group, the State, and bid packages 1 and 2 to review existing systems to remain and systems that will remain live during demolition.
 - b. Contractor shall be responsible for all core drilling required for this scope of work. Core drill locations shall be submitted to Architect/Engineer for approval prior to proceeding with work. This shall include exact dimensional locations as well as sizes.
 - c. This contractor is responsible for complete fire suppression scope of working including, but not limited to, design, material, panels, and installation. This Contractor shall review and include all costs required to remove, re-route, and re-install sprinkler lines that are required to coordinate with structural, plumbing, HVAC, and electrical scopes of work. This work may not be represented on the Fire Protection drawings but shall be reviewed with all disciplines in the Contract Documents, As-Built Drawings, and Pre-Bid field visits for inclusion in this bid. No additional compensation will be made to Contractor for failure to include this work.
 - d. Any penetrations created by this contractor, whether from demolition of existing systems or installation of new, shall be sealed by this contractor to match adjacent surface and rating.
 - e. If required by the authority having jurisdiction, this contractor shall perform flow test and confirm water pressure/volume within ten (10) working days after contract execution.
 - f. The fire protection system shall be designed to meet owners insurance company standards where applicable.

- g. All areas of the building shall be sprinkled including canopies, walkways, overhangs, soffits, above and below ceilings, and building projections. All accessible combustible concealed spaces shall be fully sprinkled.
- h. Provide all labels and signage according to bid documents.
- i. Contractor shall install all pipes high as possible to avoid conflicts with other disciplines.
- j. Contractor shall notify the owner, and construction manager before any system drainage or recharge of sprinkler system.
- k. Provide the necessary design drawings to the Construction Manager and State Fire Marshall within twenty (20) working days after notice of contract award.
- l. The contractor shall include all permits and AHJ review and inspections.
- m. Contractor to verify sprinkler requirements based on actual installation, usage, architectural, ceiling plan and NFPA 13 requirements.
- n. The contractor shall remove existing sprinkler caps and ceiling tile at sprinkler heads prior to ceiling demolition.
- o. Contractor shall be responsible for any sprinkler system demolition required in the bid documents.
- p. Minor changes in pipe routings that do not affect the intended function, may be made as required to avoid space conflicts. Items may not be resized, exposed items relocated, or items run exposed when not intended without written approval by the Construction Manager. No changes shall be made to any structural members or architectural features which affect the function or aesthetics of the buildings.
- q. Contractor will be responsible for the installation of sprinkler heads into new ceiling tile, including cutting and installing the ceiling tile containing the sprinkler head. All sprinkler heads shall be centered in both directions in new ceiling tiles.
- r. Contractor shall coordinate with the State and the State's fire alarm monitoring contractor for fire alarm tag out

D. **Bid Package #04 – Electrical and Low Voltage:** Trade Contractor shall include all of the following, but not limited to, as part of the contract:

- 1. General
 - a. Contractor will be responsible for matching, providing and installing fixtures as noted in the drawings.
 - b. Prior to the start of work, this bid package shall participate in a meeting with DCI Group, the State, and bid packages 1,2 and 3 to review existing systems to remain and systems that will remain live during demolition.
 - c. This contractor shall be responsible for OSHA compliant lighting levels in all areas of work. Existing light fixtures may be utilized for construction lighting.
 - d. This contractor shall be responsible for obtaining an electrical permit for work performed by this bid package. Copies of permit requests, inspections reports, and closed permits shall be provided to the Construction Manager.
 - e. Contractor is responsible for ensuring that the complete electrical installation meets ADA standards.
 - f. Contractor shall be responsible for all core drilling required for this scope of work. Core drill locations shall be submitted to Architect/Engineer for approval prior to proceeding with work. This shall include exact dimensional locations as well as sizes.
 - g. Contractor will be responsible for any potholing required to locate existing utilities.
 - h. Contractor shall conceal conduits in walls, partitions, above ceilings, in floor slabs, etc. unless otherwise noted on the plans.
 - i. Contractor shall be responsible for removal and replacement of the ceilings, ceiling tiles, and ceiling grid associated with the areas of work.
 - j. When it comes to exterior electrical work the contractor will be responsible for removal and replacement of existing sidewalk, pavement, grass, shrubs, tree, etc. that will be impacted by the installation of new conduits shown in the bid

documents. No additional costs will be approved for placing conduits deeper than required minimum depths to avoid existing underground utilities.

- k. The contractor will be responsible for verifying existing conditions before starting work. Notify construction manager and designer of any conflicts.
 - l. Contractor shall coordinate with the construction manager and furniture provider on the layout of furniture and floor boxes to confirm locations prior to installation.
 - m. Contractor shall review existing conditions prior to fabrication of cable tray, busway, conduit racks, and other systems. Risers and Drops may be necessary because of existing field conditions.
 - n. Where existing electrical systems are located in areas that conflict with new equipment, piping, or ductwork to be installed, each contractor shall either arrange new equipment, conduit, or ductwork in such a fashion that it does not conflict with existing systems, or rework existing systems to allow for installation of new equipment, piping, or ductwork.
 - o. Contractor to leave pull strings in all empty conduits.
 - p. Contractor will be responsible for all electrical labeling required by bid documents.
 - q. Contractor shall be responsible for all permitting, application, coordination of design, installation to include any and all products/services by MidAmerican energy. This shall include but not limited to coordination with the design firm, owner and construction manager.
 - r. Electrical startups are contingent on new MidAmerican transformer installation. Coordinate with construction manager and design firm.
2. Demolition
- a. Contractor is responsible for the complete demolition/disconnect and removal of all electrical, data, and fire alarm equipment including devices, panels, circuits, transformers, wiring and conduits.
 - b. This contractor shall be responsible for the salvage and turnover to the Owner, or for reinstallation, of electrical and low voltage items as identified in the project drawings. This shall include, but not be limited to:
 - 1) Battery Chargers
 - 2) 50A Receptacle
 - 3) Lighting fixtures
 - 4) Track lighting
 - 5) Downlights
 - 6) Troffer fixtures
 - 7) High Bay Lights
 - 8) Water heater
 - c. It shall be the responsibility of this contractor to disconnect and make safe all electrical and low voltage that may be impacted by demolition activities. Utilities that must remain in place to serve systems to remain, required for construction, or required for life safety shall be clearly marked and reviewed with the demolition contractor prior to the start of demolition activities. Notify the Construction Manager when areas are ready so the demolition crews can begin.
 - d. All utilities to be abandoned in place shall be clearly marked on contractor's as-built documentation to be turned over at the end of the project.
3. Electrical
- a. This contractor is responsible for all electrical, data and life safety scope including, but not limited to, new electrical, grounding, light fixtures, switches, GFCI, Whips, power poles, J-hooks, bonding, busbars, risers, switches, overrides, sensors, panels, cabinets, meters, breakers, receptacles, fire alarm devices, conduits, boxes, receptacle sound barrier insulation, emergency lighting, exit signs, data wiring and connections.
 - b. At the start of construction, this contractor shall review all panel locations to verify room for installation and code required clearances. Any discrepancies shall be brought the construction manager and designer immediately.

- c. Where electrical or low voltage devices are shown to be salvaged and reinstalled, it shall be the responsibility of this contractor.
 - d. Contractor shall be responsible for providing pathways, circuiting, and power connections to all mechanical and electrical equipment. This contractor shall coordinate with the trades providing the equipment and with the approved submittals.
 - e. Contractor will be responsible for lighting and lighting controls.
 - f. Contractor is responsible for the installation of Owner provided furniture harnesses. Coordinate locations and requirements with Owner.
 - g. Contractor will be responsible for verifying all furniture, modular furniture, and equipment locations with architectural plans, elevations, and reviewed shop drawings prior to making the actual electrical installation. Contractors shall adjust receptacles, outlets, or connection locations to accommodate furniture and/or equipment.
 - h. Contractor shall coordinate with the construction manager and furniture provider on the layout of furniture and floor boxes to confirm locations prior to installation.
 - i. This contractor shall be responsible for providing, wiring and installing duct smoke detectors. Coordinate with Bid Package #02 on installation.
 - j. Contractor shall provide and install power to all mechanical equipment controllers.
 - k. Contractor shall be responsible for connections of owner provided equipment where noted in the drawings.
 - l. Contractor shall be required to label all electrical receptacles per Owner's labeling requirements. Coordinate with Owner on requirements.
 - m. This Contractor shall wire all integral disconnects/starters for Mechanical Equipment. The Mechanical Contractor shall provide all integral disconnects/starters for mechanical equipment.
4. Low Voltage
- a. This contractor shall be responsible for all low voltage and technology installations including, but not limited to data cabling and termination, information outlets, cabling pathways, and testing.
 - b. This contractor shall be responsible for bringing all new cabling into IT closets and clearly labeling cabling for Owner connection to Owner provided patch panels. Cabling shall be neatly coiled into IT closets with sufficient slack for Owner connection. Contractor shall coordinate with Owner on labeling and slack requirements.
 - c. Contractor shall be required to label all data receptacles per Owner's labeling requirements. Coordinate with Owner on requirements.
 - d. Category 6a cabling will be required in room F103 only.
5. Audio & Visual
- a. This contractor shall be responsible for pathways, junction boxes, and back boxes for all audio and visual technologies. Audio and visual equipment will be provided and installed by Owner.
- E. **Alternate #01** – Ohio Building: Provide Demolition of existing Office O112 and Restroom O113 and replace with new construction/reconfiguration for Office O112 and Restroom O113: Trade Contractor shall include all of the following, but not limited to, as part of the contract:
- 1. This contractor shall be responsible for the complete scope for the Ohio Building: Provide Demolition of existing Office O112 and Restroom O113 and replace with new construction/reconfiguration for Office O112 and Restroom O113.
 - 2. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 3. 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.
 - 4. Execute accepted alternates under the same conditions as other work of the Contract.

- F. **Alternate #02** – Ohio Building: New construction of Conference Room O108, Interview O109, Interview O110 and Hallway O111: Trade Contractor shall include all of the following, but not limited to, as part of the contract:
1. This contractor shall be responsible for the complete scope for the Ohio Building: New construction of Conference Room O108, Interview O109, Interview O110 and Hallway O111.
 2. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 3. 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.
 4. Execute accepted alternates under the same conditions as other work of the Contract.
- G. **Alternate #03** – Ohio Building: Demolition of existing construction and new construction of Training Room O116: Trade Contractor shall include all of the following, but not limited to, as part of the contract:
1. This contractor shall be responsible for the complete scope for the Ohio Building: Demolition of existing construction and new construction of Training Room O116.
 2. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 3. 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.
 4. Execute accepted alternates under the same conditions as other work of the Contract.
- H. **Alternate #04** – Ohio Building: New construction of Evidence Storage Room O115: Trade Contractor shall include all of the following, but not limited to, as part of the contract:
1. This contractor shall be responsible for the complete scope for the Ohio Building: New construction of Evidence Storage Room O115.
 2. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 3. 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.
 4. Execute accepted alternates under the same conditions as other work of the Contract.
- I. **Alternate #05** – Forest Building: New construction of Cold Storage Room F118 and Office F117: Trade Contractor shall include all of the following, but not limited to, as part of the contract:
1. This contractor shall be responsible for the complete scope for the Forest Building: New construction of Cold Storage Room F118 and Office F117.
 2. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 3. 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.
 4. Execute accepted alternates under the same conditions as other work of the Contract.
- J. **Alternate #06** – Forest Building: New construction of DNR Storage F110: Trade Contractor shall include all of the following, but not limited to, as part of the contract:
1. This contractor shall be responsible for the complete scope for the Forest Building new construction of DNR Storage F110: Trade Contractor shall include all of the following, but not limited to, as part of the contract.
 2. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

3. 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.
4. Execute accepted alternates under the same conditions as other work of the Contract.

K. **Owner Furnished & Owner Installed Products:** Department of Public Safety (DPS) will provide and install the following material:

1. Locker Pass Thru
2. 8' Workstations
3. Fence above existing dock
4. 8'x8' Workstations
5. TV
6. Lift
7. Work Bench
8. New demountable wall systems
9. 6'x9' Workstations
10. Office Desks
11. Workstations
12. Mobile Shelving
13. 4'x8' Shelving
14. 1' x 6" x 6' Shelving
15. Tool Workbench
16. Refrigerator
17. Ice Maker
18. Compressor
19. Work Table
20. Cutter
21. Brake
22. Table Saw
23. FAB Materials
24. Racking
25. Shelving
26. Furniture
27. Print, Scan, Files
28. Ship Station
29. Chain Link Fencing
30. MIG
31. Plasma
32. Band Saw
33. Drill
34. Lockers
35. Vending Machine
36. Lift Charger 220 50 Amp

END OF SECTION

SECTION 01 1201

GENERAL WORK REQUIREMENTS

1.01 BIDDING

- A. Trade Contractor shall include all applicable fees, permits, freight, hoisting, scaffolding, clean up, supervision, overhead, etc. to perform his work.
- B. The owner will provide the general building permit only. All other permits required for completion of a contractor's scope of work or by any governing body are the responsibility of said contractor.
- C. Bidders review ALL Bid Packages to fully understand the requirements of each package. Where two bid packages conflict, confirm with Construction Manager as to which package is to perform the work noted before bidding. After bidding, any conflict noted will be evaluated by the Construction Manager. The Construction Manager will then determine which package should perform the work and which package will credit the associated work's cost.
- D. Where conditions conflict in the project manual or project drawings, contact the Construction Manager for clarification. When in doubt figure the more extensive requirement.
- E. Each contractor is responsible for the identification of alternates and how they relate to each bid package. If a bid package is affected in ANY way by ANY of the alternates, an add/deduct should be noted on the bid form. If there is no change in cost write zero dollars.
- F. The Contractor should visit the site of the Work to acquaint the firm with all local conditions affecting the Contract, including the structure of the ground, the obstacles which may be encountered, and all other conditions relative to the Work to be performed; and shall not be allowed any extra compensation by reason of any difficulties or obstacles which the Bidder could have discovered or reasonably anticipated prior to Bidding. Contractor shall review Instructions to Bidders for coordination of site visits.
- G. On all project Drawings, figures take precedence over measurement by scale, and any scaling is done at the Contractor's own risk. The Design Professional shall decide on questions that may arise regarding the meaning and intent of the Project Drawings and Project Specifications. Should any details or figures have been omitted which are necessary to a clear understanding of the Work or should any error appear in either, or should discrepancies be found between the Project Drawings and Project Specifications, it shall be the duty of the Contractor to notify the Construction Manager of such omissions, errors, or discrepancies, and in no case proceed in uncertainty. Mistakes resulting from the Contractor's neglect to notify the Construction Manager in such matters shall be corrected at the expense of the Contractor. Bidders are responsible for all electronic documents and their use is at their risk.
- H. Construction Manager (DCI Group) has been engaged for this Project to serve as an advisor to the Owner and to provide assistance in administering the Contract for Construction between Owner and the Contractor. The Construction Manager will not be providing any self-performed work for this Project.
- I. All Contractors are responsible for on the job supervision of their work, or any subcontracted work. An onsite Superintendent or lead foreman is required during any time that work is being performed to coordinate their work and work with other trades. No superintendent or lead foreman may be replaced without approval of the Owner and DCI Group. Any work necessary to be performed after the regular working hours shall be supervised and shall be done at no additional cost to the Owner.
- J. All food and drinks shall be confined to CM designated areas and a maintained covered trash container shall be provided by the contractor. Failure to comply with this rule may cause a need for extra cleaning efforts by others which will result in a back charge to the Contractor.
- K. Tools, materials, and equipment storage and security is the responsibility of each Contractor.
- L. All work shall comply with the applicable codes and standards adopted by the Authority having Jurisdiction.
- M. All Authorities having Jurisdiction inspections shall be requested by the responsible contractor and coordinated through the Construction Manager. Attendance by contractors is mandatory as applicable to the work being inspected.
- N. All contractors must have the appropriate licenses to perform work in the jurisdictions.

- O. Before ordering any materials or performing any Work, the Contractors shall verify all measurements at the Project Site for the particular Work and be responsible for the correctness of same. No extra charge or compensation will be allowed to the Contractor on account of differences between actual dimensions and the measurements shown on the Project Drawings. Any noticeable discrepancy in this request shall be reported to the Construction Manager immediately for his consideration and decision. All the component parts of the Work shall be carefully checked and laid out in order that the structure as a whole shall conform to the intent of the Project Drawings and Project Manual.
- P. The Contractor shall have personnel attending regular project meetings. These meetings will be held at intervals established by the Construction Manager. Contractor must have representative attending when they are on the job or needed for coordination prior to having work start on the project. The representative attending must be able to adequately represent the Contractor and speak on the Contractors behalf providing valuable information to the meeting; specifically, things such as schedule, cost, production, manpower, etc.
- Q. Contractor will be required to attend all pre-installation conferences before commencement of related work.
- R. Trade Contractor shall complete a daily log for each work day on site and submit to Construction Manager. Content of daily log will be directed by Construction Manager.
- S. This Contractor is responsible to protect all openings made to the existing buildings envelope, as required for this bid package work, for the entire time work is being conducted until the new work scope is completed. This protection shall include but is not limited to protection against; rain, snow, wind infiltration, security and temperature fluctuations. Trade Contractor will maintain all weather protection provisions until permanent work is completed. All cost relating to damage incurred to existing facilities as a result of improper weather protection provisions will be borne by the Trade Contractor.

1.02 SAFETY

- A. The contractor shall comply with all local and federal, safety and health requirements.
 - 1. Contractor will provide a safety plan customized for the project to DCI Group.
 - 2. It is the contractor's responsibility to notify other contractor's on the jobsite of any hazardous materials to which their employees may be exposed.
 - 3. All Contractors shall inform their employees to immediately advise their supervisor of any unsafe conditions that are encountered. The supervisor shall promptly remediate such danger and/or contact the Construction Manager.
 - 4. Contractors performing hot work are to have a fire extinguisher in their work areas at all times as applicable.
 - 5. All Contractors are responsible for their own fall protection.
 - 6. Contractors are required to provide emergency phone numbers upon the request of the Construction Manager. Emergency phone numbers are numbers where the Contractor can be reached during off hours.
 - 7. All floor edge, roof and similar openings, barricades, handrails, or cabling for fall protection will be installed by the Contractor that creates the hazard as part of that Contractor's scope of work. At no time shall an opening be left unprotected from fall hazard. All Contractors shall protect and maintain such devices per OSHA standards. When a device conflicts with the work of this bid package or when the work of this bid package replaces the need for such devices, this Contractor is responsible for removal. If the work of this Contractor requires additional holes/penetrations, this Contractor shall provide necessary protection until final materials are installed.
 - 8. No fire exit can be blocked at any time.

1.03 SITE MANAGEMENT

- A. All contractors are responsible for all their own utility locates. This shall include both public and private locates. All Contractors shall coordinate locates with One Call Services.

- B. When active services are encountered in the Work, protect, brace and support existing active sewers, gas, electric or other services, where required for proper execution of the Work. If existing active services are encountered that require relocation, make request in writing for determination. Do not proceed with Work until written directions are received. Do not prevent or disturb operation of active services that are to remain.
- C. All contractors are required to protect their work. Provide proper protection for all existing work performed by others when performing your work next to, or around, other materials. Repair or replacement of any damaged material will be the responsibility of the contractor who damaged it.
- D. All contractors/vendors are responsible for their own cutting and patching unless otherwise specified.
- E. All contractors shall provide protection to the building at any penetrations created by that bid package. This shall include protection from rain, wind, temperatures, humidity, animals, or unauthorized access. Protection shall be in place and maintained until final penetration sealants or repairs are made.
- F. All contractors are responsible for maintaining dust control during their work.
- G. Contractors shall be responsible for maintaining traffic control coordination with the Owner, DCI Group, and the Authority Having Jurisdiction.
- H. Public and private roadways will be maintained and cleaned as required by the contractor leaving debris, mud, excess gravel, etc. on roadways at their expense as defined in bid packages.
- I. No steel track mounted equipment will be allowed on finished paved surfaces. Any damage to the finished paved surfaces will be repaired at the cost to the contractor causing such damage.
- J. Bridging of finished pavement will be responsibility of the contractor. This includes bridging curbs, pavement, sidewalks, etc. Any damage to the aforementioned including pavement markings will be repaired or replaced at the cost of the contractor causing such damage.
- K. Contractors that have work that requires equipment off of the existing road ways are required to locate and protect from damage all under and above ground existing features such as utilities, tunnels, landscaping, etc... The Contractor will be responsible to repair back to original condition any damages that occur, including but not limited to ruts and sod damage.
- L. Any areas disturbed or damaged by one's operation are to be repaired to Owner/Construction Manager's satisfaction.
- M. Contractor shall clean their installed materials prior to the next successor activity.
- N. Any signs located on the jobsite must be approved by the Construction Manager. Signage will not be allowed in most cases unless it is required for safety or provides instruction.
- O. Receiving, unloading and handling of material provided by the bid package shall be included. Spotting location shall be coordinated with the Construction Manager. All deliveries shall be coordinated with other Contractors and Construction Manager in advance of the delivery. Provide freight to the jobsite for any material provided. If storage is not available onsite, each bid package shall include other means of secure storage. If contractor is not onsite to unload delivery, the delivery will be rejected and will have to be re-scheduled at the contractor's expense. Materials must be stored off the ground, out of the mud and on a solid surface. As required or needed, material should be stored on dunnage or pallets in order to keep it off the ground or surface below. Special storage is the responsibility of respective contractor.
- P. Contractor shall not store materials within construction designated locations without approval from Construction Manager. No materials storage will be allowed that may inhibit construction progress.
- Q. The Contractors shall layout and correctly establish all lines, levels, grades, positions, walls, partitions, equipment and location of all Work on the Project and be responsible for their accuracy and proper correlation with control lines, monuments and data furnished. Such monuments and data shall be carefully preserved and, if displaced, reset at the expense of the persons displacing them.
- R. All Contractors are responsible for the coordination of their work with the complete set of specifications, construction drawings, addenda, request for information (RFI's), Architect's Instruction to Contractor (ITC), shop drawings, coordination drawings, and other contract modifications.
- S. Contractor shall carefully inspect any work performed by others that is to receive, align, abut or similarly relate to the Contractor's work and shall immediately notify the Construction Manager in

writing of any apparent defects or inconsistencies. The Contractor is responsible for coordinating and verifying the dimension, measurements, and elevations at the project site relevant to the Contractor's work. If Contractor commences his work without such written notice, such commencement shall constitute acceptance of all such work performed by others and of all such field conditions, and all costs incurred in connection with the Contractor's work as a result thereof shall be borne by Contractor.

- T. Incorporate construction tolerances for the work of others into the design of the systems in this scope of work. Include field measurements of work by others and any necessary adjustments to systems prior to fabrication to accommodate such allowable tolerances, or accept all costs to correct materials, which do not fit job conditions.
- U. Any interior work that is scheduled to be completed while Owner is in normal operation must be sensitive to the Owners continued use of the building. No workers are allowed to be in areas of the building that are not directly related to scope of work. Hallways and general access paths to construction areas must also be kept clean at all times. The Owner has the right at any time to shut down any construction activities that they deem to be too much of a distraction to the occupants of the building.
- V. All contractors are responsible for familiarizing themselves with the coordination and sequencing requirements related to Owner furnished equipment.
- W. If not already required by the contract documents and reasonably requested by the Construction Manager, the Contractor shall prepare coordinated drawings in areas of congestion specifically noting and advising the Construction Manager of potential conflicts between the Contractor's work and other work at the project. Even with such cooperative and coordinated efforts should a conflict occur the Construction Manager will determine how such conflicts should be resolved and its decision in that regard will be final. The Contractor agrees to abide by such decisions and make any changes required to eliminate such conflict without additional costs or expense to the Owner.

1.04 SCHEDULE MANAGEMENT

- A. Prior to the commencement of the construction for the Prime Contract Work, the Prime Contractor shall participate in a minimum of two (2) joint planning meetings with the Construction Manager and other Prime Contractors for the purpose of planning the overall Construction Schedule. A Preliminary Construction Schedule as developed by the Construction Manager will be used as the basis of the overall Construction Schedule. In consultation with the Prime Contractor, the Construction Manager shall incorporate the Prime Contract Work and work of other prime contractors into the overall Construction Schedule for the entire project. Critical Milestones and working hours as defined by the Construction Manager (as included in the bidding documents) will not be altered. The Prime Contractor shall on a weekly basis (at a minimum) provide the Construction Manager scheduling information with regards to progress and work to be performed in the next 4 (four) weeks. The Prime Contractor shall be bound by the Construction schedule. Nothing in the Prime Contract Agreement shall relieve the Prime Contractor of any liability for any unexcused failure to comply with the agreed upon overall Construction Schedule or any completion dates. The Construction Manager shall have the right to coordinate the Prime Contractors, including the right, if necessary, to change the time, order and priority in which the various portions of the Prime Contract Work and other work associated with the Project shall be performed.
- B. All Contractors shall cooperate with the Construction Manager and with other Contractors. The completion of the Work will depend upon a collective effort by all parties involved.

1.05 GENERAL HOUSEKEEPING

- A. Daily cleanup (broom clean) of dust and debris from construction operation is part of each contractor's scope of work. If any contractor fails to keep the site clean and organized on a continuous basis, the Construction Manager will notify the contractor in writing only once. The contractor will then have 24 hours to correct the situation. If the contractor fails to correct the situation, the Construction Manager will hire another party for cleaning and charge the said

contractor. Trade Contractor shall submit prior to beginning work a plan to the Construction Manager defining manpower and methods for achieving daily cleanup. If Construction Manager deems necessary, each Trade Contractor shall provide 1 employee for each 5 employees on the project to clean all work areas and/or staging areas to a broom clean condition. If the Trade Contractor has less than 5 employees on site, the contractor will provide 1 employee to the necessary cleanup requirement. Cleanup duration will take as long as it takes to achieve the broom clean results.

- B. Contractor plan tables and break areas will be restricted to the areas identified on 3rd floor only. Plan tables and break set ups outside of this area will not be allowed until this area must be vacated for final finishes.

END OF SECTION

SECTION 01 2500

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Substitution Procedures
- B. Request for Substitution form

PART 2 - EXECUTION

2.01 SUBSTITUTION PROCEDURES

- A. Where the Bidding Documents stipulate a specific product be provided by naming one or more manufacturer and model, a substitute product will be considered when written request is received by the date and time identified in Section 00 1113 NOTICE TO BIDDERS. Substitution requests will be considered for all products, even if the specification does not include a statement such as "or equal," "equal to," "equivalent to," or "basis of design," unless noted otherwise.
- B. References in the Bidding Documents to brand or trade names are intended to illustrate the general characteristics of the item and not to limit competition unless noted otherwise.
- C. The written request shall be on the "Request for Substitution" form included in the Project Manual. If no such form is included, the request shall be provided on the letterhead of the company making the request.
- D. Substitution requests received after the specified date will be viewed in the context of a Change Order to the Contract, and consideration will only be given in the event a product becomes unavailable or not practical due to no fault of the Contractor, or the substitution is substantially to the Owner's advantage (equal product for less cost or higher quality product at no change in Contract Sum).
- E. Document each substitution request with complete data substantiating compliance of the proposed substitution with the Bidding Documents. Each request shall identify the specified product for which the substitution is requested, and shall clearly describe the product for which approval is requested. The burden shall be on the requester to demonstrate the proposed substitute product's suitability for use in the Work and its equivalency or superiority in function, appearance, quality, and performance with the product named in the Bidding Documents.
- F. A description of any changes to the Bidding Documents that the proposed substitution will require shall be included with the request. The requester shall affirm that dimensions shown on the Drawings will not be affected by the substitute product, and that it will have no adverse effect on other trades, the construction schedule, or specified warranty requirements. The request for use of a substitute product shall be signed by an authorized representative of the firm submitting the request, who shall state that the firm will pay for any changes to the building design, including Design Professional's design, detailing, and construction cost caused by the requested substitution if the substitution is approved for use in the Work.
- G. All such substitute products approved for use in the Work during the established period of time before receipt of Bids will be identified in a subsequent Addendum to the Bidding Documents.

2.02 REQUEST FOR SUBSTITUTION FORM

- A. A Request for Substitution Form is attached following this page.
- B. Substitution requests shall be emailed to the Issuing Officer at the email address provided in Instructions to Bidders Section 1.04.

END OF SECTION

SUBSTITUTION REQUEST FORM

Project: _____ Substitution Request Number: _____

From: _____
To: _____ Date: _____

A/E Project Number: _____
Re: _____

Specification Title: _____ Description: _____
Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____
Manufacturer: _____ Address: _____ Phone: _____
Trade Name: _____ Model No.: _____

History: New product 2-5 years old 5-10 yrs old More than 10 years old

Differences between proposed substitution and specified product: _____

Point-by-point comparative data prepared by contractor and attached - REQUIRED BY A/E

Reason for not providing specified item: _____

Similar Installation:

Project: _____ Architect: _____
Address: _____ Owner: _____
_____ Date Installed: _____

Proposed substitution affects other parts of Work: No Yes; explain _____

Supporting Data Attached: Drawings Product Data Samples Tests Reports _____

SUBSTITUTION REQUEST FORM

(Continued)

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

Telephone: _____

Attachments: _____

A/E's REVIEW AND ACTION

- Substitution approved - Make submittals in accordance with Specification Section 01 3300.
- Substitution approved as noted - Make submittals in accordance with Specification Section 01 3300.
- Substitution rejected - Use specified materials.
- Substitution Request received too late - Use specified materials.

Signed by: _____

Date: _____

Additional Comments: Contractor Subcontractor Supplier Manufacturer A/E _____

SECTION 01 2600

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Change procedures

1.02 CHANGE PROCEDURES

- A. The Design Professional will advise of minor changes in the work not involving an adjustment to Contract Sum/Price or contract time as authorized.
- B. The Construction Manager may issue a Proposal Request that includes a detailed description of a proposed change with supplementary or revised drawings and specifications and a change in contract time for executing the change as provided by the Design Professional. The Trade Contractor will prepare and submit an estimate within 7 calendar days. Estimates shall be provided for the project at no cost, regardless of acceptance or rejection of proposal.
- C. The Trade Contractor may propose changes by submitting a Request for Information to the Construction Manager, describing the proposed change and its full effect on the work. Include a statement describing the reason for the change, and the effect on the Contract Sum/Price and contract time with full documentation and a statement describing the effect on work by separate or other contractors. Document any requested substitutions in accordance with the specifications. Construction Manager will forward the Request for Information on to the Design Professional for their official response.
- D. Stipulated Sum/Price Change Order: Based on executed Change Order and contractor's fixed price quotation.
- E. Unit Price Change Order: The change order will be executed on a fixed unit price basis for pre-determined unit prices and quantities. Changes in contract price or contract time will be computed as specified for time and material change orders.
- F. Time and Material Change Order: The change order will be executed on a not to exceed basis. Design professional and Construction Manager will determine the not to exceed estimated cost based on contractor's proposal for hourly rates and material costs. Maintain detailed records of work done on time and material basis. Time and Material tickets must be submitted daily to the Construction Manager for verification. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the work. Submit itemized account and supporting data after completion of change. A final deductive change order will be issued to reconcile final cost to the initial change order.
- G. Change Order Forms: CONSENSUSDOC Forms provided by Owner.
- H. Execution of Change Orders: The Construction Manager will issue change orders for signature of parties as provided in the Conditions of the Contract.
- I. With respect to pricing change orders, the percentage mark-up for overhead and profit is subject to the following limits:
 - 1. Fifteen (15) percent maximum for work directly performed by employees of the Constructor, Subcontractor or Sub-subcontractor.
 - 2. Five (5) percent maximum for work performed or passed through by a Subcontractor and passed through to the Owner by the Constructor.
 - 3. Five (5) percent maximum Subcontractor's mark-up for Work performed by a Sub-Subcontractor and passed through to the Owner by the Subcontractor and Constructor.
 - 4. The maximum allowable mark-up shall be twenty-five (25) percent passed through to the Owner by the Constructor under any circumstances. Overhead and profit shall be shown separately for the Constructor and each Subcontractor of any tier performing the Change Order Work.
- J. Contractor and subcontractor agree to provide and require all suppliers to provide a detailed breakdown of labor, labor burden, materials, installation, rental, and fuel costs.

- K. **Please refer to Article 8 of CONSENSUSDOCS 802- STANDARD FORM OR AGREEMENT BETWEEN OWNER AND TRADE CONTRACTOR for additional Change Procedures.**

END OF SECTION

SECTION 01 2900

PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Schedule of values
- B. Application for payment

1.02 SCHEDULE OF VALUES

- A. Coordination: Trade Contractor will coordinate preparation of the Schedule of Values with preparation of the Construction Manager's Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including Application for Payment forms with Continuation Sheets, Submittals Schedule, and Construction Manager's Construction Schedule.
 - 2. Submit original Schedule of Values in Procore within 14 days after date of Owner-Trade Contractor Agreement. Schedule of Values must be approved by Owner prior to submission for first application for payment.
- B. Format: Utilize the Table of Contents of this project manual. Identify each line item with number and title of the major specification section. Each major specification section should be further itemized by materials cost, labor cost and subcontractor cost for each building separately for the base bid and all accepted alternates. Identify site mobilization, bonds and insurance and include a line item for closeout paperwork for a value of no less than 1% of the total contract value or \$1,000, whichever is greater.
 - 1. Identification: Include the following Project identification on the Schedule of Values:
 - a. Project name and location.
 - b. Name and address of Owner, Trade Contractor, Construction Manager and Design Team.
 - c. DAS Project Number.
 - d. Date of Submittal.
 - 2. Revise the Schedule of Values to list approved Change Orders with each Application for Payment.

1.03 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications for payments as certified by the Design Professional and paid for by Owner.
 - 1. 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. Progress payments shall be submitted to the Construction Manager. Any request for payment for work completed prior to June 30th of any year needs to be submitted by July 15th of the same calendar year.
- C. Payment Application Forms: Use AIA form G702 and G703 as the form for the Application for Payment or an equivalent approved by the owner.
- D. Include lien waiver forms required by the owner when applicable.
- E. Application Preparation: Complete every entry on form. Construction Manager will return incomplete applications without action.
 - 1. Include amounts of Change Orders issued before last day of construction period covered by application.

- F. Waivers of Mechanic's Lien: If requested by Owner with each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment when applicable.
 - 1. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 - 2. Submit waivers of lien on forms, executed in a manner acceptable to Owner.
- G. Initial Application for Payment: Administrative actions and submittals that must precede submittal of first Application for Payment include the following:
 - 1. Schedule of Values
 - 2. Certificates of insurance and insurance policies.
 - 3. Lists of vendors and any subcontractors.
- H. Application for Payment at Substantial Completion: After the Certificate of Substantial Completion has been fully executed, submit an Application for Payment showing 100 percent completion for the portion of the Work claimed as substantially complete, not including the closeout paperwork line item.
 - 1. Include documentation supporting the claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 - 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- I. Final Payment Application: 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 taxes, 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. Letter of Notification to all sub-contractors and suppliers of application for release of retainage.
 - 8. Evidence that claims have been settled.
- J. Payments will be made to the extent of the value of the work performed in the previous month less a retainage amount of 5% of the value of the work performed. Upon substantial completion for the entire work, a sum sufficient to decrease the total retained to 5% of the contract sum, plus the full amount of the line item for closeout paperwork, plus such other retainage as the engineer shall determine for all incomplete work and unsettled claims will be authorized. The closeout paperwork line item may only be billed once the certificate of final completion has been fully executed.

END OF SECTION

SECTION 01 3100

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Coordination
- B. Pre-construction meeting
- C. Progress meetings
- D. Coordination Meetings
- E. Requests for Interpretation (RFIs)
- F. Background Checks

1.02 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the project manual to ensure efficient and orderly sequence of installation of interdependent construction elements.
 - 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 accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Administrative procedures: The Trade Contractor will coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Trade Contractor's Construction Schedule.
 - 2. Provide updated information for Construction Manager's Construction Schedule.
 - 3. Preparation of Schedule of Values.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Pre-installation conferences.
 - 7. Project closeout activities
- C. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work, which are indicated diagrammatically on drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated conceal pipes and wiring within the construction. Coordinate locations of piping with finish elements.
- F. Coordinate completion and cleanup of work of separate sections in preparation for Substantial Completion.
- G. After owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of owner's activities.
- H. During construction coordinate use of site and facilities through Construction Manager.
- I. Comply with Construction Manager and Owner's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- J. Make the following types of submittal to Architect through the Construction Manager via Procure:

1. Request for Information/Interpretation.
2. Request for substitution.
3. Shop drawings, product data, and samples.
4. Test and inspection reports.
5. Design data.
6. Manufacturer's instructions and field reports.
7. Applications for payment and change order requests.
8. Progress schedules.
9. Coordination drawings.
10. Correction punch list and final correction punch list for substantial completion
11. Closeout submittals

PART 2 - EXECUTION

2.01 PRE-CONSTRUCTION MEETING

- A. The Construction Manager and Owner will schedule a meeting after Notice of Award.
- B. Required: Design Professional, Owner, Construction Manager, Trade Contractor and any Subcontractors.
- C. Agenda:
 1. Execution of Owner-Contractor Agreement.
 2. Submission of executed bonds and insurance certificates.
 3. Distribution of Contract Documents.
 4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 5. Designation of personnel representing the parties in Contract.
 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, change orders, RFIs and contract closeout procedures
 7. Tentative construction schedule.
 8. Critical work sequencing and long-lead items.
 9. Procedures for testing and inspecting.
 10. Preparation of Record Documents.
 11. Safety Procedures.
 12. Owner's requirements.
 13. Security and housekeeping procedures.
 14. Background Checks.
 15. Responsibility for temporary facilities and controls.
 16. Construction waste management.
 17. Logistics (use of premise, parking, work restrictions, maintain egress, etc.)
- D. The Construction Manager is to record minutes and distribute copies within two days after meeting to participants, with one copy to owner, participants, and those affected by decisions made.

2.02 PROGRESS MEETINGS

- A. The Construction Manager shall schedule and administer meetings throughout progress of the work at bi-weekly intervals.
- B. The Construction Manager is to make arrangements for meetings, prepare agenda with copies for participants, and preside at meetings, record minutes and distribute copies within two days to those affected by decisions made.
- C. Attendees may include: Project superintendent, major subcontractors and suppliers, Owner, Construction Manager, Architect/Engineer, as appropriate to agenda topics for each meeting. All participants at the conference call shall be familiar with the Project and authorized to conclude matters relating to the Work.
- D. Agenda:
 1. Review minutes of previous meetings.

2. Review the Construction Manager's Construction Schedule.
 3. Field observations, problems, and decisions.
 4. Identification of problems that impede planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Review of RFI's.
 7. Review of off-site fabrication and delivery schedules.
 8. Corrective measures to regain projected schedules.
 9. Planned progress during succeeding work period.
 10. Coordination of projected progress.
 11. Maintenance of quality and work standards.
 12. Effect of proposed changes on progress schedule and coordination.
 13. Other business relating to work.
 14. Access, temporary facilities and controls, housekeeping and progress cleaning.
 15. Safety.
 16. Status of proposal requests, pending changes, official Change Orders.
- E. Minutes:
1. Following the meeting, the meeting minutes will be published in Procore by the Construction Manager for all parties.

2.03 COORDINATION MEETINGS

- A. Coordination meetings will be held at the discretion of the construction manager.

2.04 REQUESTS FOR INTERPRETATION (RFIs)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, prepare and submit an RFI in Procore.
1. RFIs shall originate with Trade Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in the Work.
- B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
1. Specification Section number and title and related paragraphs, as appropriate.
 2. Drawing number and detail references, as appropriate.
 3. Field dimensions and conditions, as appropriate.
 4. Trade Contractor's suggested solution(s). If Trade Contractor's solution(s) impact the Contract Time or the Contract Sum, Trade Contractor shall state impact in the RFI.
 5. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
- C. Design Professional's Action: Design Professional will review each RFI, determine action required, and return it. Allow seven (7) working days for Design Professional's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day. The following RFIs will be returned without action:
1. Requests for approval of submittals.
 2. Requests for approval of substitutions.
 3. Requests for coordination information already indicated in the Contract Documents.
 4. Requests for adjustments in the Contract Time or the Contract Sum.
 5. Requests for interpretation of Design Professional's actions on submittals.
 6. Incomplete RFIs or RFIs with numerous errors.
 7. Design Professional's action may include a request for additional information, in which case Design Professional's time for response will start again.
- D. Design Professional's action on RFIs that may result in a change to the Contract Time or the Contract Sum/Price.

1. If the Trade Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Construction Manager in writing within ten (10) days of receipt of the RFI response.
- E. On receipt of Design Professional's response in Procore, review the response and notify Design Professional within seven (7) days if Trade Contractor disagrees with response.

2.05 BACKGROUND CHECKS

- A. Background checks must be performed on all on site employees, including sub-contractors.
- B. The Contractor hereby explicitly authorized the Iowa DAS to conduct criminal history and/or other background investigation(s) of the Contractor, its officers, supervisory personnel, employees, and other staff retained by the Contractor or their sub-contractors for the performance of the contract.
- C. A state of Iowa record check request form will be provided at the pre-construction meeting. Information required may include:
 1. Last Name
 2. First Name
 3. Middle Name
 4. Date of Birth
 5. State Driver's License or State ID #
 6. Social Security #

END OF SECTION

SECTION 01 3100.01

WEB BASED CONSTRUCTION MANAGEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Owner and Contractor shall utilize **Procore Technologies, Inc. Procore** system for electronic submittal of all data and documents (unless specified otherwise by the owner's representative) throughout the duration of the Contract. **Procore** is a web-based electronic media site that is hosted by **Procore Technologies, Inc.**, utilizing their **Procore** web solution. **Procore** will be made available to all contractors' project personnel, subcontractor personnel, suppliers, consultants and the Designer of Record. The joint use of this system is to facilitate; electronic exchange of information, automation of key processes, and overall management of the contract. **Procore** shall be the primary means of project information submission and management. When required by the Owners representative, paper documents will also be provided. In the event of discrepancy between the electronic version and paper documents, the paper documents will govern. **Procore** is a registered trademark of **Procore Technologies, Inc.**

1.02 USER ACCESS LIMITATIONS

- A. The Owner's Representative/Construction Manager will control the Contractor's access to **Procore** by allowing access and assigning user profiles to accepted Contractor personnel. User profiles will define levels of access into the system, determine assigned function-based authorizations (determines what can be seen) and user privileges (determines what they can do). Sub-contractors and suppliers will be given access to **Procore** through the Contractor. Entry of information exchanged and transferred between the Contractor and its sub-contractors and suppliers on **Procore** shall be the responsibility of the Contractor.
1. Joint Ownership of Data: Data entered in a collaborative mode (entered with the intent to share as determined by permissions and workflows within the **Procore** system) by the Owner's Representative and the Contractor will be jointly owned.

1.03 AUTOMATED SYSTEM NOTIFICATION AND AUDIT LOG TRACKING

- A. Review comments made (or lack thereof) by the Owner on Contractor submitted documentation shall not relieve the Contractor from compliance with requirements of the Contract Documents. The Contractor is responsible for managing, tracking, and documenting the Work to comply with the requirements of the Contract Documents. Owner's acceptance via automated system notifications or audit logs extends only to the face value of the submitted documentation and does not constitute validation of the Contractor's submitted information.

1.04 SUBMITTALS

- A. See Section 01 3300 SUBMITTAL PROCEDURES:
- B. Preconstruction Submittals
1. List of Contractor's key **Procore** personnel. Include descriptions of key personnel's roles and responsibilities for this project. Contractor should also identify their organization's administrator on the list.

1.05 COMPUTER REQUIREMENTS

- A. The Contractor shall use computer hardware and software that meets the requirements of the **Procore** system as recommended by **Procore Technologies, Inc.** to access and utilize

Procure. As recommendations are modified by **Procure**, the Contractor will upgrade their system(s) to meet the recommendations or better. Upgrading of the Contractor's computer systems will not be justification for a cost or time modification to the Contract. The contractor will ensure that connectivity to the **Procure** system (whether at the home office or job site) is accomplished through DSL, cable, T-1 or wireless communications systems. The minimum bandwidth requirement for using the system is 128kb/s. It is recommended a faster connection be used when uploading pictures and files into the system. **Procure** supports the current and prior two major versions of Chrome, Firefox, Internet Explorer, and Safari.

- B. The Contractor shall be responsible for the validity of their information placed in **Procure** and for the abilities of their personnel. Accepted users shall be knowledgeable in the use of computers, including Internet Browsers, email programs, cad drawing applications, and Adobe Portable Document Format (PDF) document distribution program. The Contractor shall utilize the existing forms in **Procure** to the maximum extent possible. If a form does not exist in **Procure** the Contractor must include a form of their own or provided by the Owner representative as an attachment to a submittal. Adobe PDF documents will be created through electronic conversion rather than optically scanned whenever possible. The Contractor is responsible for the training of their personnel in the use of **Procure** (outside what is provided by the owner) and the other programs indicated above as needed.
- C. User Access Administration: Provide a list of Contractor's key **Procure** personnel for the Owner's Representative acceptance. Contractor is responsible for adding and removing users from the system. The Owners Representative reserves the right to perform a security check on all potential users. The Contractor will be allowed to add additional personnel and sub-contractors to **Procure**.

1.06 CONNECTIVITY PROBLEMS

- A. **Procure** is a web-based environment and therefore subject to the inherent speed and connectivity problems of the Internet. The Contractor is responsible for its own connectivity to the Internet. **Procure** response time is dependent on the Contractor's equipment, including processor speed, Internet access speed, etc. and current traffic on the Internet. The Owner will not be liable for any delays associated from the usage of **Procure** including, but not limited to: slow response time, down time periods, connectivity problems, or loss of information. The contractor will ensure that connectivity to the **Procure** system (whether at the home office or job site) is accomplished through DSL, cable, T-1 or wireless communications systems. The minimum bandwidth requirement for using the system is 128kb/s. It is recommended a faster connection be used when uploading pictures and files into the system. Under no circumstances shall the usage of the **Procure** be grounds for a time extension or cost adjustment to the contract.

1.07 TRAINING

- A. The Construction Manager shall provide the necessary training to the Prime Contractor.

PART 2 - PRODUCTS

2.01 DESCRIPTION

- A. **Procure** project management application (no equal) Provided by Procure Technologies, Inc. www.Procure.com

PART 3 - EXECUTION

3.01 PROCORE UTILIZATION

- A. **Procore** shall be utilized in connection with submittal preparation and information management required by Sections:
1. PROJECT MANAGEMENT AND COORDINATION
 2. CONSTRUCTION PROGRESS DOCUMENTATION
 3. SUBMITTAL PROCEDURES
 4. QUALITY REQUIREMENTS
 5. Other Division One sections.
 6. Requirements of this section are in addition to requirements of all other sections of the specifications.
- B. Design Document Submittals
1. All design drawings and specifications shall be submitted as cad .dwg files or PDF attachments to the **Procore** submittal work flow process and form.
- C. Shop Drawings
1. Shop drawing and design data documents shall be submitted as cad .dwg files or PDF attachments to the **Procore** submittal work flow process and form. Examples of shop drawings include, but are not limited to:
 2. Standard manufacturer installation drawings.
 3. Drawings prepared to illustrate portions of the work designed or developed by the Contractor.
 4. Steel fabrication, piece, and erection drawings.
- D. Product Data
1. Product catalog data and manufacturer's instructions shall be submitted as
 2. PDF attachments to the **Procore** submittal work flow process and form. Examples of product data include, but are not limited to:
 3. Manufacturer's printed literature.
 4. Preprinted product specification data and installation instructions.
- E. Samples
1. Sample submittals shall be physically submitted as specified in Section 01 3300 SUBMITTAL PROCEDURES. Contractor shall enter submittal data information into **Procore** with a copy of the submittal form(s) attached to the sample. Examples of samples include, but are not limited to:
 2. Product finishes and color selection samples.
 3. Product finishes and color verification samples.
 4. Finish/color boards.
 5. Physical samples of materials.
- F. Administrative Submittals
1. All correspondence and pre-construction submittals shall be submitted using **Procore**. Examples of administrative submittals include, but are not limited to:
 2. Digging permits and notices for excavation.
 3. List of product substitutions
 4. List of contact personnel.
 5. Notices for roadway interruption, work outside regular hours, and utility cut overs.
 6. Requests for Information (RFI).
 7. Construction progress Schedules and associated reports and updates.
 - a. Each schedule submittal specified in CONSTRUCTION PROGRESS DOCUMENTATION shall be submitted as a native backed-up file (.PRX or .STX) of the scheduling program being used. The schedule will also be posted as a PDF

file in the format.

8. Plans for safety, demolition, environmental protection, and similar activities.
9. Quality Control Plan(s), Testing Plan and Log, Quality Control Reports, Production Reports, Quality Control Specialist Reports, Preparatory Phase Checklist, Initial Phase Checklist, Field Test reports, Summary reports, Rework Items List, etc.
10. Meeting minutes for quality control meetings, progress meetings, pre-installation meetings, etc.
11. Any general correspondence submitted.

G. Compliance Submittals

1. Test reports, certificates, and manufacture field report submittals shall be submitted on **Procore** as PDF attachments. Examples of compliance submittals include, but are not limited to:
 - a. Field test reports.
 - b. Quality Control certifications.
 - c. Manufacturer's documentation and certifications for quality of products and materials provided.

H. Record and Closeout Submittals

1. Operation and maintenance data and closeout submittals shall be submitted on **Procore** as PDF documents during the approval and review stage as specified, with actual set of documents submitted for final. Examples of record submittals include, but are not limited to:
 - a. Operation and Maintenance Manuals: Final documents shall be submitted as specified.
 - b. As-built Drawings: Final documents shall be submitted as specified.
 - c. Extra Materials, Spare Stock, etc.: Submittal forms shall indicate when actual materials are submitted.

I. Financial Submittals

1. Schedule of Value, Pay Applications and Change Request Proposals shall be submitted on **Procore**. Supporting material for Pay Applications and Change Requests shall be submitted on **Procore** as PDF attachments. Examples of compliance submittals include, but are not limited to:
 - a. Contractors Schedule of Values
 - b. Contractors Monthly Progress Payment Requests
 - c. Contract Change proposals requested by the project owner

END OF SECTION

SECTION 01 3200

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Construction Progress Schedule
- B. Construction Manager's Construction Schedule
- C. Submittal Schedule
- D. Daily Construction Reports
- E. Progress Photographs

PART 2 - EXECUTION

2.01 CONSTRUCTION MANAGER'S MASTER CONSTRUCTION SCHEDULE

- A. Upon award of package, Contractor agrees to accept and meet or improve upon the schedule proposed in section **00 3113 PRELIMINARY SCHEDULE** with intermediate handoffs. Each package contractor will be required to participate in schedule coordination meetings with the Construction Manager.
- B. If the bid package contractor does not meet the handoff milestones in the master construction schedule, the bid package contractor shall take measures to increase work forces, increase work hours, initiate revisions to means and methods of construction, and/or other similar measures as required to make up lost time and complete the work in accordance with the construction schedule and remain consistent with project progress and overall construction schedule. Such measures shall be at no additional cost to the Owner. The Construction Manager shall have sole discretion on decisions to accelerate work.
- C. Updating the master construction schedule – Contractors are required to attend and participate in schedule coordination update meetings with the Construction Manager. This will be an opportunity for contractors to further define their scheduled scope of work in conjunction with other trades on site.
- D. Acceptance of revised master construction schedule – After an updated master construction schedule has been issued via Procore, Contractors will have 48 hours to dispute the new schedule. All contractors will be held to the last fully accepted master construction schedule.

2.02 CONSTRUCTION PROGRESS SCHEDULE

- A. Submit preliminary outline to the Construction Manager no later than 48 hours prior to the pre-construction meeting for coordination with Owner's requirements.
- B. Submit revised progress schedule with each application for payment.
- C. Schedules will be electronically submitted through Procore.
- D. Distribute copies of reviewed schedules to project site file, subcontractors, suppliers, and other concerned parties.
- E. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.
- F. Submit computer generated horizontal bar chart with separate line for each major portion of work or operation, identifying the first day of each week.
- G. Show complete sequence of construction activity, identifying work of separate stages and other logically grouped activities. Indicate early and late start, early and late finish, float dates, and duration.

- H. Indicate estimated percentage of completion for each item of work at each submission.
- I. Participate in joint review and evaluation of schedule with Construction Manager.
- J. Revisions to schedules:
 - 1. Indicate progress of each activity to date of submittal and projected completion date of each activity.
 - 2. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.
 - 3. Prepare narrative report to define problem areas, anticipate delays, and impact on schedule. Report corrective action taken, or proposed, and its effect including effect of changes on schedules of separate contractors.

2.03 **SUBMITTAL SCHEDULE**

- A. Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, re-submittal, ordering, manufacturing, fabrications, and delivery when establishing dates.
 - 1. Coordinate submittal schedule with list of subcontractors, the schedule of values, and construction schedule.
 - 2. Submit concurrently with first complete submittal of contractor's construction schedule.

2.04 **DAILY CONSTRUCTION REPORTS**

- A. Daily Construction Reports: Submitted at weekly intervals.
 - 1. Daily Construction Reports will be submitted to Construction Manager.
- B. Prepare a daily construction report recording the following information concerning events at project site:
 - 1. Count of personnel at Project site
 - 2. Equipment at Project site
 - 3. Material Deliveries
 - 4. High and low temperatures and general weather conditions, including presence of rain or snow
 - 5. Accidents
 - 6. Meetings and significant decisions
 - 7. Unusual events
 - 8. Stoppages, delays, shortages, and losses
 - 9. Meter readings and similar recordings
 - 10. Emergency procedures
 - 11. Orders and requests of authorities having jurisdiction
 - 12. Change orders received and implemented
 - 13. Services connected and disconnected
 - 14. Equipment or system tests and startups
 - 15. Partial completions and occupancies
 - 16. Substantial completions authorized

2.05 **PROGRESS PHOTOGRAPHS**

- A. Progress photographs will be electronically submitted through Procore.
- B. Preconstruction Photographs: Before starting construction, take photographs of project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Construction manager.

1. Take additional photographs as required to record existing damage to site, structure, equipment, or finishes.
- C. Periodic Construction Photographs: Take photographs at regular intervals. Select vantage points to show status of construction and progress since last photographs were taken.
- D. Field Completion Construction Photographs: Take photographs after the date of Substantial Completion for submission as project record documents. The construction manager will inform of desired vantage points.

END OF SECTION

SECTION 01 3300

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Submittals for Review
- B. Submittals for Information
- C. Submittal Procedures
- D. Samples

PART 2 - EXECUTION

2.01 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 - 1. Product Data
 - 2. Shop Drawings
 - 3. Samples for Selection
 - 4. Samples for Verification
- B. Submit to Construction Manager to forward to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
- C. Samples will be reviewed only for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record document purposes.

2.02 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 - 1. Design data.
 - 2. Certificates.
 - 3. Test reports.
 - 4. Inspection reports.
 - 5. Manufacturer's instructions.
 - 6. Manufacturer's field reports.
 - 7. Other types indicated.
- B. Submit for Construction Manager, Architect, and Owner's knowledge. No action will be taken.

2.03 SUBMITTAL PROCEDURES

- A. Submittals will be electronically submitted through Procore. Contractor will be invited to join web based program after issue of Notice of Intent to award.
- B. Shop Drawing Procedures:
 - 1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related Work.
 - 2. Do not reproduce the Contract Documents to create shop drawings.
 - 3. Generic, non-project specific information submitted as shop drawings do not meet the requirements for shop drawings.

- C. Transmit each submittal with a copy of approved submittal form.
- D. Sequentially number the submittal form. Revise submittals with original number and a sequential numeric suffix.
- E. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.
- F. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
- G. Schedule submittals to expedite the project and coordinate submission of related items.
- H. For each submittal review, allow 15 days excluding delivery time to and from the contractor.
- I. Identify variations from the Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
- J. When revised for resubmission, identify all changes made since previous submission.
- K. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
- L. Submittals not requested will not be recognized or processed.

2.04 **SAMPLES**

- A. Submit to Construction Manager to forward to Architect/Engineer for review for limited purpose for checking conformance with information given and design concept expressed in the Contract Documents.
- B. Samples for selection as specified in product sections:
 - 1. Submit to Construction Manager to forward to Architect/Engineer for aesthetic, color, or finish selections.
 - 2. Submit samples of finishes from full range of manufacturer's standard colors, textures, and patterns to Construction Manager to forward to Architect/Engineer for selection.
- C. Submit samples to illustrate functional and aesthetic characteristics of products, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- D. Include identification on each sample, with full project information.
- E. Submit number of samples specified in individual specification sections.
- F. Photograph of submitted samples, along with transmittal sheet, shall be uploaded as a submittal in Procore.

END OF SECTION

SECTION 01 4000

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. References
- B. Quality assurance and control of installation
- C. Tolerances
- D. Defect Assessment
- E. Inspection and testing laboratory services
- F. Manufacturer's field services and reports

1.02 REFERENCES

- A. Conform to reference standard in effect at date of contract.
- B. When required by contract documents, obtain copies of standards.
- C. Should specified reference standards conflict with contract documents request clarification from engineer before proceeding.
- D. The contractual relationship of the parties to the contract shall not be altered from the contract documents by mention or inference otherwise in any reference document.

PART 2 - EXECUTION

2.01 QUALITY ASSURANCE/CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship to produce work of specified quality.
- B. Comply fully with manufacturer's instructions, including each step in sequence.
- C. Should manufacturer's instructions conflict with contract documents, request clarification from the engineer prior to proceeding.
- D. Comply with specified standards as a minimum quality for the work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform work by persons qualified to produce workmanship of specified quality
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stress, vibration, physical distortion, or disfiguration.

2.02 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with contract documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

2.03 DEFECT ASSESSMENT

- A. Replace work or portions of work not conforming to specified requirements.
- B. If, in the option of the Owner, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or recommend adjusted payment.

2.04 INSPECTION AND TESTING

- A. Owner shall include and pay for all required special inspections and testing required by IBC Section 1705, if applicable. This does not include inspections and testing required by other specification sections in this Project Manual. Copies of all testing and inspection reports shall be submitted to the Construction Manager and Design Professional by the testing and inspection agency.
- B. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with Architect, Construction Manager, and contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of contract documents.
 - 4. Immediately notify the Construction Manager and contractor of observed irregularities or non-conformance of work or products.
 - 5. Perform additional testing and inspections required by the Owner
- C. Limits on Testing Agency/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirement of contract documents.
 - 2. Agency may not approve or accept any portion of the work.
 - 3. Agency may not assume any duties of the contractor.
 - 4. Agency has no authority to stop the work.
- D. Contractor responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - 2. Cooperate with laboratory personnel, and provide access to the work and to manufacturer's facilities.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of products to be tested/inspected.
 - c. To facilitate test/inspections.
 - d. To provide storage and curing of test samples.
 - 4. Notify Construction Manager and laboratory 24 hours prior to expected time for operations requiring testing/inspection.
- E. Re-testing required because of non-conformance to specified requirements shall be performed by the same testing agency on instruction by Architect/Construction Manager.
- F. Re-testing required because of non-conformance to specified requirements shall be paid for by the Contractor.

2.05 MANUFACTURER'S FIELD SERVICES AND REPORTS

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start up of equipment, test, adjust and balance of equipment as applicable and to initiate instructions when necessary.
- B. Individuals are to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to the manufacturers' written instructions.
- C. Submit report in duplicate within 30 days of observation to Construction Manager for review.

END OF SECTION

SECTION 01 5000

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Temporary Utilities
- B. Temporary Sanitary Facilities
- C. Telephone Service
- D. Removal of Utilities, Facilities, and Controls
- E. Temporary Facilities
- F. Equipment
- G. Vehicular Access and Parking
- H. Traffic Regulation
- I. Barriers
- J. Waste Removal

1.02 TEMPORARY UTILITIES

- A. Owner will provide the following:
 - 1. Electrical Power, consisting of connection to existing facilities.
 - 2. Water Supply, consisting of connection to existing facilities.
- B. The Contractor shall pay for installation, maintenance, and removal of temporary utilities. Temporary utilities shall not disrupt the Facility's need for continuous service.

1.03 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.

1.04 TELEPHONE SERVICE

- A. Provide, maintain, and pay for telephone service to field or use a cellular telephone.

1.05 REMOVAL OF UTILITIES, FACILITIES AND CONTROLS

- A. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 - PRODUCTS

2.01 TEMPORARY FACILITIES

- A. Field Offices: Coordinate with Construction Manager and Owner if applicable.

2.02 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated, with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 - EXECUTION

3.01 VEHICULAR ACCESS AND PARKING

- A. Use designated existing on-site roads for construction traffic.
- B. Parking is as directed by Owner.
- C. When site space is not adequate, provide additional off-site parking.
- D. Use of designated existing on-site streets and driveways used for construction traffic is permitted. Track vehicles not allowed on paved areas.
- E. Use of designated areas of existing parking facilities used by construction personnel as permitted.
- F. Do not allow heavy vehicles or construction equipment in parking areas.
- G. Provide and maintain access to fire hydrants, free of obstructions.
- H. Provide means of removing mud from vehicle wheels before entering streets.

3.02 TRAFFIC REGULATION

- A. Flag Persons: Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.
- B. Flares and lights: Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.
- C. Haul Routes:
 - 1. Consult with authority having jurisdiction, establish public thoroughfares to be used for haul routes and site access.
- D. Removal:
 - 1. Remove equipment and devices when no longer required.
 - 2. Repair damage caused by demolition.

3.03 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for Owner's use of site and to protect existing facilities and adjacent properties from damage during construction operations.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

3.04 WASTE REMOVAL

- A. Except for items or materials to be salvaged, recycled or otherwise reused, remove waste materials from project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Waste Disposal Facilities: Provide waste collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.

END OF SECTION

SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. General product requirements
- B. Product options
- C. Maintenance materials
- D. Transportation and handling
- E. Storage and protections

PART 2 - PRODUCTS

2.01 GENERAL PRODUCT REQUIREMENTS

- A. Provide new products unless specifically required or permitted by the contract documents.
- B. Do not use products having any of the following characteristics:
 - 1. Made using or containing CFC's or HCFC's
 - 2. Made of wood from newly cut old growth timber.
- C. Where all other criteria are met, contractor shall give preference to products that:
 - 1. If used on interior, have lower emissions
 - 2. If wet-applied, have lower VOC content
 - 3. Are extracted, harvested, and/or manufactured closer to the location of the project
 - 4. Have longer documented life span under normal used
 - 5. Result in less construction waste
 - 6. Are made of vegetable materials that are rapidly renewable

2.02 PRODUCT OPTIONS

- 1. Products specified by reference standards or by description only: Use of any product meeting those standards or description.
- 2. Products specified by naming one or more manufacturers, with or without a provision for substitutions: Use a product of one of the manufacturers named and meeting specifications or submit a request for substitution for any manufacturer not named by the date specified in this project manual. Substitution requests shall be emailed to the Issuing Officer at the email address provided in Instructions to Bidders Section 1.04.

2.03 MAINTENANCE MATERIALS

- 1. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- 2. Deliver to project site; obtain receipt prior to final payment.

PART 3 - EXECUTION

3.01 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.02 STORAGE AND PROTECTIONS

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to the product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Comply with manufacturers' warranty conditions, if any.
- H. Cover product subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- I. Prevent contact with material that may cause corrosion, discoloration, or staining.
- J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 7300

EXECUTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures
- B. Alteration project procedures
- C. Cutting and patching
- D. Cleaning and protection
- E. Adjusting

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.01 EXAMINATION, PREPARATION, AND GENERAL INSTALLATION PROCEDURES

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misproduction.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to cutting: Examine existing conditions prior to commencing work; include elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.
- G. Clean substrate surfaces prior to applying next material or substance.
- H. Seal cracks or openings of substrate prior to applying next material or substance.
- I. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.
- J. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- K. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- L. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- M. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- N. Make neat transitions between different surfaces, maintaining texture and appearance.

3.02 ALTERATION PROJECT PROCEDURES

- A. Materials: As specified in product sections match existing products and work for patching and extending work.
- B. Employ skilled and experienced installer to perform alteration work.
- C. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.
- D. Remove unsuitable material not marked for salvage, including rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished work.
- E. Remove, cut and patch work in a manner to minimize damage and to provide a means of restoring products and finished to original condition.

- F. Remove debris and abandoned items from area and from concealed spaces.
- G. Refinish visible existing surfaces to remain in renovated rooms and spaces to specified condition for each material with a neat transition to adjacent finishes.
- H. Where new work abuts or aligns with existing, perform a smooth and even transition. Patched work to match existing adjacent work in texture and appearance.
- I. When finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line of division and make recommendation to the Construction Manager. Prior to cutting get the Owner's approval.
- J. Where change of plane of ¼ inch or more occurs, submit recommendation for providing smooth transition to the Construction Manager for review.

3.03 CUTTING AND PATCHING

- A. Employ skilled and experienced installer to perform cutting and patching.
- B. Submit written request in advance of cutting or altering elements which affect:
 1. Structural integrity of element.
 2. Integrity of weather-exposed or moisture-resistant elements.
 3. Efficiency, maintenance, or safety of element.
 4. Visual qualities of sight exposed elements.
 5. Work of owner or separate contractor.
- C. Execute cutting, fitting, and patching to complete work, and to:
 1. Fit the several parts together, to integrate with other work.
 2. Uncover work to install or correct ill-timed work.
 3. Remove and replace defective and non-conforming work.
 4. Remove samples of installed work for testing.
 5. Provide openings in elements of work for penetrations of mechanical and electrical work.
- D. Execute work by methods to avoid damage to other work and which will provide proper surfaces to receive patching and finishing.
- E. Cut rigid materials using masonry saw or core drill.
- F. Cut masonry and concrete materials using masonry saw or core drill.
- G. Restore work with new products in accordance with requirements of Contract Documents.
- H. Fit work tight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.
- I. Maintain integrity of wall, ceiling or floor construction; completely seal voids.
- J. Refinish surfaces to match adjacent finishes. Refinish to nearest intersection for continuous surfaces. Refinish entire unit for continuous surfaces for an assembly.
- K. Identify hazardous substances or conditions exposed during the work to the engineer for decision or remedy.

3.04 CLEANING AND PROTECTION

- A. Progress cleaning
 1. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
 2. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.
- B. Protection of installed work
 1. Protect installed work from damage by construction operations.
 2. Provide special protection where specified in individual specification sections.
 3. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
 4. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.
 5. Prohibit traffic from landscaped areas.

3.05 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

END OF SECTION

SECTION 01 7700

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Inspections
- B. Substantial Completion
- C. Project Record Documents
- D. Warranties
- E. Operations and Maintenance Manuals
- F. Operations and Maintenance Data for Materials and Finishes
- G. Operations and Maintenance Data for Equipment and Systems
- H. Training
- I. Final Completion
- J. Maintenance

PART 2 - EXECUTION

2.01 INSPECTIONS

- A. Ensure all state inspections have been completed by the authority having jurisdiction.
- B. Upload documentation of all test/inspections to Procore.
- C. Submit a written request for inspection of Substantial Completion. On receipt of request, The Design Professional will either proceed with inspection or notify contractor of unfulfilled requirements. The Design Professional 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.

2.02 SUBSTANTIAL COMPLETION

- A. A substantial completion checklist is attached for reference following this specification section.
- B. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to the Construction Manager through upload to Procore.
- C. Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Submit written certification that contract documents have been reviewed, work has been inspected, and that work is completed in accordance with contract documents and ready for review
 - 2. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the work has not been completed.
 - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Make final changeover of permanent locks and deliver key to the owner. Advise owner's personnel of changeover in security provisions.
 - 5. Complete startup testing of systems.
 - 6. Submit test/adjust, balance records.
 - 7. Terminate and remove temporary facilities from project site, along with mockups, construction tools, and similar elements.
 - 8. Advise owner of changeover in heat and other utilities.

9. Submit changeover information related to owner's occupancy, use, operation, and maintenance.
10. Complete final cleaning requirements, including touch up painting.
11. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

2.03 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the work:
 1. Drawings
 2. Specifications
 3. Addenda
 4. Change orders and other modifications to the contract
 5. Reviewed shop drawings, product data, and samples
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress, not less than weekly.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 1. Manufacturer's name and product model and number.
 2. Product substitutions or alterations utilized.
 3. Changes made by Addenda and modifications.
- F. Record Drawings:
 1. Measured depths of foundations in relation to finish first floor datum.
 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.
 4. Field changes of dimension and detail.
 5. Details not on original contract drawings.
- G. Record Drawings shall be uploaded to Procore in pdf format.

2.04 WARRANTIES

- A. Submit written warranties for designated portions of the work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Submit properly executed warranties in Procore prior to Final Completion.
- C. Verify that documents are in proper form, contain full information, and are notarized.
- D. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- E. Include warranties in operation and maintenance manuals.
- F. Items of work delayed beyond date of Substantial Completion, provide updated submittal after acceptance by Owner, listing date of acceptance as start of warranty period

2.05 OPERATIONS AND MAINTENANCE MANUALS

- A. Format: Submit operations and maintenance manuals in the following format:
 1. Portable Document Format (PDF) electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Owner and upload to Procore.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 2. Assemble with data arranged in the same sequence as, and identified by the specification sections. Where systems involve more than one specification section, provide separate index for each system.

3. Include project directory listing title and address of project, names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
 4. Include Table of Contents listing every item separated by index and specification section.
- B. Source Data: For each product or system, list names, addresses, and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
 - C. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
 - D. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use project record documents as maintenance drawings.
 - E. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

2.06 OPERATIONS AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For each product, applied material, and finish:
 1. Product data, with catalog number, size, composition, and color and texture designations.
 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specified products.

2.07 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For each item of equipment and each system:
 1. Description of unit or system, and component parts
 2. Identify function, normal operating characteristics, and limiting conditions
 3. Include performance curves, with engineering data and tests
 4. Complete nomenclature and model number of replacement parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specified products.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Include color coded wiring diagrams as installed.
- E. Operating procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- F. Maintenance requirements: Include routine procedure and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- G. Provide servicing and lubrication schedule and list of lubricants required.
- H. Include manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by controls manufacturer.
- J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Provide control diagrams by controls manufacturer as installed.
- L. Provide contractor's coordination drawings, with color coded piping diagrams as installed.

- M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- O. Include test and balancing reports.
- P. Additional requirements: As specified in individual specification sections.

2.08 TRAINING

- A. Demonstrate operations of systems, subsystems, and equipment.
- B. Train in operation and maintenance of systems, subsystems, and equipment
- C. 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.
- D. Submit written agenda to Construction Manager for approval prior to scheduling training.
- E. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

2.09 FINAL COMPLETION

- A. A final completion checklist is attached for reference following this specification section.
- B. Before requesting final inspection for determining date of Final Completion, complete the following:
 - 1. Complete punch list items.
 - 2. Prepare and submit project record documents, operation and maintenance manuals, damage or settlement surveys, and similar final record information.
 - 3. Deliver tools, spare parts, extra materials, and similar items to location designated by owner. Label with manufacturer's name and model number where applicable.
 - 4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
 - 5. All trailers, construction signs, unused, broken or demolition materials have been removed from the site and the premises returned to the original condition in the opinion of the Owner and Design Professional.
 - 6. Submit a final Application for Payment (retainage).
- C. Upon receipt of final payment complete final completion certificate in Procore.

END OF SECTION

Substantial Completion Project Checklist

Date: _____

DAS Project Number: _____

Project Title: _____

Location: _____

Contractor: _____

In order to process the 99% payment (100% pay app less closeout and retainage) on a Capital Project, the Department of Administrative Services needs the following information. Please complete this form and obtain the necessary documents.

Have all state inspections been completed and documentation uploaded to Procore?
(Including but not limited to the following inspections)

Boiler Inspection Yes No N/A

Water Heater Inspection Yes No N/A

Energy Code Inspection Yes No N/A

Building Code Inspection Yes No N/A

Electrical Inspection Yes No N/A

Elevator Inspection Yes No N/A

Other: _____ Yes No N/A

Occupancy Permit if applicable

Test and Balance has been performed

Certificate of Substantial Completion in Procore (Consensus Docs 814)

Are there any disputes with the above mentioned vendor which need resolution?

Yes (provide description below) No

Can payment (less closeout and retainage) be released? Yes No

Final Completion Project Checklist

Date: _____

DAS Project Number: _____

Project Title: _____

Location: _____

Contractor: _____

In order to process the 100% payment and Retainage payment on a Capital Project, the Department of Administrative Services needs the following information. Please complete this form and obtain the necessary documents.

Have all Warranties been received? Yes No

Have the Operations and Maintenance Manuals been received? Yes No

Who is in possession of the O & M Manuals? _____

Has all training been completed? Yes No

Have all as-built drawings been scanned and uploaded into Procore? Yes No

Have electronic drawing/specification files been transferred to DAS? Yes No

Have all Test & Balance reports been received? Yes No

Have all punchlist items been corrected? Yes No

573 Notification (*To be obtained from the general contractor*): Copy of general contractor's notification of application for retainage to all subcontractors and suppliers. General contractor must follow IAC 26 section 23.13.2.

AIA Form G706 – Contractor's Affidavit of Payment of Debts and Claims

AIA Form G706A – Contractor's Affidavit of Release of Liens

AIA Form G707 – Consent of Surety Company to Final Payment

Certificate of Final Completion in Procore (Consensus Docs 815)

Are there any disputes with the above mentioned vendor which need resolution?

Yes (provide description below) No

Can 100% payment and retainage payment be released? Yes No

SECTION 024119
SELECTIVE STRUCTURE DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of selected portions of a building or structure.
 - 2. Demolition and removal of selected site elements.
 - 3. Salvage of existing items to be reused.

1.2 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: Detach items from existing construction and deliver them to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction not to be removed and not otherwise indicated to be removed, removed, and salvaged, or removed and reinstalled.

1.3 SUBMITTALS

- A. Schedule of Selective Demolition Activities: Indicate detailed sequence of selective demolition and removal work, with starting and ending dates for each activity, interruption of utility services and locations of temporary partitions and means of egress. Facility is to remain fully functional throughout entire construction period.

1.4 CLOSEOUT SUBMITTALS

- 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.

1.5 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that specializes in demolition work similar in material and extent to that indicated for this Project.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before

beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

- C. Standards: Comply with ANSI A10.6 and NFPA 241.
- D. Pre-demolition Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1. Before selective demolition, Owner will remove items of value.
- B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.
- D. Storage or sale of removed items or materials on-site is not permitted.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure nature and extent of conflict. Promptly submit written report to Architect.
- E. Perform surveys as Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect against damage during selective demolition operations.
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Arrange to shut off indicated utilities with utility companies.
 - 2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit after bypassing.

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 specified in Division 01 Specifications.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- 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.

3.4 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to extent required by new construction and as indicated. Use methods required to complete Work within limitations of governing regulations and as follows:
 - 1. 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.
 - 2. Cut or drill from exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 3. Do not use cutting torches until the 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.
 - 4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 5. 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 designated by Owner.
 - 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. Protect items from damage during transport and storage.
 - 3. 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 reinstalled in their original locations after selective demolition operations are complete.

3.5 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.

- B. Burning: Do not burn demolished materials.

- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.6 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

SECTION 054000

COLD-FORMED STEEL FRAMING (CFSF) SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Load bearing structural steel stud and joist framing system of 18 to 12-gauge (43 mil to 97 mil) members along with fasteners and related accessories. Furnish and install cold-form steel framing, as shown on the drawings and specified herein. Work shall include, but not be limited to the following items:
 - 1. Formed steel stud interior partition wall framing.
 - 2. Formed steel ceiling joist framing and bridging.
 - 3. Provide tracks, blocking, lintels, clips angles, bridging, shoes, reinforcements, fasteners, and accessories to construct a complete steel framing system.
- B. Structural notes indicated on the drawings regarding cold-formed steel framing system shall be considered a part of this Specification.

1.2 RELATED WORK

- A. Pertinent Sections of Division 01.
- B. Division 9 for non-load bearing studs of 20 gauge (33 mil) or lighter.

1.3 REFERENCES

- A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified. Where any provisions of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.
 - 1. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.
 - 2. AISI S200 - North American Standard for Cold-Formed Steel Framing - General Provisions.
 - 3. AISI S202 - North American Standard for Cold-Formed Steel Structural Framing.
 - 4. AISI S210 - North American Standard for Cold-Formed Steel Framing - Floor and Roof System Design.
 - 5. AISI S211 - North American Standard for Cold-Formed Steel Framing - Wall Stud Design.
 - 6. AISI S212 - North American Standard for Cold-Formed Steel Framing - Header Design.
 - 7. AISI S213 - North American Standard for Cold-Formed Steel Framing - Lateral Design.
 - 8. ASTM A653 - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

9. ASTM A1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
10. ASTM C955 - Standard Specification for Cold-Formed Steel Structural Framing Members.
11. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
12. AWCI - Association of Wall and Ceiling Industries.
13. AWS D1.3 - Structural Welding Code - Sheet Steel.
14. SSMA - Steel Stud Manufacturers Association.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Structural Performance:

1. Design CFSF to withstand design loads meeting the following deflection limits:
 - a. Interior Partition Walls: Horizontal deflection of 1/240 of wall height under 5 psf service wind load.
 - b. Ceiling Joist Framing: Vertical deflection of 1/360 for live load and 1/240 for a superimposed dead load of 5 psf and live load of 20 psf.
2. Design CFSF to provide for movement of framing members 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°F.
3. Design system to accommodate construction tolerances, deflection of building structural members (1-inch maximum), and clearances of intended openings.
4. Design CFSF system to be stable. Walls that are not braced by ceiling joists are to extend up to existing steel deck.
5. CFSF shall be designed in accordance with all AISI Standards.

1.5 SUBMITTALS

A. Shop Drawings:

1. Prepare and submit complete erection and detailed shop drawings for Engineer's approval, including framing plans indicating size, gauge, weight, and location of all framing members. Shop drawings shall indicate the following:
 - a. Component details, framed openings, bearing, anchorage, loading, welds, type and location of fasteners, bracing, bridging, strapping, connections, and accessories or items required of other related work. Provide stud and ceiling joist layout.
 - b. Describe method for securing studs to tracks and for bolted/welded framing connections.
 - c. Provide calculations for loadings and stresses of the steel framing system, including specially fabricated components and roof trusses, prepared by a registered Professional Engineer, with registration from the State in which the project is located.
 - d. Detail size and location of all bridging, strapping, bracing, splices, and accessories required for installation.

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B. Product Data:

1. Provide product data on standard framing members. Describe materials and finish, product criteria and limitations. Submit manufacturer's installation instructions.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Steel members shall be transported, stored, and erected in a manner that will avoid any damage or deformation. Bent or deformed members will be rejected and shall be replaced or repaired at the expense of the responsible party. Store clear of ground and in such a manner so as to eliminate excessive handling.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Framing Materials:

1. Studs shall conform to the ASTM designations listed in the General Notes of the drawings, unless noted otherwise, and be formed to channel shape, punched web, with nominal size as indicated on the drawings.
2. Joists shall conform to the ASTM designations listed in the General Notes of the drawings, unless noted otherwise, and be formed of channel or open box shape, solid or punched web with nominal depths as noted on the drawings. All joists shall be single length span (without splices) unless otherwise indicated.

B. Accessories:

1. Bracing, furring, and bridging shall consist of formed sheet steel with thickness determined for conditions encountered. Provide manufacturer's standard shapes, complete with finish same as framing members.
2. Plates, gussets, and clips shall consist of formed sheet steel with thickness determined for conditions encountered. Provide manufacturer's standard shapes, complete with finish same as framing members.

C. Fasteners:

1. Self-drilling, self-tapping screws, bolts, nuts, and washers shall conform to ASTM A90, complete with hot-dip galvanized coating, minimum size: 1/4-14.
2. Expansion anchors shall be "Kwik" bolts, as manufactured by Hilti, Inc.
3. All other fasteners shall be as indicated on drawings or as recommended by the cold-form manufacturer.

D. Finishes:

1. Furnish all studs, joists, and system components with a factory galvanized (G60), finish.

2.2 FABRICATION

- A. Fabricate assemblies of framed sections, of sizes and profiles required with framing members fitted, reinforced, and braced to suit design requirements.
- B. Fit and assemble in largest practical sections for delivery to Worksite, ready for installation.
- C. Bearing studs must be fabricated with full stud end seated against track web. Do not use studs that have been cut at punchouts.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify substrate surfaces and building framing components are ready to receive work.
- B. Beginning of installation means acceptance of existing conditions and substrate.

3.2 INSTALLATION

- A. General:
 - 1. Cold-formed steel framing system shall consist of structural steel studs and joists with locations as shown on the drawings. All work shall be in accordance with approved shop drawings and manufacturer's latest printed specifications. Framing members shall be securely attached by mechanical fasteners as indicated on the drawings and as recommended by the manufacturer.
 - a. Wire tying of stud or joist components will not be allowed.
 - b. Complete framing system ready to receive subsequent facing material.
 - 2. Provision shall be made in the studs for rigid fastening of all blocking and special braces or framing and for attachment and support of electrical outlets or other equipment indicated to be supported by stud construction.
 - a. All anchorage, bracing and blocking shall be in accordance with approved shop drawings and as recommended by the manufacturer.
 - 3. Surfaces abraded by handling, weld locations and other miscellaneous defects shall be touched-up with zinc-rich galvanizing compound (ZRC) coating.

END OF SECTION

SECTION 055000
METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Miscellaneous steel channel supports.
- B. See Division 05 Section "Metal Stairs" for metal-framed stairs.
- C. See Division 05 Section "Pipe and Tube Railings" for metal pipe and tube railings.

1.2 SUBMITTALS

- A. Shop Drawings: Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- B. Templates: For anchors and bolts.
- C. Samples: For each type and finish of extruded nosing and tread.

PART 2 PRODUCTS

2.1 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.
- B. Ferrous Metals:
 - 1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 2. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304 or 316L.
 - 3. Steel Tubing: ASTM A 500, cold-formed steel tubing.
 - 4. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
 - 5. Slotted Channel Framing: Cold-formed metal channels complying with MFMA-3, 1-5/8 by 1-5/8 inches. Channels made from galvanized steel complying with ASTM A 653/A 653M, structural steel, Grade 33, with G90 coating; 0.079-inch nominal thickness.
 - 6. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

2.2 FASTENERS

- A. General: Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Cast-in-Place Anchors in Concrete: Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

2.3 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI #79.
- B. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
 - 1. Available Products:
 - a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
 - b. Carboline Company; Carbozinc 621.
 - c. ICI Devoe Coatings; Catha-Coat 313.
 - d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
 - e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
 - f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
 - g. Tnemec Company, Inc.; Tneme-Zinc 90-97.
- C. Galvanizing Repair Paint: SSPC-Paint 20, high-zinc-dust-content paint for re-galvanizing welds in steel.

2.4 FABRICATION

- A. General: Preassemble items in the shop to the greatest extent possible. Use connections that maintain structural value of joined pieces.
 - 1. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
 - 2. Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercutting or overlapping. Remove welding flux immediately. Finish exposed welds smooth and blended.
 - 3. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.
 - 4. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
 - 5. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 24 inches o.c.
- B. Miscellaneous Framing and Supports: Provide steel framing and supports not specified in other Sections as needed to complete the Work. Fabricate units from steel shapes, plates, and bars of welded construction. Cut, drill, and tap units to receive hardware, hangers, and similar items.

2.5 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish metal fabrications after assembly.
- B. Steel and Iron Finishes:
 - 1. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below for environmental exposure conditions of installed metal fabrications:
 - a. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
 - 2. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting," for shop painting.

PART 3 EXECUTION

3.1 INSTALLATION

- A. General: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, with edges and surfaces level, plumb, and true.
 - 1. Fit exposed connections accurately together. Weld connections that are not to be left as exposed joints but cannot be shop welded. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication.
 - 2. Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
 - 3. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- B. Set bearing and leveling plates on cleaned surfaces using wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts and pack solidly with nonshrink, nonmetallic grout.
- C. Touch up surfaces and finishes after erection.
 - 1. Painted Surfaces: Clean field welds, bolted connections, and abraded areas and touch up paint with the same material as used for shop painting.
 - 2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 061000
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. This Section includes the following:
 - 1. Wood blocking and nailers.

1.3 DEFINITIONS

- A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. 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 lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
 - 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.

2.2 FIRE-RETARDANT-TREATED MATERIALS

- A. 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 beyond the centerline of the burners at any time during the test.
 - 1. Treatment not to promote corrosion of metal fasteners.
 - 2. Interior Type 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.
- B. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
 - 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 testing agency.
- C. For exposed items indicated to receive a stained or natural finish, chemical formulations not to bleed through, contain colorants, or otherwise adversely affect finishes.

2.3 DIMENSION LUMBER

- A. General: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.
- B. Structural Framing: Number 2 or better Douglas Fir -or- Hem Fir.
- C. Non-structural Uses: Number 2 or better Spruce-Pine-Fir.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide lumber required for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
- B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 19 percent maximum moisture content.
- C. For furring strips if indicated on Drawings, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 FASTENERS

- A. General: Provide fasteners of size and type that comply with requirements specified in this Article for material and manufacture.
 - 1. Comply with requirements of the General Structural Notes on the Drawings.
 - 2. Where rough carpentry is exposed to weather, in ground contact, in area of high relative humidity, or preservative treated, provide fasteners with hot-dip zinc coating complying with ASTM A 153 Class D.

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- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: CABO NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening 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.
- F. Lag Bolts: ASME B18.2.1.
- G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers, galvanized per ASTM A153.
- H. Anchor Bolts:
 - 1. Adhesive Type.
 - a. Anchor Rods:
 - 1) Carbon Steel for Interior Applications: Compliant with ASTM A307.
 - b. Nuts:
 - 1) Carbon Steel for Interior Applications: Compliant with ASTM A563, Grade A.
 - c. Washers.
 - 1) Carbon Steel for Interior Applications: Compliant with ANSI B18.22.1, Type A.
 - d. Adhesive.
 - 1) Compliant with ASTM C881, Type I to IV, Grade 3, Class B or C.
 - e. Acceptable manufacturers and products:

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough 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. Do not use materials with defects that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- C. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.
- D. Securely attach rough carpentry work to substrate by anchoring and fastening as required.
- E. 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 between members. Install fasteners without splitting wood; predrill as required.
- F. Use finishing nails for exposed work, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
Indicate locations of other fasteners, such as wood screws, bolts, and lag screws, on

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Drawings.

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. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.

END OF SECTION

SECTION 061600

SHEATHING

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Wall and Ceiling Sheathing.

1.2 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 and fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements.
- B. Research/Evaluation Reports: For the following:
 - 1. Fire-retardant-treated plywood.

1.3 QUALITY ASSURANCE

- 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.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 PRODUCTS

2.1 WOOD PANEL PRODUCTS, GENERAL

- A. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.

2.2 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Comply with performance requirements in AWPA C27.
 - 1. Use Exterior type with exterior bond classification of Grade C or better for exterior locations and where indicated.

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2. Use Interior Type A, High Temperature (HT) for roof sheathing and where indicated.
 3. Use Interior Type A, unless otherwise indicated.
- B. Kiln-dry material after treatment to a maximum moisture content of 15 percent.
- C. Identify fire-retardant-treated plywood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
- D. Application: Treat plywood indicated on Drawings.

2.3 WALL AND CEILING SHEATHING

- A. Plywood Wall Sheathing: Exposure 1, Structural I sheathing.
1. Exterior Bond Classification: Grade C or better.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated.
1. For wall and roof sheathing panels, provide fasteners with corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

- A. 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 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's "Uniform Building Code."
 4. Table 2305.2, "Fastening Schedule," in BOCA's "BOCA National Building Code."
 5. Table 2306.1, "Fastening Schedule," in SBCCI's "Standard Building Code."
 6. 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."
 7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's "International One- and Two-Family Dwelling Code."
- B. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that exclude exterior moisture.
- C. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

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3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30S, "Engineered Wood Construction Guide."

- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Wall and Ceiling Sheathing:
 - a. Screw to cold-formed metal framing.

END OF SECTION

SECTION 064023

INTERIOR ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Solid-surfacing-material countertops.
 - 2. Deal Tray.
- B. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips unless concealed within other construction before woodwork installation.
- C. Rough carriages for stairs are a part of interior architectural woodwork. Platform framing, headers, partition framing, and other rough framing associated with stairwork are specified in Division 06 Section "Rough Carpentry."

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated including solid-surfacing material, cabinet hardware and accessories, handrail brackets and finishing materials and processes.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
- C. Samples:
 - 1. Lumber and panel products for transparent finish, for each species and cut, finished on one side and one edge.
 - 2. Lumber and panel products with shop-applied opaque finish, for each finish system and color, with exposed surface finished.
 - 3. Solid-surfacing materials.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer (5 years minimum) who has completed architectural woodwork 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.
- B. Fabricator Qualifications: A firm experienced (5 years minimum) in producing architectural woodwork like that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards".

1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.
 - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Wood Products:
 - 1. Medium-Density Fiberboard: ANSI A208.2, Grade MD.
 - 2. Particleboard: ANSI A208.1, Grade M-2.
 - 3. Softwood Plywood: DOC PS 1, Medium Density Overlay.
- B. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
 - 1. Manufacturers: See finish schedule.

2.2 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural woodwork, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."
- B. Deal Tray: Counter Recessed Deal Tray. Brushed Stainless steel finish, size: 12" x 8" x 1-1/2". Basis of Design: Insulgard Security Products, Counter Recessed Deal Tray.

2.3 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, fire-retardant-treated, kiln-dried to less than 15 percent moisture content.

2.4 FABRICATION

- A. General: Complete fabrication to maximum extent possible before shipment to Project site. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
 - 1. Interior Woodwork Grade: Custom.

2. Shop cut openings to maximum extent possible. Sand edges of cutouts to remove splinters and burrs. Seal edges of openings in countertops with a coat of varnish.
 3. Install glass to comply with applicable requirements in Division 08 Section "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.
- B. Solid-Surfacing-Material Countertops:
1. Solid-Surfacing-Material Thickness: 1/2 inch.
 2. Colors, Patterns, and Finishes: See Finish Schedule.
 3. Fabricate tops in one piece with shop-applied backsplashes. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
 4. Install integral sink bowls in countertops in shop.

2.5 SHOP FINISHING

- A. Finish architectural woodwork at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.
- B. Back priming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas. Examine shop-fabricated work for completion and complete work as required, including removal of packing and back priming.
- B. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- C. Install woodwork level, plumb, true, and straight to a tolerance of 1/8 inch in 96 inches. Shim as required with concealed shims.
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

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- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.
 - 1. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.

- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants".

END OF SECTION

SECTION 072110
ACOUSTICAL BATT INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Mineral wool insulation for interior wall assembly sound attenuation.
- B. Related Sections:
 - 1. Section 092900 - Gypsum Board assemblies.

1.2 SUBMITTALS

- A. Product Data: Submit product data including manufacturer's literature for insulation, including preparation instructions and recommendations, installation methods, and storage and handling requirements.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Work experience of 2 years minimum with work similar to work in this Section.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials and accessories in insulation manufacturer's original packaging with identification labels intact and in sizes to suit project. Ensure insulation materials are not exposed to moisture during delivery. Replace wet or damaged insulation materials.
- B. Storage and Handling: Store materials off ground in dry location and protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacture. Store in original packaging until installed.
- C. Packaging Waste Management: Remove waste packaging materials from site and dispose of packaging materials at appropriate recycling facilities. Collect and separate for disposal paper and plastic material in appropriate on-site storage containers for recycling.

PART 2 PRODUCTS

2.1 MANUFACTURER - MINERAL WOOL

- A. Basis-of-Design Manufacturer: ROCKWOOL (US), www.rockwool.com.
 - 1. Other Approved Manufacturers, provided product meets Basis of Design.
 - a. Isolatek International.

- b. Johns Manville.
- c. Owens Corning.
- d. Thermafiber.
- e. Substitutions: Allowed in accordance with Division 01 Specifications.

2.2 THERMAL AND ACOUSTICAL INSULATION - MINERAL WOOL

- A. Thermal / Acoustical Insulation:
 - 1. Product: ROCKWOOL Acoustical Fire Batts (AFB) for Steel Stud; unfaced.
 - a. Density: >2.5 lbs/ft³, nominal.
 - b. Melting Point - Minimum melting point temperature of 2150°F.
 - c. Surface Burning Characteristics: Tested in accordance with ASTM E84.
 - 1) Unfaced: Flame Spread 0 and Smoke Developed 0.
 - d. Non-combustible: classified non-combustible per CAN/ULC S114.
 - e. Non-combustible: classified non-combustible per ASTM E136 at 750oC.
 - f. Moisture Resistance: Absorption of less than 0.03 percent by volume, when tested in accordance with ASTM C1104.
 - g. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
 - h. Fungi resistance: Zero mold growth to ASTM C1338.
 - i. Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.
 - j. Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025.
 - k. Air Erosion: maximum air velocity of 1,000 fpm per UL 181.
 - l. UL Classification Code: BZJZ.
 - m. ULC Classification Code: BZJZC.
 - n. GREENGUARD Gold Certified.
 - o. MEA Approval, New York City Approval - 338-97-M.
 - p. City of Los Angeles Approval - RR 25444.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine the areas and conditions under which work of this section will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install insulation in accordance with manufacturer's written recommendations and guidelines.
- B. Do not compress insulation to fit into spaces.
- C. Fit insulation closely around electrical boxes, pipes, ducts, frames, and other objects in or passing through insulation.
- D. Keep insulation minimum 3" from heat emitting devices such as recessed light fixtures, and minimum 2" from sidewalls of chimneys and vents.

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3.3 PROTECTION

- A. Store the material to protect against weathering and physical damage, including humidity. Unpack the material at the installation site. Open a door or open a window to ensure good ventilation during installation on the construction site. Cover open ventilation ducts to reduce particulate in the ducts.

END OF SECTION

SECTION 079200
JOINT SEALANTS

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes sealants for the following applications, including those specified by reference to this Section:
 - 1. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
 - a. Perimeter joints between interior wall surfaces and frames of interior doors, and windows.
 - b. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - c. Other joints as indicated.

1.2 PERFORMANCE REQUIREMENTS

- A. Provide silicone and elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.3 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each application indicated below:
 - a. Each kind of sealant and joint substrate is indicated.
 - 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 - 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. 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.
 - 1) 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.
 - 5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 - 6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each product exposed to view.
- C. 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.

1.5 CLOSEOUT SUBMITTALS

- A. General Warranty: 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. Special Installer's Warranty: Written warranty, signed by Installer agreeing to repair or replace silicone and elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- C. Special Manufacturer's Warranty: Written warranty, signed by elastomeric sealant manufacturer agreeing to furnish silicone and elastomeric 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:
 - a. Urethane: 5 years from date of Substantial Completion.
 - b. Silicone: 20 years from date of Substantial Completion.
- D. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
 - 1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
 - 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 are caused by accumulation of dirt or other atmospheric contaminants.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: 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.
 - 2. When joint substrates are wet.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

PART 2 PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified in the sealant schedules at the end of Part 3.
- B. Acceptable Manufacturers - sealants:
 - 1. Master Builders Solutions, a division of BASF.
 - 2. Dow Corning.
 - 3. Pecora.
 - 4. Sika.
 - 5. Tremco.
 - 6. United States Gypsum.

2.2 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 sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

2.3 SILICONE AND ELASTOMERIC JOINT SEALANTS

- A. Silicone and Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Silicone and Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.
- B. Stain-Test-Response Characteristics: Where sealants are specified in the Silicone and Elastomeric Joint-Sealant Schedule 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.

2.4 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type 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, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 - 1. Closed cell polyethylene rod designed for use with cold applied joint sealants.
- 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 where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 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 sealants 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 with 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, blast cleaning, 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 from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
 - a. Metal.
 - b. Glass.
 - c. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on 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 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 of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

- C. Install sealant backings of type 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 back of joints.
- E. Install sealants by proven techniques to 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 provided for 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 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 sealants from surfaces adjacent to joint.
 - 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 configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.4 CLEANING

- A. Clean off excess sealants or sealants 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.

3.5 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 the original work.

3.6 ELASTOMERIC JOINT-SEALANT SCHEDULE

- A. Listed Manufacturer's products are representative examples.
- B. Sealant Type 1: Acoustical Sealant.
 - 1. Use: Electrical outlets and top/bottom partitions.
 - 2. ASTM C-919, one part acrylic latex equivalent to Tremco "Acoustical Sealant".

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- C. Sealant Type 2: Acrylic latex sealant.
 - 1. Use: Hollow metal interior frames abutting drywall (1/8" maximum joint) and interior windowsills.
 - 2. ASTM C834 for latex sealing compounds.
 - 3. Joint movement capability: $\pm 7.5\%$.
 - 4. Equivalent to Tremco "Tremflex 834" or BASF NP520.

- D. Sealant Type 5: Silicone sealant.
 - 1. Use: Around plumbing fixtures and sinks.
 - 2. ASTM C920, Type S, Grade NS, Class 25, uses NT, G, A, O.
 - 3. Joint movement capability: $\pm 50\%$.
 - 4. Equivalent to Tremco "Tremsil 200".
 - 5. Color to match plumbing fixtures.

- E. Backer Rod (typical use except Sealant Type 4).
 - 1. Provide closed-cell polyethylene rod designed for use with cold applied joint sealants.
 - 2. Provide backer rod of size required for joint design.

- F. Color of sealants will be selected by the Architect from the manufacturer's full color range.

END OF SECTION

SECTION 081113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Standard hollow metal doors and frames.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and other details.
- C. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

1.3 QUALITY ASSURANCE

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 the following:
 - 1. Allegion Republic.
 - 2. Ceco Door Products; an Assa Abloy Group company.
 - 3. Curries Company; an Assa Abloy Group company.
 - 4. Deansteel Manufacturing Company, Inc.
 - 5. Firedoor Corporation.
 - 6. Fleming Door Products Ltd.; an Assa Abloy Group company.
 - 7. Habersham Metal Products Company.
 - 8. Kewanee Corporation (The).
 - 9. Mesker Door Inc.
 - 10. Pioneer Industries, Inc.
 - 11. Security Metal Products Corp.
 - 12. Steelcraft; an Ingersoll-Rand company.
- B. Substitutions: Allowed in accordance with Division 01 Specifications.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS, Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, CS, Type B.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A60 metallic coating. Required for all exterior doors.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z 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. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- G. Mineral-Fiber Insulation: ASTM C 665, Type I.
- H. Glazing: Division 08 Section "Glazing."
- I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat.

2.3 STANDARD HOLLOW METAL DOORS

- A. General: Comply with ANSI/SDI A250.8.
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core. Where indicated provide doors fabricated as thermal-rated assemblies with a minimum R-value of 2.8 or better.
 - 3. Vertical Edges for Single-Acting Doors: Latch: Beveled edge, 1/8 inch in 2 inches. Hinge: Square edge Manufacturer's standard.
 - 4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.
 - 5. Tolerances: SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
 - 6. Non-handed doors not allowed.
- B. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - 1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush).
- C. Hardware Reinforcement: ANSI/SDI A250.6.

2.4 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8.

- B. Interior Frames: Fabricated from cold-rolled steel sheet.
 - 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames as full profile welded.
 - 3. Frames for Level 3 Steel Doors: 0.053-inch- thick steel sheet.
 - 4. Frames for Borrowed Lights: Same as adjacent door frame.
- C. Hardware Reinforcement: ANSI/SDI A250.6.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 - 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 - 4. 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, not less than 0.042 inch thick, 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 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032-inch thick, same material as door face sheet.
- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032-inch thick, same material as frames.

2.7 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- wide steel.

2.8 FABRICATION

- A. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

- B. Hollow Metal Doors:
 - 1. Glazed Lites: Factory cut openings in doors.
 - 2. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated.

- C. Hollow Metal Frames: Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - 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 bottom of jambs and mullions with at least four spot welds per anchor.
 - 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry 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) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 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) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
 - c. Compression Type: Not less than two anchors in each jamb.
 - d. Post-installed Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
 - 6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers.
 - a. Single-Door Frames: Three door silencers.
 - b. Double-Door Frames: Two door silencers.

- D. Hardware Preparation: Factories prepare hollow metal work to receive templated mortised hardware according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
 - 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 - 2. Reinforce doors and frames to receive non-templated, mortised and surface-mounted door hardware.
 - 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 - 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 electrical Sections.

- E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or 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 doors and frames.
4. Provide loose stops and moldings on the inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.9 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.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Hollow Metal Frames: Comply with ANSI/SDI A250.11.
 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. 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.
 - b. Install frames with removable glazing stops located on secure side of opening.
 - c. Install door silencers in frames before grouting.
 - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - e. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - f. Field applies bituminous coating to backs of frames that are 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 powder-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 behind 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 Gypsum Board Partitions: Secure frames in place with post-installed expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 7. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend the top of struts to provide flush contact for securing supporting construction. Provide adjustable wedged or bolted anchorage to

- frame jamb members.
8. 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.
 - B. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - C. Glazing: Comply with installation requirements in Division 08 Section "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.

3.2 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. 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.

END OF SECTION

SECTION 081416
FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid-core doors with wood-veneer faces.
 - 2. Factory finishing flush wood doors.
 - 3. Factory machining for hardware.

- B. Related Sections:
 - 1. Division 08 - "Glazing" for glass view panels in flush wood doors.

1.2 SUBMITTALS

- A. Product Data: For each type of door indicated. Include factory-finishing specifications.

- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate requirements for veneer matching.
 - 4. Indicate doors to be factory finished and finish requirements.

- C. Samples: For factory-finished doors.

1.3 CLOSEOUT SUBMITTALS

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

1.4 QUALITY ASSURANCE

- A. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

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. Algoma Hardwoods, Inc.
 2. Ampco, Inc.
 3. Buell Door Company Inc.
 4. Chappell Door Co.
 5. Eagle Plywood & Door Manufacturing, Inc.
 6. Eggers Industries.
 7. Graham; an Assa Abloy Group company.
 8. Haley Brothers, Inc.
 9. Ideal Architectural Doors & Plywood.
 10. Ipik Door Company.
 11. Lambton Doors.
 12. Marlite.
 13. Marshfield Door Systems, Inc.
 14. Mohawk Flush Doors, Inc.; a Masonite company.
 15. Oshkosh Architectural Door Company.
 16. Poncraft Door Company.
 17. Vancouver Door Company.
 18. VT Industries Inc.

2.2 DOOR CONSTRUCTION, GENERAL

- A. WDMA I.S.1-A Performance Grade:
1. Heavy Duty unless otherwise indicated.
- B. Particleboard-Core Doors:
1. Particleboard: ANSI A208.1, Grade 1-LD-2.
 2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
 3. Provide doors with either glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors:
1. Grade: Premium, with Grade A faces.
 2. Species: Match species of existing doors in each building. Doors appear to be select white maple-contractor to confirm.
 3. Cut: Plain sliced (flat sliced).
 4. Match between Veneer Leaves: Book match.
 5. Assembly of Veneer Leaves on Door Faces: Balance match.
 6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
 7. Core: Particleboard.
 8. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering.

2.4 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
- B. Factory machine doors for hardware that is not surface applied.
- C. Openings: Cut and trim openings through doors in factory.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."

2.5 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Finish doors at factory that are indicated to receive transparent finish.
- C. Transparent Finish:
 - 1. Grade: Premium.
 - 2. Finish: WDMA TR-6 catalyzed polyurethane.
 - 3. Staining: Match existing doors. Provide samples.
 - 4. Effect: Open-grain finish.
 - 5. Sheen: Satin.

2.6 FACTORY PRIMING

PART 3 EXECUTION

3.1 INSTALLATION

- A. Hardware: For installation, see Division 08 - "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

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- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels; do not trim stiles and rails more than limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 3/4 inch from bottom of door to top of floor slab unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

END OF SECTION

SECTION 083613
SECTIONAL DOORS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes manually operated sectional doors.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type and size of sectional door and accessory.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
- C. Samples: For each exposed product and for each color and texture specified.

1.3 CLOSEOUT SUBMITTALS

- A. Special Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- C. Maintenance data.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Sectional doors shall comply with performance requirements specified

without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.

2.2 DOOR ASSEMBLY

- A. Steel Sectional Door: Sectional door formed with hinged sections and fabricated according to DASMA 102 unless otherwise indicated.
 - 1. Manufacturers:
 - a. ArmRLite Overhead Doors.
 - b. C.H.I. Overhead Doors.
 - c. Clopay Building Products, a Griffon company.
 - d. Raynor,
 - e. Wayne-Dalton Corp.
- B. Operation Cycles: Door components and operators capable of operating for not less than 20,000.
- C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. at 15 and 25 mph (24.1 and 40.2 km/h) when tested according to ASTM E283.
- D. R-Value: 12.0°F x h x sq. ft./Btu.
- E. Steel Sections: Zinc-coated (galvanized) steel sheet with G60 (Z180) zinc coating.
 - 1. Section Thickness: 2 inches.
 - 2. Exterior-Face Surface: Flat.
 - 3. Interior Facing Material: Zinc-coated (galvanized) steel sheet.
- F. Track Configuration: Standard-lift and Vertical-lift track.
- G. Weatherseals: Fitted to bottom and top and around entire perimeter of door.
- H. Locking Devices: Equip door with slide bolt for padlock.
 - 1. Locking Device Assembly: Single-jamb side locking bars, operable from inside with thumbturn.
- I. Manual Door Operator: Push-up operation.
- J. Door Finish:
 - 1. Baked-Enamel or Powder-Coat Finish: Color and gloss as selected by Architect from manufacturer's full range.
 - 2. Factory Prime Finish: Manufacturer's standard color.
 - 3. Finish of Interior Facing Material: Finish as indicated by manufacturer's designations.
- K. Door Position Switch Plates with wired alarm.
 - 1. Heavy duty wired alarm magnetic contracts switch sensor NC with adjustable bracket. Basis of Design: Seco-Larm SM-226L-3Q.

2.3 STEEL DOOR SECTIONS

- A. Exterior Section Faces and Frames: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet.
 - 1. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weather-resistant 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 welded to door section. Provide intermediate stiles formed from 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.
- E. Provide reinforcement for hardware attachment.
- F. Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free insulation, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84. Enclose insulation completely within steel sections and the interior facing material, with no exposed insulation.

2.4 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 indicated on Drawings, Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides for required door type, size, weight, and loading.
 - 1. Track Reinforcement and Supports: Galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.
- B. 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.

2.5 HARDWARE

- A. General: 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 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.
- C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted

with varying projections to suit slope of track. 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: Equip each push-up operated or emergency-operated door with galvanized-steel lifting handles on each side of door, finished to match door.

2.6 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.

2.7 COUNTERBALANCE MECHANISM

- A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A229/A229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.
- B. Cable Drums and Shaft for Doors: Cast-aluminum or gray-iron casting cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.
- C. Cables: Galvanized-steel, multistrand, lifting cables.
- D. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.
- E. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
- F. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

2.8 MANUAL DOOR OPERATORS

- A. General: Equip door with manual door operator by door manufacturer.
- B. Push-up Operation: Lift handles and pull rope for raising and lowering doors, with counterbalance mechanism designed so that required lift or pull for door operation does not exceed 25 lbf.

PART 3 EXECUTION

3.1 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

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as specified.

- B. Tracks: Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
- C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
- D. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- E. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A780/A780M.

3.2 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION

SECTION 083850
ACOUSTICAL METAL DOORS

PART 1 GENERAL

1.1 SUMMARY

- A. This section includes swinging steel sound control door and frame systems where shown on the drawings, as specified herein, and as needed for complete and proper installation.

1.2 QUALITY ASSURANCE

- A. Provide laboratory test reports from an independent laboratory in accordance with ASTM E90 and ASTM 413. The laboratory referenced in the test report and/or certification must be qualified under the National Voluntary Laboratory Accreditation Program (NVLAP) of the National Institute for Science and Technology (NIST).
- B. Provide a minimum of five field test done by five separate independent testing agencies to substantiate acoustical performance when installed at no less than four (4) FSTC ratings below the specified STC. The test certification must be in accordance with ASTM E336 and ASTM 413, with calculations showing adjustments made for ambient noise and flanking.
- C. Provide labeled doors and frames for those openings requiring fire protection ratings where scheduled by the Architect. Such doors and frames shall be constructed as tested in accordance with ASTM E152 (UL-10B) and approved by Underwriters' Laboratories.

1.3 CLOSEOUT SUBMITTALS

- A. All hollow metal work shall be warranted from defects in workmanship and quality for a period of two (2) years from shipment.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design: Acoustical Door as manufactured by Wenger Corporation.
 - 1. Size: 3'-0".
 - 2. STC Rating: min. 50.

2.2 DOOR SYSTEMS

- A. Provide acoustical assemblies complete with door frame, anchors, continuous cam-lift hinge, sound seals, retainers and covers, continuous magnetic seals, Teflon covered sweeps, door bottom, and cutouts and reinforcements for other hardware items as listed or required.

- B. Where indicated on the drawings or otherwise required, provide a factory-installed laminated safety glass assembly in dimensions meeting the specified STC rating.
- C. Fabricate the work of this Section in strict accordance with the Approved Shop Drawings.

2.3 DOORS

- A. Materials:
 - 1. Doors shall be constructed of 12- and 14-gauge minimum thickness commercial quality, level, cold rolled steel conforming to ASTM A 366 and free of scale, pitting or surface defects.
 - 2. Exterior door face sheets and frames shall have a zinc coating applied by the hot dip process conforming to ASTM A 526 (G90) with a coating weight of not less than 1.25 ounces per square foot on both sides.
- B. Construction:
 - 1. All doors shall be of the types and sizes shown on Approved Shop Drawings and shall be of welded seamless construction with no visible seams or joints on faces or vertical edges. All welds shall be ground, filled and dressed smoothly to make them invisible and provide a smooth flush surface.
 - 2. Top and bottom edges of all doors shall have an inverted continuous recessed steel 16-gauge channel, extending the full width of the door and spot welded to both face sheets. An additional flush closing channel shall be installed.
- C. Hardware:
 - 1. Doors shall be mortised, reinforced, drilled, and tapped at the factory for fully templated hardware only, in accordance with the Approved Hardware Schedule and templates provided by the hardware contractor. Where surface-mounted hardware is to be applied, doors shall have reinforcing plates only, all drilling and tapping shall be done by others. Refer to Section 087100.
 - 2. Door Hardware: Provide manufacturer's standard acoustical seals, threshold, and hinges required to achieve sound control performance requirements specified.
 - 3. Door Bottoms: Fixed in place foam and fiberglass-backed, teflon-coated sweep seal, field-adjustable, providing sound control seal without mechanical drop operation.

2.4 FRAMES

- A. Materials:
 - 1. Frames shall be constructed of 14-gauge minimum thickness commercial quality, level, cold rolled, steel conforming to ASTM A 366 and free of scale, pitting or surface defects.
 - 2. Exterior door face sheets and frames shall have a zinc coating applied by the hot dip process conforming to ASTM A526 (G90) with a coating weight of not less than 1.25 ounces per square foot on both sides.
- B. Construction:
 - 1. Frames shall be welded units with integral trim, of the sizes and shapes shown on Approved Shop Drawings. Knock-down frames will not be accepted. If field splices are required because of shipping limitations, such splices should be field welded after installation.
 - 2. Corner joints shall have all contact edges closed tight, with trim faces mitered and continuously welded. The use of gussets will not be permitted.

- C. Jamb anchors:
 - 1. Frames for installation in stud partitions shall be provided with steel continuous channel that surrounds the stud and allows drywall penetration into the throat of the frame, not less than 16-gauge thickness, securely welded inside each jamb.
 - 2. Frames to be anchored to previously placed concrete, masonry shall be provided with anchors of suitable design as shown on Approved Shop Drawings. Fasteners for such anchors shall be provided by others.
 - 3. Dust cover boxes (or mortar guards) of not thinner than 22-gauge steel shall be provided at all hardware mortises on frames to be set in masonry or plaster partitions.
 - 4. All frames shall be provided with a temporary steel spreader attached to the feet of both jambs to serve as a brace during shipping and handling. The steel spreader is not to be used for installation purposes.

2.5 SILL CONDITION

- A. Where indicated on the drawings, furnish a smooth flush stainless steel threshold for the door bottom to seal against when the door is in the closed position. The minimum width of the threshold shall be door thickness plus 4" to allow the threshold to extend a minimum of 1-1/2" beyond the face of the door on both sides of opening. For openings where carpet extends through opening, the threshold height shall be 1/16" greater in height than the carpet thickness.

2.6 FINISH

- A. Finish: All tool marks and surface imperfections shall be removed and exposed faces of all welded joints shall be dressed smoothly. Assemblies shall be treated and shall be coated on all accessible surfaces with a rust-inhibitive primer which meets ASTM B117 salt spray for 150 hours, and ASTM D1735 water fog test for organic coatings for 200 hours, and which is fully cured prior to shipment.
- B. Standard powder painted gray primer.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Check all frames prior to installation for size, swing, squareness, alignment, twist and plumbness. Permissible installation tolerances shall not exceed the HMMA standards.
- B. Solidly grout-fill frames where indicated on the drawings or the approved submittals, eliminating all voids. The flanking path normally found behind the frame must be packed or grout filled to assure minimum sound transmission.
- C. Proper door clearances must be maintained in accordance with HMMA standards.
- D. Hardware shall be applied in accordance with hardware manufacturer's templates and instructions.
- E. Gasket retainers, retainer covers and gaskets shall be installed and adjusted in accordance with manufacturer's instructions.

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- F. Pay such costs as required and secure a visit to the jobsite by a qualified representative of the manufacturer of the sound control door systems, who shall:
 - 1. Inspect this completed installation.
 - 2. Put all components of the work of this Section through at least ten complete cycles of operations, verifying that each component is properly installed and properly operating and making required adjustments to achieve optimum operation.
 - 3. The door supplier will pay at his expense the independent testing of the acoustical assemblies. Assemblies will be selected at random by the owner and tested under his supervision in accordance with ASTM E336.
 - 4. State in a certified test report to the Architect that the work of this Section has been installed in complete accordance with the Approved Shop Drawings and meets the FSTC ratings as called for.

3.2 MAINTENANCE

- A. Instruct the Owner's Maintenance Personnel regarding the proper operation and maintenance of these doors.

END OF SECTION

SECTION 087100
DOOR HARDWARE

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Mechanical and electrified door hardware.
 - 2. Electronic access control system components.

- B. Section excludes:
 - 1. Windows.
 - 2. Cabinets (casework), including locks in cabinets.
 - 3. Signage.
 - 4. Toilet accessories.
 - 5. Overhead doors.

- C. Related Sections:
 - 1. Division 01 "General Requirements" sections for Allowances, Alternates, Owner Furnished Contractor Installed, Project Management and Coordination.
 - 2. Division 06 Section "Rough Carpentry".
 - 3. Division 06 Section "Finish Carpentry".
 - 4. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
 - 5. Division 08 Sections:
 - a. "Metal Doors and Frames"
 - b. "Flush Wood Doors"
 - c. "Stile and Rail Wood Doors"
 - d. "Interior Aluminum Doors and Frames"
 - e. "Aluminum-Framed Entrances and Storefronts"
 - f. "Stainless Steel Doors and Frames"
 - g. "Special Function Doors"
 - h. "Entrances"
 - 6. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
 - 7. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

1.2 REFERENCES

- A. UL LLC.
 - 1. UL 10B - Fire Test of Door Assemblies.
 - 2. UL 10C - Positive Pressure Test of Fire Door Assemblies.
 - 3. UL 1784 - Air Leakage Tests of Door Assemblies.
 - 4. UL 305 - Panic Hardware.

- B. DHI - Door and Hardware Institute.

1. Sequence and Format for the Hardware Schedule.
 2. Recommended Locations for Builders Hardware.
 3. Keying Systems and Nomenclature.
 4. Installation Guide for Doors and Hardware.
- C. NFPA - National Fire Protection Association.
1. NFPA 70 - National Electric Code.
 2. NFPA 80 - 2016 Edition - Standard for Fire Doors and Other Opening Protectives.
 3. NFPA 101 - Life Safety Code.
 4. NFPA 105 - Smoke and Draft Control Door Assemblies.
 5. NFPA 252 - Fire Tests of Door Assemblies.
- D. ANSI - American National Standards Institute.
1. ANSI A117.1 - 2017 Edition - Accessible and Usable Buildings and Facilities.
 2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties.
 3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems.
 4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors.
 5. ANSI/SDI A250.8 - Standard Steel Doors and Frames.

1.3 SUBMITTALS

- A. General:
1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
 2. Prior to forwarding submittal:
 - a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
 - b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
- B. Action Submittals:
1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
 2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
 - a. Wiring Diagrams: For power, signal, and control wiring and including:
 - 1) Details of interface of electrified door hardware and building safety and security systems.
 - 2) Schematic diagram of systems that interface with electrified door hardware.
 - 3) Point-to-point wiring.
 - 4) Risers.
 3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
 4. Door Hardware Schedule:
 - a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction

- schedule.
 - b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
 - c. Indicate complete designations of each item required for each opening, include:
 - 1) Door Index: door number, heading number, and Architect's hardware set number.
 - 2) Quantity, type, style, function, size, and finish of each hardware item.
 - 3) Name and manufacturer of each item.
 - 4) Fastenings and other pertinent information.
 - 5) Location of each hardware set cross-referenced to indications on Drawings.
 - 6) Explanation of all abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for hardware.
 - 8) Door and frame sizes and materials.
 - 9) Degree of door swing and handing.
 - 10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.
5. Key Schedule:
- a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
 - b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
 - c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
 - d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
 - e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
 - f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.
- C. Informational Submittals:
- 1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
 - 2. Provide Product Data:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
 - b. Include warranties for specified door hardware.
- D. Closeout Submittals:
- 1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Final approved hardware schedule edited to reflect conditions as installed.
 - d. Final keying schedule.
 - e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
 - f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

- E. Inspection and Testing:
 - 1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
 - a. Fire door assemblies, in compliance with NFPA 80.
 - b. Required egress door assemblies, in compliance with NFPA 101.

1.4 CLOSEOUT SUBMITTALS

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.
 - 1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
 - 2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
 - a. Mechanical Warranty.
 - 1) Locks.
 - a) Schlage L Series: 10 years.
 - 2) Exit Devices.
 - a) Von Duprin: 10 years.
 - 3) Closers.
 - a) LCN 4000 Series: 30 years.
 - b. Electrical Warranty.
 - 1) Miscellaneous Electrical Components: 1 year.

1.5 QUALITY ASSURANCE

- A. Qualifications and Responsibilities:
 - 1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
 - 2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
 - 3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
 - a. For door hardware: DHI certified AHC or DHC.
 - b. Can provide installation and technical data to Architect and other related subcontractors.
 - c. Can inspect and verify components are in working order upon completion of installation.
 - d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.
 - 4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
- B. Certifications:
 - 1. Fire-Rated Door Openings:

- a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
 - b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
 2. Smoke and Draft Control Door Assemblies:
 - a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. at tested pressure differential of 0.3-inch wg of water.
 3. Electrified Door Hardware.
 - a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
 4. Accessibility Requirements:
 - a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.
- C. Pre-Installation Meetings.
1. Keying Conference.
 - a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - 1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2) Preliminary key system schematic diagram.
 - 3) Requirements for key control system.
 - 4) Requirements for access control.
 - 5) Address for delivery of keys.
 2. Pre-installation Conference.
 - a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Inspect and discuss preparatory work performed by other trades.
 - c. Inspect and discuss electrical roughing-in for electrified door hardware.
 - d. Review sequence of operation for each type of electrified door hardware.
 - e. Review required testing, inspecting, and certifying procedures.
 - f. Review questions or concerns related to proper installation and adjustment of door hardware.
 3. Electrified Hardware Coordination Conference:
 - a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.

- C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
- D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.7 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.8 MAINTENANCE

- A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.
- B. Turn over unused materials to Owner for maintenance purposes.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."
 - 1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.
- B. Approval of alternate manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category are only to be considered by official substitution request in accordance with section 012500.

- C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.2 MATERIALS

- A. Fabrication.
 - 1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer's recognized installation standards for application intended.
 - 2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
 - 3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with "Metal Doors and Frames", "Flush Wood Doors", "Stile and Rail Wood Doors" to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.
- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
 - 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.
- C. Cable and Connectors:
 - 1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
 - 2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
 - 3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.3 HINGES

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. Ives 5BB series.
 - 2. Acceptable Manufacturers and Products:
 - a. Hager BB1191/1279 series.
 - b. McKinney TB series.
 - c. Best FBB series.
- B. Requirements:
 - 1. Provide hinges conforming to ANSI/BHMA A156.1.
 - 2. Provide five knuckle, ball bearing hinges.
 - 3. 1-3/4-inch-thick doors, up to and including 36 inches wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches high.
 - b. Interior: Standard weight, steel, 4-1/2 inches high.

4. 1-3/4-inch-thick doors over 36 inches wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches high.
 - b. Interior: Heavy weight, steel, 5 inches high.
5. 2 inches or thicker doors:
 - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches high.
 - b. Interior: Heavy weight, steel, 5 inches high.
6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches or less in height, and one additional hinge for each 30 inches of additional door height.
8. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins.
 - b. Non-Ferrous Hinges: Stainless steel pins.
 - c. Out-Swinging Exterior Doors: Non-removable pins.
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins.
 - e. Interior Non-lockable Doors: Non-rising pins.
9. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.4 MORTISE LOCKS

- A. Manufacturers and Products:
 1. Scheduled Manufacturer and Product:
 - a. Schlage L9000 series.
 2. Acceptable Manufacturers and Products:
 - a. Sargent 8200 series.
- B. Requirements:
 1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
 2. Indicators: Where specified, provide indicator window measuring a minimum 2-3/5-inch x 3/5 inch with 180-degree visibility. Provide messages color-coded using ANSI Z535 Safety Red with full text and/or symbols, as scheduled, for easy visibility. When applicable allows for lock status indication on both sides of the door.
 3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
 4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
 5. Provide locks with standard 2-3/4 inches backset with full 3/4 inch throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch throw, constructed of stainless steel.
 6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches.
 7. Provide motor based electrified locksets that comply with the following requirements:
 - a. Universal input voltage - single chassis accepts 12 or 24VDC to allow for changes in the field without changing lock chassis.
 - b. Fail Safe/Fail Secure - changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case.
 - c. Low maximum current draw - maximum 0.4 amps to allow for multiple locks on a single power supply.
 - d. Low holding current - maximum 0.01 amps to produce minimal heat, eliminate "hot

- levers” in electrically locked applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.
- e. Connections - provide quick-connect Molex system standard.
- 8. (KEY OVERRIDE OPTION WHEN XL13-439 IS SPECIFIED IN HARDWARE SETS)
Provide locks with a key override feature built into the chassis that allows the outside key to retract the deadbolt and/or latchbolt, overriding the inside thumbturn when it is being held in the locked position.
- 9. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
 - a. Vandlgard: Provide levers with vandal resistant technology for use at heavy traffic or abusive applications.
 - b. Lever Design: To match existing-Contractor Confirm.

2.5 CYLINDRICAL LOCKS - GRADE 1

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. Schlage ND series.
 - 2. Acceptable Manufacturers and Products:
 - a. Sargent 11-Line.
- B. Requirements:
 - 1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3-hour fire doors.
 - 2. Indicators: Where specified, provide escutcheon with lock status indicator window on top of lockset rose:
 - a. Escutcheon height (including rose) 6.05 inches high by 3.68 inches wide.
 - b. Indicator window measuring a minimum 3.52-inch by .60 inch with 1.92 square-inches of front facing viewing area and 180-degree visibility with a total of .236 square-inches of total viewable area.
 - c. Provide snap-in serviceable window to prevent tampering. Lock must function if indicator is compromised.
 - d. Provide messages color-coded with full text and symbols, as scheduled, for easy visibility.
 - e. Unlocked and Unoccupied message will display on white background, and Locked and Occupied message will display on red background.
 - 3. Cylinders: Refer to “KEYING” article, herein.
 - 4. Provide locks with standard 2-3/4 inches backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
 - 5. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
 - 6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
 - 7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
 - 8. Provide electrified options as scheduled in the hardware sets.
 - 9. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
 - a. Lever Design: Match existing - Contractor to verify.

2.6 EXIT DEVICES

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. Von Duprin 99/33A series.
 - 2. Acceptable Manufacturers and Products:
 - a. Sargent 19-43-GL-PE80 series.

- B. Requirements:
 - 1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
 - 2. Cylinders: Refer to "KEYING" article, herein.
 - 3. Provide grooved touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
 - 4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
 - 5. Provide exit devices with dead latching feature for security and for future addition of alarm kits and/or other electrified requirements.
 - 6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
 - 7. Provide flush end caps for exit devices.
 - 8. Provide exit devices with manufacturer's approved strikes.
 - 9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
 - 10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
 - 11. Provide cylinder or hex-key dogging as specified at non-fire-rated openings.
 - 12. Removable Mullions: 2 inches x 3 inches steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
 - 13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
 - 14. Provide electrified options as scheduled.
 - 15. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
 - 16. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.
 - 17. Lever design - Match existing, Contractor to verify.

2.7 ELECTRIC STRIKES

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. Von Duprin 6000 Series.
 - 2. Acceptable Manufacturers and Products:
 - a. Folger Adam 300 Series.
 - b. HES 1006 Series.

- B. Requirements:
 - 1. Provide electric strikes designed for use with type of locks shown at each opening.
 - 2. Provide electric strikes UL Listed as burglary resistant that are tested to a minimum endurance test of 1,000,000 cycles.

3. Where required, provide electric strikes UL Listed for fire doors and frames.
4. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

2.8 PASSIVE INFRARED MOTION SENSORS

- A. Manufacturers and Products:
 1. Scheduled Manufacturer and Product:
 - a. Schlage SCAN II Series.
 2. Acceptable Manufacturers and Products:
 - a. RCI 915 Series.
 - b. Securitron XMS Series.
 - c. Security Door Controls MD-31D Series.
- B. Requirements:
 1. Provide motion sensors as specified in hardware groups.

2.9 POWER SUPPLIES

- A. Manufacturers and Products:
 1. Scheduled Manufacturer and Product:
 - a. Schlage/Von Duprin PS900 Series.
 2. Acceptable Manufacturers and Products:
 - a. Dynalock 5000 series.
 - b. Securitron BPS series.
 - c. Security Door Controls 600 series.
- B. Requirements:
 1. Provide power supplies approved by manufacturer of supplied electrified hardware.
 2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
 3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
 4. Provide power supplies with the following features:
 - a. 12/24 VDC Output, field selectable.
 - b. Class 2 Rated power limited output.
 - c. Universal 120-240 VAC input.
 - d. Low voltage DC regulated and filtered.
 - e. Polarized connector for distribution boards.
 - f. Fused primary input.
 - g. AC input and DC output monitoring circuit w/LED indicators.
 - h. Cover mounted AC Input indication.
 - i. Tested and certified to meet UL294.
 - j. NEMA 1 enclosure.
 - k. Hinged cover w/lock down screws.
 - l. High voltage protective cover.

2.10 CYLINDERS

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. Schlage Everest 29 S.
 - 2. Acceptable Manufacturers and Products:
 - a. Sargent DG1.
- B. Requirements:
 - 1. Provide cylinders/cores compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset; manufacturer's series as indicated. Refer to "KEYING" article, herein.
 - 2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
 - a. Patented Open: cylinder with interchangeable core with open keyway.
 - 3. Patent Protection: Cylinders/cores requiring use of restricted, patented keys, patent protected.
 - 4. Nickel silver bottom pins.

2.11 KEYING

- A. Scheduled System:
 - 1. New factory registered system:
 - a. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
- B. Requirements:
 - 1. Construction Keying:
 - a. Replaceable Construction Cores.
 - 1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - a) 3 construction control keys.
 - b) 12 construction change (day) keys.
 - 2) Owner or Owner's Representative will replace temporary construction cores with permanent cores.
 - 2. Permanent Keying:
 - a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
 - 1) Master Keying system as directed by the Owner.
 - b. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
 - c. Provide keys with the following features:
 - 1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm).
 - 2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
 - d. Identification:
 - 1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
 - 2) Identification stamping provisions must be approved by the Architect and Owner.
 - 3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to

- enforce the patent protection.
- 4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
- 5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
- e. Quantity: Furnish in the following quantities.
 - 1) Permanent Control Keys: 3.
 - 2) Master Keys: 6.
 - 3) Change (Day) Keys: 3 per cylinder/core that is keyed differently.
 - 4) Key Blanks: Quantity as determined in the keying meeting.

2.12 KEY CONTROL SYSTEM

- A. Manufacturers:
 - 1. Scheduled Manufacturer:
 - a. Telkee.
 - 2. Acceptable Manufacturers:
 - a. No Substitute.
 - b. HPC.
 - c. Lund.
- B. Requirements:
 - 1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
 - a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
 - b. Provide hinged-panel type cabinet for wall mounting.

2.13 DOOR CLOSERS

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. LCN 4040XP series.
 - 2. Acceptable Manufacturers and Products:
 - a. Sargent 281 series.
- B. Requirements:
 - 1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
 - 2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
 - 3. Cylinder Body: 1-1/2-inch diameter piston with 5/8-inch diameter double heat-treated pinion journal. QR code with a direct link to maintenance instructions.
 - 4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120°F to -30°F.
 - 5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards. Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.
 - 6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for

latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. Provide positive stop on reg valve that prevents reg screw from being backed out.

7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117 or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.
11. Closers shall be capable of being upgraded by adding modular mechanical or electronic components in the field.

2.14 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives.
2. Acceptable Manufacturers:
 - a. Burns.
 - b. Trimco.
 - c. Rockwood.

B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.15 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives.
2. Acceptable Manufacturers:
 - a. Burns.
 - b. Trimco.
 - c. Rockwood.

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Size plates 2 inches less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.16 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

- A. Manufacturers:
 - 1. Scheduled Manufacturers:
 - a. Glynn-Johnson.
 - 2. Acceptable Manufacturers:
 - a. Rixson.
 - b. ABH.
- B. Requirements:
 - 1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.

2.17 DOORSTOPS AND HOLDERS

- A. Manufacturers:
 - 1. Scheduled Manufacturer:
 - a. Ives.
 - 2. Acceptable Manufacturers:
 - a. Burns.
 - b. Trimco.
 - c. Rockwood.
- B. Provide door stops at each door leaf:
 - 1. Provide wall stops wherever possible. Provide concave type where lockset has a push button or thumbturn.
 - 2. Where a wall stop cannot be used, provide universal floor stops.
 - 3. Where wall or floor stop cannot be used, provide overhead stop.
 - 4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.18 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

- A. Manufacturers:
 - 1. Scheduled Manufacturer:
 - a. Zero International.
 - 2. Acceptable Manufacturers:
 - a. National Guard.
 - b. Reese.
 - c. Pemko.
- B. Requirements:
 - 1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
 - 2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - 3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
 - 4. Size thresholds 1/2 inch high by 5 inches wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.19 SILENCERS

- A. Manufacturers:
 - 1. Scheduled Manufacturer:
 - a. Ives.
 - 2. Acceptable Manufacturers:
 - a. Burns.
 - b. Rockwood.
 - c. Trimco.

- B. Requirements:
 - 1. Provide "push-in" type silencers for hollow metal or wood frames.
 - 2. Provide one silencer per 30 inches of height on each single frame, and two for each pair frame.
 - 3. Omit where gasketing is specified.

2.20 DOOR POSITION SWITCHES

- A. Manufacturers:
 - 1. Scheduled Manufacturer:
 - a. Schlage.
 - 2. Acceptable Manufacturers:
 - a. GE-Interlogix.
 - b. Sargent.

- B. Requirements:
 - 1. Provide recessed or surface mounted type door position switches as specified.
 - 2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used with magnetic locking device, provide minimum of 4 inches between switch and magnetic locking device.

2.21 FINISHES

- A. FINISH: BHMA 626/652 (US26D):
 - 1. Hinges at Exterior Doors: BHMA 630 (US32D).
 - 2. Aluminum Geared Continuous Hinges: BHMA 628 (US28).
 - 3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D).
 - 4. Protection Plates: BHMA 630 (US32D).
 - 5. Overhead Stops and Holders: BHMA 630 (US32D).
 - 6. Door Closers: Powder Coat to Match.
 - 7. Wall Stops: BHMA 630 (US32D).
 - 8. Latch Protectors: BHMA 630 (US32D).
 - 9. Weatherstripping: Clear Anodized Aluminum.
 - 10. Thresholds: Mill Finish Aluminum.

- B. FINISH: BHMA 625/651 (US26):
 - 1. Hinges at Exterior Doors: BHMA 629 (US32).
 - 2. Push Plates, Pulls, and Push Bars: BHMA 629 (US32).
 - 3. Protection Plates: BHMA 629 (US32).
 - 4. Overhead Stops and Holders: BHMA 629 (US32).
 - 5. Door Closers: US26.
 - 6. Wall Stops: BHMA 629 (US32).

PART 3 EXECUTION

3.1 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A.
 - 4. Installation Guide for Doors and Hardware: DHI TDH-007-20.
- B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.
- C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.
- I. Lock Cylinders:
 - 1. Install construction cores to secure building and areas during construction period.
 - 2. Replace construction cores with permanent cores as indicated in keying section.
 - 3. Furnish permanent cores to Owner for installation.

- J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:
 - 1. Conduit, junction boxes and wire pulls.
 - 2. Connections to and from power supplies to electrified hardware.
 - 3. Connections to fire/smoke alarm system and smoke evacuation system.
 - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
 - 5. Connections to panel interface modules, controllers, and gateways.
 - 6. Testing and labeling wires with Architect's opening number.
- K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- L. Continuous Hinges: Re-locate the door and frame fire rating labels where they will remain visible so that the hinge does not cover the label once installed.
- M. Door Closers & Auto Operators: Mount closers/operators on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers/operators so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
- N. Overhead Stops/Holders: Mount overhead stops/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- O. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
- P. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- Q. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- R. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- S. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- T. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.3 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.
 - 1. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
 - 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - 3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.4 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items per manufacturer's instructions to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.5 DOOR HARDWARE SCHEDULE

- A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.
- B. Discrepancies, conflicting hardware, and missing items are to 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.
- C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.
- D. Hardware Manufacturers:
 - 1. Glynn-Johnson Corp - GLY.
 - 2. H.B. Ives - IVE.
 - 3. LCN Commercial Division - LCN.
 - 4. Pemko Mfg Co - PEM.
 - 5. Schlage Electronic Security - SCE.
 - 6. Schlage Lock Company - SCH.
 - 7. Von Duprin - VON.
 - 8. Zero International Inc - ZER.

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E. Hardware Sets:

Legend:					
~Electrified Opening					
Hardware Group No. 010.0					
For use on Door #(s): O105					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	625	IVE
1	EA	EXIT HARDWARE - CLASSROOM	99-L-17	US26	VON
1	EA	FSIC RIM CYL W/ CONST CORE	TYPE AS REQ'D	625	SCH
1	EA	FSIC CORE - PERMANENT CORE	TYPE AS REQ'D	626	SCH
1	EA	OH STOP	90S	US32	GLY
1	EA	SURFACE CLOSER	4040XP REG MC	US26	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	629	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 011.0					
For use on Door #(s): F101					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	EXIT HARDWARE - CLASSROOM	99-L-17	US26D	VON
1	EA	FSIC RIM CYL W/ CONST CORE	TYPE AS REQ'D	626	SCH
1	EA	FSIC CORE - PERMANENT CORE	TYPE AS REQ'D	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	US26D	IVE
3	EA	SILENCER	SR64	GRY	IVE

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Hardware Group No. 012.0					
For use on Door #(s): O116					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	625	IVE
1	EA	EXIT HARDWARE - CLASSROOM	99-L-17	US26	VON
1	EA	FSIC RIM CYL W/ CONST CORE	TYPE AS REQ'D	625	SCH
1	EA	FSIC CORE - PERMANENT CORE	TYPE AS REQ'D	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA MC	US26	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	629	IVE
1	EA	WALL STOP	WS406/407CVX	US26	IVE
3	EA	SILENCER	SR64	GRY	IVE

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Hardware Group No. 020.0					
For use on Door #(s): O111A O111B					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	625	IVE
1	EA	STOREROOM LOCK	ND80P6D SPA	625	SCH
1	EA	FSIC CORE - PERMANENT CORE	TYPE AS REQ'D	626	SCH
1	EA	ELECTRIC STRIKE	6400 FSE 12/24 VAC/VDC	US32D~	VON
1	EA	SURFACE CLOSER	4040XP REG MC	US26	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	629	IVE
1	EA	WALL STOP	WS406/407CVX	US26	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	WIRE HARNESS (FRAME) ELECTRIC STRIKE TO POWER/CONTROLLER	CON-192P		SCH
1	EA	DOOR POSITION SWITCH	67-05	BLK~	SCE
1	EA	RX SWITCH - MOTION SENSOR	SCANII 12/24 VDC	BLK~	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC	~	VON
1	EA	SET OF WIRING DIAGRAMS			
DOORS NORMALLY CLOSED, LATCHED AND SECURE. FREE EGRESS AT ALL TIMES. ENTRY BY CARD READER RELEASES ELECTRIC STRIKE ALLOWING DOOR TO BE PULLED OPEN. ENTRY BY KEY OVERRIDE. CARDER READER AND ELECTRICAL WIRING BY SECURITY CONTRACTOR.					

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Hardware Group No. 021.0					
For use on Door #(s): F103 F118					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D SPA	626	SCH
1	EA	FSIC CORE - PERMANENT CORE	TYPE AS REQ'D	626	SCH
1	EA	ELECTRIC STRIKE	6400 FSE 12/24 VAC/VDC	US32D~	VON
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP REG	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	WIRE HARNESS (FRAME) ELECTRIC STRIKE TO POWER/CONTROLLER	CON-192P		SCH
1	EA	DOOR POSITION SWITCH	67-05	BLK~	SCE
1	EA	RX SWITCH - MOTION SENSOR	SCANII 12/24 VDC	BLK~	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC	~	VON
1	EA	SET OF WIRING DIAGRAMS			
DOORS NORMALLY CLOSED, LATCHED AND SECURE. FREE EGRESS AT ALL TIMES. ENTRY BY CARD READER RELEASES ELECTRIC STRIKE ALLOWING DOOR TO BE PULLED OPEN. ENTRY BY KEY OVERRIDE. CARDER READER AND ELECTRICAL WIRING BY SECURITY CONTRACTOR.					

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Hardware Group No. 022.0					
For use on Door #(s): F104 F108 F110					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D SPA	626	SCH
1	EA	FSIC CORE - PERMANENT CORE	TYPE AS REQ'D	626	SCH
1	EA	ELECTRIC STRIKE	6400 FSE 12/24 VAC/VDC	US32D~	VON
1	EA	SURFACE CLOSER	4040XP REG	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	US26D	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	WIRE HARNESS (FRAME) ELECTRIC STRIKE TO POWER/CONTROLLER	CON-192P		SCH
1	EA	DOOR POSITION SWITCH	67-05	BLK~	SCE
1	EA	RX SWITCH - MOTION SENSOR	SCANII 12/24 VDC	BLK~	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC	~	VON
1	EA	SET OF WIRING DIAGRAMS			
DOORS NORMALLY CLOSED, LATCHED AND SECURE. FREE EGRESS AT ALL TIMES. ENTRY BY CARD READER RELEASES ELECTRIC STRIKE ALLOWING DOOR TO BE PULLED OPEN. ENTRY BY KEY OVERRIDE. CARDER READER AND ELECTRICAL WIRING BY SECURITY CONTRACTOR.					

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Hardware Group No. 023.0					
For use on Door #(s): O115A					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D SPA	626	SCH
1	EA	FSIC CORE - PERMANENT CORE	TYPE AS REQ'D	626	SCH
1	EA	ELECTRIC STRIKE	6400 FSE 12/24 VAC/VDC	US32D~	VON
1	EA	SURFACE CLOSER	4040XP REG	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	US26D	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	WIRE HARNESS (FRAME) ELECTRIC STRIKE TO POWER/CONTROLLER	CON-192P		SCH
1	EA	DOOR POSITION SWITCH	67-05	BLK~	SCE
1	EA	RX SWITCH - MOTION SENSOR	SCANII 12/24 VDC	BLK~	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC	~	VON
1	EA	SET OF WIRING DIAGRAMS			
DOORS NORMALLY CLOSED, LATCHED AND SECURE. FREE EGRESS AT ALL TIMES. ENTRY BY CARD READER RELEASES ELECTRIC STRIKE ALLOWING DOOR TO BE PULLED OPEN. ENTRY BY KEY OVERRIDE. CARDER READER AND ELECTRICAL WIRING BY SECURITY CONTRACTOR.					

Hardware Group No. 030.0					
For use on Door #(s): O115B F118A					
Provide each RU door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
	EA	ALL HARDWARE BY DOOR MFG/SUPPLIER			

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Hardware Group No. 040.0					
For use on Door #(s): O101					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	625	IVE
1	EA	EXIT HARDWARE - CLASSROOM	99-L-17	US26	VON
1	EA	FSIC RIM CYL W/ CONST CORE	TYPE AS REQ'D	625	SCH
1	EA	FSIC CORE - PERMANENT CORE	TYPE AS REQ'D	626	SCH
1	EA	ELECTRIC STRIKE - RIM	6300 FSE 12/24 VAC/VDC	630~	VON
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP RW/62A	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	WIRE HARNESS (FRAME) ELECTRIC STRIKE TO POWER/CONTROLLER	CON-192P		SCH
1	EA	DESK MOUNT BUTTON	660-PB	628~	SCE
1	EA	DOOR POSITION SWITCH	67-05	BLK~	SCE
1	EA	RX SWITCH - MOTION SENSOR	SCANII 12/24 VDC	BLK~	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC	~	VON
1	EA	SET OF WIRING DIAGRAMS			
DOOR NORMALLY CLOSED, LATCHED AND SECURE. FREE EGRESS AT ALL TIMES. ENTRY BY CARD READER OR DESK MOUNTED SWITCH RELEASES ELECTRIC STRIKE ALLOWING DOOR TO BE PULLED OPEN. ENTRY BY KEY OVERRIDE. CARD READER AND ELECTRICAL WIRING BY SECURITY CONTRACTOR.					

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Hardware Group No. 041.0					
For use on Door #(s): F106					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	EXIT HARDWARE - CLASSROOM	99-L-17	US26D	VON
1	EA	FSIC RIM CYL W/ CONST CORE	TYPE AS REQ'D	626	SCH
1	EA	FSIC CORE - PERMANENT CORE	TYPE AS REQ'D	626	SCH
1	EA	ELECTRIC STRIKE - RIM	6300 FSE 12/24 VAC/VDC	630~	VON
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP RW/62A	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	WIRE HARNESS (FRAME) ELECTRIC STRIKE TO POWER/CONTROLLER	CON-192P		SCH
1	EA	DOOR POSITION SWITCH	67-05	BLK~	SCE
1	EA	RX SWITCH - MOTION SENSOR	SCANII 12/24 VDC	BLK~	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC	~	VON
1	EA	SET OF WIRING DIAGRAMS			
DOOR NORMALLY CLOSED, LATCHED AND SECURE. FREE EGRESS AT ALL TIMES. ENTRY BY CARD READER OR DESK MOUNTED SWITCH RELEASES ELECTRIC STRIKE ALLOWING DOOR TO BE PULLED OPEN. ENTRY BY KEY OVERRIDE. CARD READER AND ELECTRICAL WIRING BY SECURITY CONTRACTOR.					

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Hardware Group No. 050.0					
For use on Door #(s): O109 O110					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	625	IVE
1	EA	STOREROOM LOCK	ND80P6D SPA	625	SCH
1	EA	FSIC CORE - PERMANENT CORE	TYPE AS REQ'D	626	SCH
1	EA	ELECTRIC STRIKE	6400 FSE 12/24 VAC/VDC	US32D~	VON
1	EA	SURFACE CLOSER	4040XP REG MC	US26	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	629	IVE
1	EA	WALL STOP	WS406/407CVX	US26	IVE
1	EA	WIRE HARNESS (FRAME) ELECTRIC STRIKE TO POWER/CONTROLLER	CON-192P		SCH
1	EA	DOOR POSITION SWITCH	67-05	BLK~	SCE
1	EA	RX SWITCH - MOTION SENSOR	SCANII 12/24 VDC	BLK~	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC	~	VON
1	EA	SET OF WIRING DIAGRAMS			
<p>STC DOOR AND FRAME ASSEMBLY. VERIFY USE OF ALL HARDWARE WITH DOOR AND FRAME MANUFACTURER TO MAINTAIN STC RATING. DOORS NORMALLY CLOSED, LATCHED AND SECURE. FREE EGRESS AT ALL TIMES. ENTRY BY CARD READER RELEASES ELECTRIC STRIKE ALLOWING DOOR TO BE PULLED OPEN. ENTRY BY KEY OVERRIDE. CARDER READER AND ELECTRICAL WIRING BY SECURITY CONTRACTOR</p>					

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Hardware Group No. 055.0					
For use on Door #(s): O108					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	625	IVE
1	EA	STOREROOM LOCK	ND80P6D SPA	625	SCH
1	EA	FSIC CORE - PERMANENT CORE	TYPE AS REQ'D	626	
1	EA	ELECTRIC STRIKE	6400 FSE 12/24 VAC/VDC	US32D~	
1	EA	SURFACE CLOSER	4040XP REG	689	
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	629	
1	EA	WALL STOP	WS406/407CVX	US26	
1	EA	GASKETING	119WB PSA	B	
1	EA	ADJUSTABLE GASKET	870AA-S	AA	
1	EA	AUTOMATIC DOOR BOTTOM	367AA	AA	
1	EA	ACOUSTIC THRESHOLD	564A	AL	
1	EA	WIRE HARNESS (FRAME) ELECTRIC STRIKE TO POWER/CONTROLLER	CON-192P		
1	EA	DOOR POSITION SWITCH	67-05	BLK~	
1	EA	RX SWITCH - MOTION SENSOR	SCANII 12/24 VDC	BLK~	
1	EA	POWER SUPPLY	PS902 120/240 VAC	~	
1	EA	SET OF WIRING DIAGRAMS			
DOORS NORMALLY CLOSED, LATCHED AND SECURE. FREE EGRESS AT ALL TIMES. ENTRY BY CARD READER RELEASES ELECTRIC STRIKE ALLOWING DOOR TO BE PULLED OPEN. ENTRY BY KEY OVERRIDE. CARDER READER AND ELECTRICAL WIRING BY SECURITY CONTRACTOR.					

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Hardware Group No. 060.0					
For use on Door #(s): O112					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D SPA	626	SCH
1	EA	FSIC CORE - PERMANENT CORE	TYPE AS REQ'D	626	SCH
1	EA	ELECTRIC STRIKE	6400 FSE 12/24 VAC/VDC	US32D~	VON
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	US26D	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	WIRE HARNESS (FRAME) ELECTRIC STRIKE TO POWER/CONTROLLER	CON-192P		SCH
1	EA	DOOR POSITION SWITCH	67-05	BLK~	SCE
1	EA	RX SWITCH - MOTION SENSOR	SCANII 12/24 VDC	BLK~	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC	~	VON
1	EA	SET OF WIRING DIAGRAMS			
<p>ALTERNATE #1 - SEE ABOVE BASE BID - EO112-NO WORK DOORS NORMALLY CLOSED, LATCHED AND SECURE. FREE EGRESS AT ALL TIMES. ENTRY BY CARD READER RELEASES ELECTRIC STRIKE ALLOWING DOOR TO BE PULLED OPEN. ENTRY BY KEY OVERRIDE. CARDER READER AND ELECTRICAL WIRING BY SECURITY CONTRACTOR.</p>					

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Hardware Group No. 070.0					
For use on Door #(s): O113					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D SPA	626	SCH
1	EA	FSIC CORE - PERMANENT CORE	TYPE AS REQ'D	626	SCH
1	EA	ELECTRIC STRIKE	6400 FSE 12/24 VAC/VDC	US32D~	VON
1	EA	SURFACE CLOSER	4040XP REG	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	US26D	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	WIRE HARNESS (FRAME) ELECTRIC STRIKE TO POWER/CONTROLLER	CON-192P		SCH
1	EA	DOOR POSITION SWITCH	67-05	BLK~	SCE
1	EA	RX SWITCH - MOTION SENSOR	SCANII 12/24 VDC	BLK~	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC	~	VON
1	EA	SET OF WIRING DIAGRAMS			
<p>ALTERNATE #1 - SEE ABOVE BASE BID - EO113-NO WORK DOORS NORMALLY CLOSED, LATCHED AND SECURE. FREE EGRESS AT ALL TIMES. ENTRY BY CARD READER RELEASES ELECTRIC STRIKE ALLOWING DOOR TO BE PULLED OPEN. ENTRY BY KEY OVERRIDE. CARDER READER AND ELECTRICAL WIRING BY SECURITY CONTRACTOR.</p>					

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Hardware Group No. 080.0					
For use on Door #(s): F102A F117					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50P6D SPA	626	SCH
1	EA	FSIC CORE - PERMANENT CORE	TYPE AS REQ'D	626	SCH
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP REG	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 081.0					
For use on Door #(s): F109					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50P6D SPA	626	SCH
1	EA	FSIC CORE - PERMANENT CORE	TYPE AS REQ'D	626	SCH
1	EA	SURFACE CLOSER	4040XP REG	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	US26D	IVE
3	EA	SILENCER	SR64	GRY	IVE

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Hardware Group No. 100.0					
For use on Door #(s): EO106					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	STOREROOM LOCK	ND80P6D SPA	625	SCH
1	EA	FSIC CORE - PERMANENT CORE	TYPE AS REQ'D	626	SCH
1	EA	ELECTRIC STRIKE	6400 FSE 12/24 VAC/VDC	US32D~	VON
1	EA	SURFACE CLOSER	4040XP EDA MC	US26	LCN
1	EA	WIRE HARNESS (FRAME) ELECTRIC STRIKE TO POWER/CONTROLLER	CON-192P		SCH
1	EA	DOOR POSITION SWITCH	67-05	BLK~	SCE
1	EA	RX SWITCH - MOTION SENSOR	SCANII 12/24 VDC	BLK~	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC	~	VON
1	EA	BALANCE OF HARDWARE EXISTING TO BE RE-USED			
1	EA	SET OF WIRING DIAGRAMS			
<p>VERIFY AND COORDINATE NEW HARDWARE WITH EXISTING DOOR AND FAME PREPS. DOOR NORMALLY CLOSED, LATCHED AND SECURE. FREE EGRESS AT ALL TIMES. ENTRY BY CARD READER RELEASES ELECTRIC STRIKE ALLOWING DOOR TO BE PULLED OPEN. ENTRY BY KEY OVERRIDE. CARD READER AND ELECTRICAL WIRING BY SECURITY CONTRACTOR.</p>					

Hardware Group No. 101.0					
For use on Door #(s): EO135					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	STOREROOM LOCK	ND80P6D SPA	625	SCH
1	EA	FSIC CORE - PERMANENT CORE	TYPE AS REQ'D	626	SCH
1	EA	ELECTRIC STRIKE	6400 FSE 12/24 VAC/VDC	US32D~	VON
1	EA	SURFACE CLOSER	4040XP REG MC	US26	LCN
1	EA	WIRE HARNESS (FRAME) ELECTRIC STRIKE TO POWER/CONTROLLER	CON-192P		SCH
1	EA	DOOR POSITION SWITCH	67-05	BLK~	SCE
1	EA	RX SWITCH - MOTION SENSOR	SCANII 12/24 VDC	BLK~	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC	~	VON
1	EA	BALANCE OF HARDWARE EXISTING TO BE RE-USED			
1	EA	SET OF WIRING DIAGRAMS			
<p>VERIFY AND COORDINATE NEW HARDWARE WITH EXISTING DOOR AND FAME PREPS. DOOR NORMALLY CLOSED, LATCHED AND SECURE. FREE EGRESS AT ALL TIMES. ENTRY BY CARD READER RELEASES ELECTRIC STRIKE ALLOWING DOOR TO BE PULLED OPEN. ENTRY BY KEY OVERRIDE. CARD READER AND ELECTRICAL WIRING BY SECURITY CONTRACTOR.</p>					

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Hardware Group No. 102.0					
For use on Door #(s): EO114B					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	STOREROOM LOCK	ND80P6D SPA	626	SCH
1	EA	FSIC CORE - PERMANENT CORE	TYPE AS REQ'D	626	SCH
1	EA	ELECTRIC STRIKE	6400 FSE 12/24 VAC/VDC	US32D~	VON
1	EA	CLOSER WITH STOP	4040XP SCUSH	689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30	689	LCN
1	EA	WIRE HARNESS (FRAME) ELECTRIC STRIKE TO POWER/CONTROLLER	CON-192P		SCH
1	EA	DOOR POSITION SWITCH	67-05	BLK~	SCE
1	EA	RX SWITCH - MOTION SENSOR	SCANII 12/24 VDC	BLK~	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC	~	VON
1	EA	BALANCE OF HARDWARE EXISTING TO BE RE-USED			
1	EA	SET OF WIRING DIAGRAMS			
<p>VERIFY AND COORDINATE NEW HARDWARE WITH EXISTING DOOR AND FAME PREPS. DOOR NORMALLY CLOSED, LATCHED AND SECURE. FREE EGRESS AT ALL TIMES. ENTRY BY CARD READER RELEASES ELECTRIC STRIKE ALLOWING DOOR TO BE PULLED OPEN. ENTRY BY KEY OVERRIDE. CARD READER AND ELECTRICAL WIRING BY SECURITY CONTRACTOR.</p>					

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Hardware Group No. 103.0					
For use on Door #(s): EO114C					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	STOREROOM LOCK	ND80P6D SPA	625	SCH
1	EA	FSIC CORE - PERMANENT CORE	TYPE AS REQ'D	626	SCH
1	EA	ELECTRIC STRIKE	6400 FSE 12/24 VAC/VDC	US32D~	VON
1	EA	CLOSER WITH STOP	4040XP SCUSH MC	US26	LCN
1	EA	WIRE HARNESS (FRAME) ELECTRIC STRIKE TO POWER/CONTROLLER	CON-192P		SCH
1	EA	DOOR POSITION SWITCH	67-05	BLK~	SCE
1	EA	RX SWITCH - MOTION SENSOR	SCANII 12/24 VDC	BLK~	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC	~	VON
1	EA	BALANCE OF HARDWARE EXISTING TO BE RE-USED			
1	EA	SET OF WIRING DIAGRAMS			
<p>VERIFY AND COORDINATE NEW HARDWARE WITH EXISTING DOOR AND FAME PREPS. DOOR NORMALLY CLOSED, LATCHED AND SECURE. FREE EGRESS AT ALL TIMES. ENTRY BY CARD READER RELEASES ELECTRIC STRIKE ALLOWING DOOR TO BE PULLED OPEN. ENTRY BY KEY OVERRIDE. CARD READER AND ELECTRICAL WIRING BY SECURITY CONTRACTOR.</p>					

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Hardware Group No. 110.0					
For use on Door #(s): EO112, EF107C, EF107E, EF107F, EO133, EO111, EO114D, EO114E					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	ELECTRIC STRIKE - RIM	6300 FSE 12/24 VAC/VDC	630~	VON
1	EA	WIRE HARNESS (FRAME) ELECTRIC STRIKE TO POWER/CONTROLLER	CON-192P		SCH
1	EA	DOOR POSITION SWITCH	67-05	BLK~	SCE
1	EA	RX SWITCH - MOTION SENSOR	SCANII 12/24 VDC	BLK~	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC	~	VON
1	EA	BALANCE OF HARDWARE EXISTING TO BE RE-USED			
1	EA	SET OF WIRING DIAGRAMS			
<p>VERIFY AND COORDINATE NEW HARDWARE WITH EXISTING DOOR AND FAME PREPS. DOOR NORMALLY CLOSED, LATCHED AND SECURE. FREE EGRESS AT ALL TIMES. ENTRY BY CARD READER RELEASES ELECTRIC STRIKE ALLOWING DOOR TO BE PULLED OPEN. CARD READER AND ELECTRICAL WIRING BY SECURITY CONTRACTOR.</p>					

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Hardware Group No. 111.0					
For use on Door #(s): EF101 EF105E EF105C EF107D					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	ELECTRIC STRIKE - RIM	6300 FSE 12/24 VAC/VDC	630~	VON
1	EA	WIRE HARNESS (FRAME) ELECTRIC STRIKE TO POWER/CONTROLLER	CON-192P		SCH
1	EA	DESK MOUNT BUTTON	660-PB	628~	SCE
1	EA	DOOR POSITION SWITCH	67-05	BLK~	SCE
1	EA	RX SWITCH - MOTION SENSOR	SCANII 12/24 VDC	BLK~	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC	~	VON
1	EA	BALANCE OF HARDWARE EXISTING TO BE RE-USED			
1	EA	SET OF WIRING DIAGRAMS			
<p>VERIFY AND COORDINATE NEW HARDWARE WITH EXISTING DOOR AND FRAME PREPS. BUZZED ENTRY, VOICE/VIDEO (EF101, EF105E, E107D). DOOR NORMALLY CLOSED, LATCHED AND SECURE. FREE EGRESS AT ALL TIMES. ENTRY BY CARD READER OR REMOTE PUSH BUTTON RELEASES ELECTRIC STRIKE ALLOWING DOOR TO BE PULLED OPEN. CARD READER AND ELECTRICAL WIRING BY SECURITY CONTRACTOR.</p>					

Hardware Group No. 112.0					
For use on Door #(s): EF105A EF105B					
Provide each SGL door(s) with the following:					
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	EXIT HARDWARE	99-NL-OP-110MD	US26D	VON
1	EA	FSIC RIM CYL W/ CONST CORE	TYPE AS REQ'D	626	SCH
1	EA	FSIC CORE - PERMANENT CORE	TYPE AS REQ'D	626	SCH
1	EA	ELECTRIC STRIKE - RIM	6300 FSE 12/24 VAC/VDC	630~	VON
1	EA	90 DEG OFFSET PULL	8190EZHD 18" O	US32D-316	IVE
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP RW/62A	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	WEATHER STRIPPING	328AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A-223	A	ZER
1	EA	WIRE HARNESS (FRAME) ELECTRIC STRIKE TO POWER/CONTROLLER	CON-192P		SCH
1	EA	DOOR POSITION SWITCH	67-05	BLK~	SCE
1	EA	RX SWITCH - MOTION SENSOR	SCANII 12/24 VDC	BLK~	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC	~	VON
1	EA	SET OF WIRING DIAGRAMS			
<p>VERIFY AND COORDINATE NEW HARDWARE WITH EXISTING DOOR AND FAME PREPS. DOOR NORMALLY CLOSED, LATCHED AND SECURE. FREE EGRESS AT ALL TIMES. ENTRY BY CARD READER RELEASES ELECTRIC STRIKE ALLOWING DOOR TO BE PULLED OPEN. CARD READER AND ELECTRICAL WIRING BY SECURITY CONTRACTOR.</p>					

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Hardware Group No. 120.0				
For use on Door #(s): EO115 EF107A EF107B EF118				
Provide each SGL door(s) with the following:				
QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1 EA	PANIC HARDWARE - EXIT ONLY	99-EO	US26D	VON
2 EA	PUSH PLATE	8200 4" X 16" +/-	US28	IVE
1 EA	BALANCE OF HARDWARE EXISTING TO BE RE-USED			
VERIFY AND COORDINATE NEW HARDWARE WITH EXISTING DOOR AND FAME PREPS. PUSH PLATES PROVIDED TO COVER EXISTING DOOR PREPS.				

Hardware Group No. 130.0				
For use on Door #(s): EF105D, EO101, EO114A				
Provide each SGL door(s) with the following:				
QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1 EA	EXISTING DOOR, FRAME AND HARDWARE TO REMAIN			

Legend:	
~Electrified Opening	
Door#	HwSet#
EF101~	111.0
EF105A~	112.0
EF105B~	112.0
EF105C~	111.0
EF105D	130.0
EF105E~	111.0
EF107A	120.0
EF107B	120.0
EF107C~	110.0
EF107D~	111.0
EF107E~	110.0
EF107F~	110.0
EF118	120.0
EO101	130.0
EO106~	100.0
EO111~	110.0
EO112~	110.0
EO114A	130.0
EO114B~	102.0
EO114C~	103.0
EO114D~	110.0
EO114E~	110.0
EO115	120.0
EO133~	110.0
EO135~	101.0
F101	011.0
F102A	080.0
F103~	021.0
F104~	022.0
F106~	041.0
F108~	022.0
F109	081.0
F110~	022.0
F117	080.0

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F118~	021.0
F118A	030.0
O101~	040.0
O105	010.0
O108	055.0
O109~	050.0
O110~	050.0
O111A~	020.0
O111B~	020.0
O112~	060.0
O113~	070.0
O115A~	023.0
O115B	030.0
O116	012.0

END OF SECTION

SECTION 088000

GLAZING

PART 1 GENERAL

1.1 SUMMARY

- A. This 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. Interior windows and glazed openings.

1.2 DEFINITIONS

- A. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- B. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- C. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for 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.
- D. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for 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.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

- B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thickness by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
 - 1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
 - a. Specified Design Wind Loads: not less than wind loads applicable to Project as required by ASCE 7 "Minimum Design Loads for Buildings and Other Structures": Section 6.0 "Wind Loads."
- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120°F, ambient; 180°F, material surfaces.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
 - 1. For monolithic glass lites, properties are based on units with lites 6.0 mm thick.
 - 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite 6.0 mm thick and a nominal 1/2-inch- wide interspace.
 - 3. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
 - a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x °F.
 - 1) Maximum Allowable U-Factor: 0.24 (winter).
 - 2) Maximum Allowable U-Factor: 0.24 (summer).
 - b. Solar Heat Gain Coefficient: NFRC 200.
 - 1) Maximum Allowable SHGC: 0.41.
 - c. Solar Optical Properties: NFRC 300.

1.4 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glazing Schedule: Use same designations indicated on Drawings.
- C. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data.
- B. Manufacturer's Special Warranty: Manufacturer's standard form made out and signed by coated-glass manufacturer agreeing to replace glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 - 1. Warranty Periods:
 - a. Tempered glass: 5-year warranty.

1.6 QUALITY ASSURANCE

- A. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing according to ASTM C 1087, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:
- B. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.
- C. 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. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

PART 2 PRODUCTS

2.1 FABRICATORS

- A. Approved Fabricators.
 - 1. Cardinal Glass.
 - 2. Guardian.
 - 3. Manko.
 - 4. Oldcastle.
 - 5. Pilkington.
 - 6. Vetrotech.
 - 7. Viracon.
 - 8. Vitro.

2.2 TEMPERED GLASS (TG-1) FOR TYPICAL INTERIOR USE

- A. Tempered Glass: Comply with ASTM C1048 for monolithic tempered glass; ¼ inch total thickness; clear.
- B. Tempered Glass shall be installed at all interior locations unless noted otherwise.

2.3 TEMPERED GLASS (TG-2) FOR TYPICAL INTERIOR USE

- A. Tempered Glass: Comply with ASTM C1048 for monolithic tempered glass; 1/2" inch total thickness; clear.
- B. Tempered Glass shall be installed at all interior locations unless noted otherwise.

2.4 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
 - 1. Neoprene, ASTM C 864.
 - 2. EPDM, ASTM C 864.
 - 3. Silicone, ASTM C 1115.
 - 4. Thermoplastic polyolefin rubber, ASTM C 1115.

- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
 - 1. Neoprene.
 - 2. EPDM.
 - 3. Silicone.
 - 4. Thermoplastic polyolefin rubber.

2.5 GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
 - 1. Compatibility: Select 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. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

- B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 - 1. Neutral-Curing Silicone Glazing Sealants.
 - a. Available Products:
 - 1) Dow Corning 795 or 799, Tremco Proglaze SSG or equivalent product.

2.6 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; 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; packaged on rolls with a release paper backing; 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; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
 - 1. Type 1, for glazing applications in which tape acts as the primary sealant.
 - 2. 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 with a Shore, Type A durometer 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.

2.8 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze 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.

PART 3 EXECUTION

3.1 GLAZING

- A. General: 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.
 - 1. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
 - 2. 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.
3. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
 4. 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.
 5. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
 6. Provide spacers for glass lites where length plus width is larger than 50 inches.
 7. 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.
- B. Tape Glazing: Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
1. Cover vertical framing joints by applying tape to heads and sills first and then to jambs. Cover horizontal framing joints by applying tape to jambs and then to heads and sills.
 2. 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.
 3. Apply heel bead of elastomeric sealant.
 4. 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.
 5. Apply cap bead of elastomeric sealant over exposed edge of tape.
- C. Gasket Glazing (Dry): Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretching during installation.
1. 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.
 2. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
 3. Install gaskets so they protrude past the face of glazing stops.
- D. Sealant Glazing (Wet): Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
1. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
 2. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.2 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 the glass surface. Remove non-permanent labels, and clean surfaces. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.
- B. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION

SECTION 092900
GYP SUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior gypsum board.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

- 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.

PART 2 PRODUCTS

2.1 INTERIOR GYP SUM BOARD

- A. General: Complying with ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Gypsum Co.
 - b. CertainTeed Gypsum Inc.
 - c. G-P Gypsum.
 - d. National Gypsum Company.
 - e. USG Corporation.
- B. Regular Type:
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered.
- C. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered.
 - 3. Provide Type X unless noted otherwise on drawings.

2.2 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 - 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.
 - g. Curved-Edge Cornerbead: With notched or flexible flanges.

2.3 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Wallboard: Paper.
- C. Joint Compound for Interior Gypsum Wallboard: 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 drying-type, all-purpose compound.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
- D. Sound Damping: Provide Green Glue Damping Compound by Sound Isolation Company for all walls and ceilings where walls and ceilings involve multiple layers of gyp bd. Install compound per manufacturer recommendations. 2 tubes for every drywall panel of size 4 by 8.

2.4 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.
- D. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."
- E. Sound Attenuation Blankets: As specified in Division 07 Section "Acoustical Batt Insulation."

PART 3 EXECUTION

3.1 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. 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.
- D. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.2 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Regular Type: As indicated on Drawings.
 - 2. Ceiling Type: Ceiling surfaces.

3.3 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.
 - 2. Bullnose Bead: Use at outside corners.
 - 3. LC-Bead: Use at exposed panel edges.
 - 4. U-Bead: Use at exposed panel edges.

3.4 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 those with trim having flanges not intended for tape.

- D. Gypsum Board Finish Levels: Finish panels to levels indicated below:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 099000 "Painting and Coating".

3.5 IDENTIFICATION

- A. Permanently identify rated walls with signs or stenciling in concealed spaces as follows:
 - 1. Located within 15 feet of end of each wall and at intervals not exceeding 30 feet measured horizontally along wall or partition.
 - 2. Lettering: Not less than 3 inches in height with minimum 3/8 inch stroke in contrasting color incorporating the following suggested wording: "FIRE AND/OR SOKE BARRIER - PROTECT ALL OPENINGS" or other wording.

3.6 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. 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

SECTION 095123
ACOUSTICAL TILE CEILINGS

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes acoustical tiles and concealed suspension systems for ceilings.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include product test reports and research/evaluation reports.
- B. Coordination Drawings: Drawn to scale and coordinating acoustical tile ceiling installation with hanger attachment to building structure and ceiling mounted items. Show size and location of initial access modules.
- C. Samples: For each exposed finish.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Units: Full-size tiles equal to 2.0 percent of quantity installed.
 - 2. Suspension System Components: Quantity of each concealed grid and exposed component equal to 2.0 percent of quantity installed.

1.4 QUALITY ASSURANCE

- A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory.
- B. Fire-Test-Response Characteristics:
 - 1. Fire-Resistance Characteristics: Where indicated, provide acoustical tile ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 2. Surface-Burning Characteristics: Acoustical tiles complying with ASTM E 1264 for Class A materials, when tested per ASTM E 84.
 - a. Smoke-Developed Index: 450 or less.

PART 2 PRODUCTS

2.1 ACOUSTICAL TILE CEILINGS, GENERAL

- A. Acoustical Tile Standard: Comply with ASTM E 1264.
- B. Metal Suspension System Standard: Comply with ASTM C 635.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 - 1. Anchors in Concrete: Cast-in-place anchors fabricated from corrosion-resistant materials, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
- D. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 1. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire but provide not less than 0.106-inch- diameter wire.
- E. Seismic struts and seismic clips.

2.2 MANUFACTURERS

- A. Approved Manufacturers:
 - 1. USG.
 - 2. Certainteed.
- B. Ceiling Tile ACT1:
 - 1. USG Mars
 - 2. Size: 24" x 24" unless noted otherwise in drawings.
 - 3. Edge Detail: Angled Tegular.
 - 4. Color: White.

2.3 METAL SUSPENSION SYSTEM FOR ACOUSTICAL TILE CEILING

- A. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.
- B. Metal Suspension System Characteristics: Comply with requirements indicated in the Acoustical Panel Ceiling Schedule at the end of Part 3.
- C. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural

and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

- D. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.
 - 1. Postinstalled Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
- E. 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.
- F. Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical tile edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners. Provide bullnose corner cover at any bullnose CMU locations.
 - 1. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
 - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong World Industries, Inc.
 - b. CertainTeed.
 - c. Chicago Metallic Corporation.
 - d. USG Interiors, Inc.
- G. Basis of Design:
 - 1. Available products include the following:
 - a. Armstrong "Prelude", 15/16-inch, exposed tee grid system.
 - b. USG Donn DX 15/16".
 - c. CertainTeed.
 - d. Submit other substitutions for approval.
 - 2. 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, G01 coating designation; other characteristics as follows:
 - a. Structural Classification: Intermediate-duty system.
 - 3. 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.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and structural framing 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 other conditions affecting performance of acoustical tile ceilings.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other Sections.
- 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 units at borders and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical tile ceilings to comply with publications referenced below per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
 - 1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.
 - 2. U.B.C.'s "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings": U.B.C. Standard 25-2.
- 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. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 - 4. Do not attach hangers to steel deck tabs.
 - 5. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches from ends of each member.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical units.
 - 1. 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.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

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- E. 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.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical tile ceilings, including trim, edge moldings, and suspension system members. 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

SECTION 096513
RESILIENT BASE AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Resilient base.
 - 2. Transition strip materials.

1.2 SUBMITTALS

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

1.3 CLOSEOUT 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.

1.4 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.

1.5 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.1 VINYL BASE RB1

- A. Resilient Base:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Tarkett.
- B. Resilient Base Standard: ASTM F 1861.
 - 1. Material Requirement: Type TV (vinyl, thermoplastic).
 - 2. Manufacturing Method: Group I (solid, homogeneous).
 - 3. Style: Cove (base with toe).
- C. Minimum Thickness: 0.125 inch.
- D. Height: 4 inches.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: preformed.
- G. Inside Corners: preformed.
- H. Finish: As selected by Architect from manufacturer's full range.
- I. Colors and Patterns: See Finish Schedule.

2.2 RESILIENT MOLDING ACCESSORY

- A. Resilient Molding Accessory:
 - 1. Manufacturers: Subject to compliance with requirements, Match Vinyl Base manufacturer:
 - a. Basis of Design: Tarkett.
- B. Description: Cap for cove carpet, Cap for cove resilient floor covering, Carpet edge for glue-down applications, Nosing for carpet, Reducer strip for resilient floor covering, Transition strips.
- C. Material: Vinyl.
- D. Profile and Dimensions: As indicated.
- E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 TRANSITION STRIP MATERIALS

- A. Carpet/ Sealed Concrete (TS1): Rubber transition to be selected by Architect from manufacturer's standards.

2.4 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.
 - 1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Cove Base Adhesives: Not more than 50 g/L.
 - b. Rubber Floor Adhesives: Not more than 60 g/L.

PART 3 EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
 - 4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.
- C. 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.
- D. 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.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.2 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.

3.3 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.

3.4 TRANSITION STRIP INSTALLATION

- A. Comply with manufacturer's written instructions for installing transition strips.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Cover resilient products until Substantial Completion.

END OF SECTION

SECTION 099000
PAINTING AND COATINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation and field painting of exposed interior items and surfaces.
- B. Painting of exposed bare and covered pipes and ducts, hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

1.2 RELATED SECTIONS

- A. Section 055000 - Metal Fabrications.
- B. Section 064200 - Interior Architectural Woodwork: Shop priming architectural woodwork.
- C. Section 081113 - Hollow Metal Doors and Frames.
- D. Section 092900 - Gypsum Board Assemblies.

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM) D 16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
- B. Steel Structures Painting Council (SSPC) SP6 - Commercial Blast Cleaning Procedures.
- C. Steel Structures Painting Council (SSPC) SP10 - Near White Blast Cleaning Procedure.

1.4 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16.
 - 1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
 - 2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
 - 3. Semi-gloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
 - 4. Full gloss refers to a high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

- B. Environments: The following terms distinguish between different corrosive exposures:
1. "Severe environments" are highly corrosive industrial atmospheres with sustained exposure to high humidity and condensation and with frequent cleaning using strong chemicals. Environments with heavy concentrations of strong chemical fumes and frequent splashing and spilling of harsh chemical products are severe environments.
 2. "Moderate environments" are corrosive industrial atmospheres with intermittent exposure to high humidity and condensation, occasional mold and mildew development, and regular cleaning with strong chemicals. Environments with exposure to heavy concentrations of chemical fumes and occasional splashing and spilling of chemical products are moderate environments.
 3. "Mild environments" are industrial atmospheres with normal exposure to moderate humidity and condensation, occasional mold and mildew development, and infrequent cleaning with strong chemicals. Environments with low levels of mild chemical fumes and occasional splashing and spilling of chemical products are mild environments. Normal outdoor weathering is also considered a mild environment.

1.5 SUBMITTALS

- A. Submit under provisions of Division 1 Specifications.
- B. Product Data for each paint system indicated, including:
1. Material List: An inclusive list of required coating materials. Indicate each material and cross reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 2. Preparation instructions and recommendations.
 3. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
 4. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. All materials, preparation and workmanship shall conform to requirements of the latest edition of the Architectural Painting Specification Manual by the Master Painters Institute (MPI) as issued by the location MPI Accredited Quality Assurance Association having jurisdiction.
- C. Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.
- D. Paint exposed surfaces. If an item or a surface is not specifically mentioned, paint the item, or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.
- E. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label:
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45°F. Maintain storage containers in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing. Keep the storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside the manufacturer's absolute limits.
- B. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90°F.
- C. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95°F.
- D. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5°F above the dew point; or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.9 CLOSEOUT SUBMITTALS

- A. Furnish extra paint materials from the same production run as the materials applied and, in the quantities, described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
 - 1. Quantity: Furnish Owner with an additional three percent, but not less than 1 gal or 1 case, as appropriate, of each material and color applied.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Approved Manufacturers: on Drawings.
 - 1. Sherwin Williams (Basis of Design).
 - 2. Benjamin Moore.
 - 3. PPG.
 - 4. Diamond Vogel.
- B. Requests for substitutions will be considered in accordance with the provisions of Division 1 Specifications.

2.2 PAINT MATERIALS - GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. VOC Classification: Provide high-performance coating materials, including primers, undercoats, and finish-coat materials, that meet the applicable local, state, or federal VOC requirements.
- C. Color: Refer to Finish Schedule and Paint Legend for paint colors.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until the substrates have been properly prepared.
- B. 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.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.
 - 2. If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding:
 - a. Confirmation of primer's suitability for expected service conditions.
 - b. Confirmation of primer's ability to be top coated with materials specified.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each substrate condition and as specified.
 - 1. Provide barrier coats over incompatible primers or remove primers and reprime substrate.
 - 2. Cementitious Substrates: Prepare concrete, brick, concrete masonry block, and cement plaster surfaces to be coated. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces.
 - a. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
 - 3. Wood Substrates: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Smoothly sand surfaces exposed to view and dust off.
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer, before applying primer.
 - b. Immediately on delivery, prime edges, ends, faces, undersides, and backsides of wood to be coated.
 - c. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - 4. Ferrous Metal Substrates: Clean un-galvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.
 - a. Blast-clean steel surfaces as recommended by coating manufacturer and according to SSPC-SP 10.
 - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
 - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire brush, solvent clean, and touch up with same primer as the shop coat.
 - 5. Nonferrous-Metal Substrates: Clean nonferrous and galvanized surfaces according to manufacturer's written instructions for the type of service, metal substrate, and application required.
 - a. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.
 - 1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
 - 2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
 - 3. Use only the type of thinners approved by manufacturer and only within recommended limits.
 - 4. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
- B. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
 - 1. The number of coats and film thickness required is the same regardless of application method.
 - 2. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.
- C. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
 - 1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. For wood finishes, varnishes, and epoxies, sand, and dust between each coat to provide an anchor for next coat and remove defects visible from distance up to 39" or as recommended by manufacturer.
 - 2. Omit primer on metal surfaces that have been shop primed and touchup painted.
 - 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 - 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform, or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.
- F. Mechanical items to be painted include, but are not limited to, the following:
 - 1. Piping, pipe hangers, and supports.
 - 2. Tanks.
 - 3. Motors and mechanical equipment.
 - 4. Accessory items.
- G. Electrical items to be painted include, but are not limited to, the following:
 - 1. Conduit and fittings.
 - 2. Switchgear.
 - 3. Panelboards.
- H. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

3.5 FIELD QUALITY CONTROL

- A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:
 - 1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.
- B. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.6 CLEANING

- A. After completing painting, clean glass and paint spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.7 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing, or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
- C. After the work of other trades is complete, touch up and restore damaged or defaced painted surfaces.

3.8 INTERIOR PAINTING SCHEDULE

- A. Gypsum Board Substrate:
 - 1. Walls:
 - a. One (1) coat, latex primer:
 - 1) PPG Paints; Speedhide Zero VOC Interior Latex Primer/Sealer, 6-4900XI.
 - 2) Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer.
 - 3) Diamond Vogel equivalent.
 - b. Two (2) coats, -acrylic-latex enamel (eggshell):
 - 1) PPG Paints; Speedhide Zero VOC Interior Latex Eggshell - 6-411ZV.
 - 2) Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer.
 - 2. Ceilings:
 - a. One (1) coat, latex primer:
 - 1) PPG Paints; Speedhide Zero VOC Interior Latex Sealer/Primer, 6-4900XI.
 - 2) Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28 Series.

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- 3) Diamond Vogel Pro Max Interior Latex Primer/Sealer.
- b. Two (2) coats, Acrylic-Latex (flat):
- 1) PPG Paints; 12-110 Speedhide Pro EV Latex Wall & Ceiling Flat.
 - 2) Sherwin-Williams ProMar 200 Zero VOC Interior Latex Flat.
 - 3) Diamond Vogel Elevate Interior Latex Ultra Flat Ceiling Paint.

END OF SECTION

SECTION 102800
TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Public-use washroom accessories.
 - 2. Private-use bathroom accessories.
 - 3. Underlavatory guards.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule:
 - 1. Identify locations using room designations indicated on Drawings.
 - 2. Identify products using designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet and bath accessories to be included in maintenance manuals.
- B. 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: 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PUBLIC-USE WASHROOM ACCESSORIES

- 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. A & J Washroom Accessories, Inc.
 - 2. American Dryer, Inc.
 - 3. American Specialties, Inc.
 - 4. Bobrick Washroom Equipment, Inc.
 - 5. Bradley Corporation.
 - 6. Columbia Partitions, Inc., a Division of PSiSC.
 - 7. General Accessory Manufacturing Co. (GAMCO).
 - 8. Plumberex Specialty Products, Inc.
 - 9. Saniflow.
 - 10. TCI Products.

11. Truebro, Inc.
 - B. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
 1. Bobrick Washroom Equipment, Inc.
 2. Excel Dryers.
 3. Foundations.
 4. Koala Child Care Products.
 5. Kennedy Hygiene Co.
 - C. Sanitary-Napkin Disposal Unit TBA-2.
 1. Basis-of-Design Product: B-270.
 2. Mounting: Surface mounted.
 3. Door or Cover: Self-closing disposal-opening cover.
 4. Receptacle: Removable.
 5. Material and Finish: Stainless steel, No. 4 finish (satin).
 - D. Toilet Tissue (Roll) Dispenser TBA-3.
 1. Basis-of-Design Product: B-686.
 2. Description: Double-roll dispenser.
 3. Mounting: Surface mounted.
 4. Operation: Noncontrol delivery with theft-resistant spindle.
 5. Capacity: Designed for 5-inch- diameter tissue rolls.
 6. Material and Finish: Stainless steel, No. 4 finish (satin).
 - E. Liquid-Soap Dispenser TBA-5.
 1. Wall Mounted: Basis-of-Design Product: B-8221 and B-4112.
 - a. Description: Designed for dispensing soap in liquid or lotion form.
 - b. Mounting: Vertically oriented, wall mounted.
 - c. Capacity: 40 oz.
 - d. Materials: Satin stainless steel.
 - e. Lockset: Locked hinge lid w/ special key, Vandal resistant.
 - f. Delete subparagraph above and below if not required.
 - g. Refill Indicator: Window type.
 - F. Paper Towel (Folded) Dispenser TBA-7.
 1. Basis-of-Design Product: B-4262.
 2. Mounting: Surface Mounted.
 3. Minimum Capacity: 400 C-fold or 525 multifold towels.
 4. Material and Finish: Stainless steel, No. 4 finish (satin).
 5. Lockset: Tumbler type.
 6. Refill Indicators: Cabinet slots.
 - G. Underlavatory Guard: Provide at all locations with exposed pipes.
 1. Basis-of-Design Product: Truebro, Inc. LavGuard2.
 2. Description: Insulating pipe covering for supply and drain piping assemblies, that prevent direct contact with and burns from piping, and allow service access without removing coverings.
 3. Material and Finish: Antimicrobial, molded-plastic, white.

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2.2 FABRICATION

- A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of 4 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 downward load of at least 250 lbf, 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 instructions.

END OF SECTION

SECTION 104416
FIRE EXTINGUISHERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.2 SUBMITTALS

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

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
- B. 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 years from date of Substantial Completion.

1.4 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.
- C. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amerex Corporation.
 - b. Ansul Incorporated; Tyco International Ltd.
 - c. Badger Fire Protection; a Kidde company.
 - d. Buckeye Fire Equipment Company.
 - e. Fire End & Croker Corporation.
 - f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - g. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
 - h. Larsen's Manufacturing Company.
 - i. Moon-American.
 - j. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.
 - k. Potter Roemer LLC.
 - l. Pyro-Chem; Tyco Safety Products.
 - 2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Multipurpose Dry-Chemical Type:
 - 1. Class A Hazard: 3-A:40-B:C nominal capacity, with dry chemical in manufacturer's standard enameled container.

2.2 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amerex Corporation.
 - b. Ansul Incorporated; Tyco International Ltd.
 - c. Badger Fire Protection; a Kidde company.
 - d. Buckeye Fire Equipment Company.
 - e. Fire End & Croker Corporation.
 - f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - g. Larsen's Manufacturing Company.
 - h. Potter Roemer LLC.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

PART 3 EXECUTION

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3.1 INSTALLATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION

SECTION 210500

BASIC FIRE SUPPRESSION REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Requirements applicable to all Division 21 Sections. Also refer to Division 01 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

- A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.
- B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make the portion of the Mechanical Work a finished and working system.
- C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- D. Scope of Work:
 - 1. Plumbing Work: Refer to Section 220500 "Basic Plumbing Requirements".
 - 2. Heating Work: Refer to Section 230500 "Basic HVAC Requirements".
 - 3. Air Conditioning and Ventilating Work: Refer to Section 230500 "Basic HVAC Requirements".
 - 4. Temperature Control Work: Refer to Section 230500 "Basic HVAC Requirements".
 - 5. Fire Protection Work shall include, but is not necessarily limited to:
 - a. Extend existing wet pipe sprinkler system for areas noted on the drawings.
 - b. Furnish and install all items listed on the Fire Protection Material List.
 - c. Furnish all hydraulic calculations and working sprinkler drawings.
 - 6. Testing, Adjusting, and Balancing Work: Refer to Section 230500 "Basic HVAC Requirements".

1.3 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

A. Definitions:

1. "Mechanical Contractors" refers to the following:
 - a. Plumbing Contractor.
 - b. Heating Contractor.
 - c. Air Conditioning and Ventilating Contractor.
 - d. Temperature Control Contractor.
 - e. Fire Protection Contractor.
 - f. Testing, Adjusting, and Balancing Contractor.
2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.
5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.
 - a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.
6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings

show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.

2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.
4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.
5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:
 - a. Light fixtures.
 - b. Gravity flow piping, including condensate.
 - c. Electrical busduct.
 - d. Sheet metal.
 - e. Electrical cable trays, including access space.
 - f. Sprinkler piping and other piping.
 - g. Electrical conduits and wireway.

C. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:
 - a. Burners.
 - b. Condensing Units.
 - c. Packaged Rooftop Units.
 - d. Split Systems
 - e. Furnaces
2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
3. Shall verify all existing equipment sizes and capacities where units are to be modified, moved or replaced. Contractor shall notify Architect/Engineer of any discrepancies prior to ordering new units or replacement parts, including replacements of equipment motors.
4. Temperature Control Subcontractor's Responsibility:
 - a. Wiring of all devices needed to make the Temperature Control System functional.
 - b. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Subcontractor.
 - c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

D. Electrical Contractor's Responsibility:

1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
2. Installs and wires all remote control devices furnished by the Mechanical Contractor or Temperature Control Subcontractor when so noted on the Electrical Drawings.
3. Provides motor control and temperature control wiring, where so noted on the drawings.
4. Coordinate with the Mechanical Contractor for size of motors and/or other electrical devices involved with repair or replacement of existing equipment.
5. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
6. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.4 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, and any item that may impact coordination with other disciplines.
 - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - d. Maintenance clearances and code-required dedicated space shall be included.
 - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.
 - a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.

3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the General Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.

3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
 - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
 - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.5 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.

2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.
- B. Qualifications:
1. Only products of reputable manufacturers are acceptable.
 2. All Contractors and subcontractors shall employ only workers skilled in their trades.
- C. Compliance with Codes, Laws, Ordinances:
1. Conform to all requirements of the City of Des Moines, Iowa's Codes, Laws, Ordinances and other regulations having jurisdiction.
 2. Conform to all State Codes.
 3. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
 4. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
 5. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
 6. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
 7. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.
- D. Permits, Fees, Taxes, Inspections:
1. Procure all applicable permits and licenses.
 2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
 3. Pay all charges for permits or licenses.
 4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
 5. Pay all charges arising out of required inspections by an authorized body.
 6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
 7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.
- E. Utility Company Requirements:
1. Secure from the appropriate private or public utility company all applicable requirements.
 2. Comply with all utility company requirements.
 3. Make application for and pay for fire protection water service connection.

F. Examination of Drawings:

1. The drawings for the fire protection work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
3. Scaling of the drawings is not sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
8. Where used in fire protection documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.
 - a. Any item listed as furnished shall also be installed, unless otherwise noted.
 - b. Any item listed as installed shall also be furnished, unless otherwise noted.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

H. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

1.6 WEB-BASED PROJECT SOFTWARE

- A. The General Contractor shall provide a web-based project software site for the purpose of hosting and managing project communication and documentation until completion of the warranty phase.
- B. The web-based project software shall include, at a minimum, the following features: construction schedule, submittals, RFIs, ASIs, construction change directives, change orders, drawing management, specification management, payment applications, contract modifications, meeting minutes, construction progress photos.
- C. Provide web-based project software user licenses for use by the Architect/Engineer. Access will be provided from the start of the project through the completion of the warranty phase.
- D. At project completion, provide digital archive of entire project in format that is readable by common desktop software applications in format acceptable to Architect/Engineer. Provide data in locked format to prevent further changes.

1.7 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

- 1. Submittals list:

Referenced Specification Section	Submittal Item
21 05 00	Owner Training Agenda
21 05 29	Hangers and Supports
21 13 00	Sprinkler Systems

- B. General Submittal Procedures: In addition to the provisions of Division 01, the following are required:

- 1. Transmittal: Each transmittal shall include the following:

- a. Date
- b. Project title and number
- c. Contractor's name and address
- d. Division of work (e.g., plumbing, heating, ventilating, etc.)
- e. Description of items submitted and relevant specification number
- f. Notations of deviations from the contract documents
- g. Other pertinent data

- 2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

- a. Date
- b. Project title and number
- c. Architect/Engineer
- d. Contractor and subcontractors' names and addresses
- e. Supplier and manufacturer's names and addresses
- f. Division of work (e.g., plumbing, heating, ventilating, etc.)

- g. Description of item submitted (using project nomenclature) and relevant specification number
 - h. Notations of deviations from the contract documents
 - i. Other pertinent data
 - j. Provide space for Contractor's review stamps
3. Composition:
- a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
 - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
 - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g., voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:
- a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the

Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:

- a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
- b. The Contractor shall clearly indicate the size, finish, material, etc.
- c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
- d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions, or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
 - a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.
16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.

4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 21 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 21 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.8 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 01.
- B. Format:
 1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
 2. Submit in Excel format.
 3. Support values given with substantiating data.
- C. Preparation:
 1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
 2. Break down all costs into:
 - a. Material: Delivered cost of product with taxes paid.
 - b. Labor: Labor cost, excluding overhead and profit.
- D. Update Schedule of Values when:
 1. Indicated by Architect/Engineer.
 2. Change of subcontractor or supplier occurs.
 3. Change of product or equipment occurs.

1.9 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.
- B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.
- C. Change order work shall not proceed until authorized.

1.10 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:
 - 1. Fire Seal Systems
- B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.
- C. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner's Operation and Maintenance Manuals.

1.11 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.
- B. Protect equipment, components, and openings with airtight covers and exercise care at every stage of storage, handling, and installation of equipment to prevent airborne dust and dirt from entering or fouling equipment to include, but not limited to:
 - 1. Motor windings and ventilation openings.
 - 2. Bearings.
 - 3. Equipment Pipe and Accessories connection openings.
 - 4. Starter and control cabinets.
 - 5. Pump Seals.
 - 6. Engine cooling, air intake, and exhaust openings.
- C. Equipment and components that are visibly damaged or have been subject to environmental conditions prior to building turnover to Owner that could shorten the life of the component (for example, water damage, humidity, dust and debris, excessive hot or cold storage location, etc.) shall be repaired or replaced with new equipment or components without additional cost to the building owner.
- D. Keep all bearings properly lubricated and all belts properly tensioned and aligned.
- E. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- F. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

1.12 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.13 WARRANTY

- A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.14 INSURANCE

- A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.15 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the scheduled manufacturer is the basis for job design and establishes the quality required.
- B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections, piping and ductwork connections and arrangement, plumbing connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.
- D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.

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- E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.
- F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

1.16 PROJECT COMMISSIONING

- A. The Contractor shall work with the Commissioning Agent (CxA) as described in Section 01 91 00 and 21 08 00 and provide all services as described in the Commissioning Plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 ENGINEER OBSERVATION OF WORK

- A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:
 - 1. Placing fill over underground and underslab utilities.
 - 2. Covering exterior walls, interior partitions and chases.
 - 3. Installing hard or suspended ceilings and soffits.
- B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.
- C. Above-Ceiling Final Observation
 - 1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
 - a. Pipe wall penetrations are sealed.
 - b. Pipe identification is installed.
 - c. Branch piping in the location of sprinklers shall be dropped to the ceiling.

2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

3.3 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 01.
- B. Final Jobsite Observation:
 1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
 2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
 3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
 4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.
- C. Before final payment is authorized, this Contractor must submit the following:
 1. Operation and maintenance manuals with copies of approved shop drawings.
 2. Record documents including marked-up drawings and specifications.
 3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
 4. Inspection report by the State Fire Marshal of the fire protection system.
 5. Start-up reports on all equipment requiring a factory installation inspection or start-up.
 6. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site; receipt by Architect/Engineer required prior to final payment approval.

3.4 OPERATION AND MAINTENANCE MANUALS

- A. General:
 1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
 2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div21.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div21.contractor.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

3.5 INSTRUCTING THE OWNER'S REPRESENTATIVES

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- D. The instructions shall include:
 - 1. Explanation of all system flow diagrams.
 - 2. Maintenance of equipment.
 - 3. Start-up procedures for all major equipment.
 - 4. Explanation of seasonal system changes.
 - 5. Description of emergency system operation.
- E. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can attend if desired.
- F. Minimum hours of instruction for each item shall be:
 - 1. Sprinkler System(s) - 2 hours.
- G. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of two weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.
- H. Operating Instructions:
 - 1. Contractor is responsible for all instructions to the Owner's representatives for the fire protection and control systems.
 - 2. If the Contractor does not have staff that can adequately provide the required instructions the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.6 SYSTEM STARTING AND ADJUSTING

- A. The fire protection systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final comfort adjustments as required.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards

are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.

- C. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.
- D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.7 RECORD DOCUMENTS

- A. The following paragraphs supplement Division 01 requirements.
- B. Maintain at the job site a separate and complete set of fire protection drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.
- C. Mark drawings to indicate revisions to piping size and location, both exterior and interior; including locations of other control devices, and other units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located; Change Orders; concealed control system devices.
- D. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.
- E. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.
- F. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

3.8 PAINTING

- A. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.
- B. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, the Contractor shall have the equipment and all its supports, hangers, etc., painted to match the room decor.

- C. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.
- D. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer the color preference and furnish this color.
- E. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.
- F. After surfaces have been thoroughly cleaned and are free of oil, dirt, and other foreign matter, paint all pipes and equipment with the following:
 - 1. Bare Metal Surfaces: Apply one coat of primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.

3.9 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.
- B. Clean all areas where moisture is present. Immediately report any mold, biological growth, or water damage.
- C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed piping, hangers, and accessories.
- D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.10 SPECIAL REQUIREMENTS

- A. Contractor shall coordinate the installation of all equipment, valves, etc., with other trades to maintain clear access area for servicing.
- B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

- 1. Penetrations fire sealed and labeled in accordance with specifications.
- 2. Fire protection system operational.
- 3. Pipes labeled.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

END OF SECTION

SECTION 210505

FIRE SUPPRESSION DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Mechanical Demolition.
- B. Cutting and Patching.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall be as specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. THE DRAWINGS ARE INTENDED TO INDICATE THE GENERAL SCOPE OF WORK AND DO NOT SHOW EVERY PIPE, DUCT, OR PIECE OF EQUIPMENT THAT MUST BE REMOVED. THE CONTRACTOR SHALL VISIT THE SITE AND VERIFY CONDITIONS PRIOR TO SUBMITTING A BID.
- B. Where walls, ceilings, etc., are shown as being removed on general drawings, the Contractor shall remove all mechanical equipment, devices, fixtures, piping, ducts, systems, etc., from the removed area.
- C. Where ceilings, walls, partitions, etc., are temporarily removed and replaced by others, This Contractor shall remove, store, and replace equipment, devices, fixtures, pipes, ducts, systems, etc.
- D. Verify that abandoned utilities serve only abandoned equipment or facilities. Extend services to facilities or equipment that shall remain in operation following demolition.
- E. Coordinate work with all other Contractors and the Owner. Schedule removal of equipment to avoid conflicts.
- F. This Contractor shall verify all existing equipment sizes and capacities where equipment is scheduled to be replaced or modified, prior to ordering new equipment.
- G. Bid submittal shall mean the Contractor has visited the project site and verified existing conditions and scope of work.

3.2 PREPARATION

- A. Disconnect fire protection systems in walls, floors, and ceilings scheduled for removal.
- B. Provide temporary connections to maintain existing systems in service during construction. When work must be performed on operating equipment, use personnel experienced in such operations.

3.3 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

- A. Remove, relocate, and extend existing installations to accommodate new construction.
- B. Remove abandoned piping to source of supply and/or main lines.
- C. Remove exposed abandoned pipes, including abandoned pipes above accessible ceilings. Cut pipes above ceilings, below floors and behind walls. Cap remaining lines. Repair building construction to match original. Remove all clamps, hangers, supports, etc. associated with pipe and duct removal.
- D. Disconnect and remove mechanical devices and equipment serving equipment that has been removed.
- E. Repair adjacent construction and finishes damaged during demolition and extension work.
- F. Maintain access to existing mechanical installations which remain. Modify installation or provide access panels as appropriate.
- G. Extend existing installations using materials and methods compatible with existing installations, or as specified.

3.4 CUTTING AND PATCHING

- A. This Contractor is responsible for all penetrations of existing construction required to complete the work of this project. Refer to Section 210529 for additional requirements.
- B. Penetrations in existing construction should be reviewed carefully prior to proceeding with any work.
- C. Penetrations shall be neat and clean with smooth and/or finished edges. Core drill where possible for clean opening.
- D. Repair existing construction as required after penetration is complete to restore to original condition. Use similar materials and match adjacent construction unless otherwise noted or agreed to by the Architect/Engineer prior to start of work.
- E. 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.

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3.5 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment which remain or are to be reused.
- B. Clean all systems adjacent to project which are affected by the dust and debris caused by this construction.
- C. FIRE PROTECTION ITEMS REMOVED AND NOT RELOCATED REMAIN THE PROPERTY OF THE OWNER. CONTRACTOR SHALL PLACE ITEMS RETAINED BY THE OWNER IN A LOCATION COORDINATED WITH THE OWNER. THE CONTRACTOR SHALL DISPOSE OF MATERIAL THE OWNER DOES NOT WANT TO REUSE OR RETAIN FOR MAINTENANCE PURPOSES.

END OF SECTION

SECTION 210529
FIRE SUPPRESSION SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Hangers, Supports, and Associated Anchors.
- B. Equipment Bases and Supports.
- C. Sleeves and Seals.
- D. Flashing and Sealing of Equipment and Pipe Stacks.
- E. Cutting of Openings.
- F. Escutcheon Plates and Trim.

1.2 QUALITY ASSURANCE

- A. Support Sprinkler Piping in conformance with NFPA 13.

1.3 REFERENCES

- A. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
- B. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.
- C. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- D. NFPA 13 - Standard for the Installation of Sprinkler Systems.

1.4 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

PART 2 - PRODUCTS

2.1 HANGER RODS

- A. Hanger rods for single rod hangers supporting steel piping shall conform to the following:
 - 1. Hanger Rod Diameter:
 - a. 4" and smaller: 3/8"
 - b. 5", 6", and 8": 1/2"
- B. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

2.2 PIPE HANGERS AND SUPPORTS

- A. General:
 - 1. All pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS-SP-58, -69, and -89 (where applicable).
- B. Vertical Supports:
 - 1. Support and laterally brace vertical pipes at every floor level in multi-story structures, and more frequently when required by applicable codes, but never at intervals over 15 feet. Support vertical pipes with riser clamps installed below hubs, couplings or lugs. Provide sufficient flexibility to accommodate expansion and contraction without compromising fire barrier penetrations and other fixed takeoff locations.
 - a. Products:
 - 1) Eaton Fig. B3373 Series
 - 2) nVent 510 Series
 - 3) Anvil Fig. 90
 - 2. Wall supports shall be used where vertical height of structure exceeds minimum spacing requirements. Install wall supports at same spacing as hangers or strut supports along vertical length of pipe runs.
 - 3. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

C. Hangers and Clamps:

1. Hangers in direct contact with bare copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, nVent Cushion Clamp or Eaton Vibra-Clamp.
2. Unless otherwise indicated, hangers shall be as follows:
 - a. Clevis Type: Service: Bare Metal Pipe
 - 1) Products: Bare Steel Pipe
 - a) Anvil Fig. 260
 - b. Adjustable Swivel Ring Type: Service: Bare Metal Pipe - 4 inches and Smaller
 - 1) Products: Bare Steel Pipe
 - a) Anvil Fig. 69
 - b) Eaton Fig. B3170NF
 - c) nVent Model 115
3. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per manufacturer's installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.
4. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
5. Unless otherwise indicated, pipe supports for use with struts shall be as follows:
 - a. Clamp Type: Service: Bare Metal Pipe
 - 1) Clamps in direct contact with copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, nVent Cushion Clamp or Eaton Vibra-Clamp.
 - 2) Pipes subject to expansion and contraction shall have clamps slightly oversized to allow limited pipe movement.
 - 3) Products: Bare Steel, Plastic or Insulated Pipe
 - a) Unistrut Fig. P1100 or P2500
 - b) Eaton Fig. B2000 or B2400
 - c) Anvil AS1200
 - d) nVent USC

D. Upper (Structural) Attachments:

1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:
 - a. Steel Structure Clamps: C-Type Wide Flange Beam Clamps (for use on top and/or bottom of wide flanges. Not permitted for use with bar-joists.)
 - 1) Products:
 - a) Anvil Fig. 86
 - b) Eaton Fig. B3033/B3034
 - c) nVent Model 300 & 310
 - b. Scissor Type Beam Clamps (for use with bar-joists and wide flange):
 - 1) Products:
 - a) Anvil Fig. 228, 292
 - b) Eaton Fig. B3054
 - c) nVent Model 360
 - c. Concentrically Loaded Open Web Joist Hangers (for use with bar joists):
 - 1) Products:
 - a) MCL. M1, M2 or M3
 - d. Unless otherwise noted, hangers, clips, and auxiliary support steel may be welded in lieu of bolting, clamping, or riveting to the building structural frame. Take adequate precautions during all welding operations for fire prevention and for protecting walls and ceilings from being damaged by smoke.

2.3 OPENINGS IN FLOORS, WALLS AND CEILINGS

- A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.
- B. Coordinate all openings with other Contractors.
- C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.
- D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at Contractor's expense.
- E. Do not cut structural members without written approval of the Architect or Structural Engineer.

2.4 ESCUTCHEON PLATES AND TRIM

- A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.
- B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.
- C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes duct and pipe openings.

2.5 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 FIRE SUPPRESSION SUPPORTS AND ANCHORS

- A. General Installation Requirements:
 - 1. Install all items per manufacturer's instructions.
 - 2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
 - 3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
 - 4. Supports shall extend directly to building structure. Do not support piping from duct hangers. Do not allow lighting or ceiling supports to be hung from piping supports.
- B. Supports Requirements:
 - 1. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
 - 2. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
 - 3. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
 - 4. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.
- C. Pipe Requirements:
 - 1. Support all piping and equipment, including valves, strainers, and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.

2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
 3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
 4. Piping shall not introduce strains or distortion to connected equipment.
 5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.
 6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
 7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.
 8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.
- D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:
1. Loads of 100 lbs or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
 2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:
 - a. The hanger is attached within 6" from a web/chord joint.
 - b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.
 3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
 4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.
- E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.
- F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.
- H. Spacing of hangers shall in no case exceed the following:
1. Steel (All steel pipe unless otherwise noted):
 - a. Maximum Spacing:
 - 1) 1-1/4" & under: 12'-0"
 - 2) 1-1/2" & larger: 15'-0"

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2. Steel (Schedule 40 lightweight alternative):
 - a. Maximum Spacing:
 - 1) 3" & under: 12'-0"
 - 2) 3" & under: 12'-0"
- I. Installation of hangers shall conform to MSS SP-58, -69, -89, and applicable NFPA standards.

END OF SECTION

SECTION 210553
FIRE SUPPRESSION IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Identification of products installed under Division 21.

1.2 REFERENCES

- A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 210500. Include list of items identified, wording, letter sizes, and color coding.
- B. Include valve chart and schedule listing valve tag number, location, function, and valve manufacturer's name and model number.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. 3M
- B. Bunting
- C. Calpico
- D. Craftmark
- E. Emedco
- F. Kolbi Industries
- G. Seton
- H. W. H. Brady
- I. Marking Services.

2.2 MATERIALS

- A. All pipe markers (purchased or stenciled) shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

OD of Pipe or Insulation	Marker Length	Size of Letters
Up to and including 1-1/4"	8"	1/2"
1-1/2" to 2"	8"	3/4"
2-1/2" to 6"	12"	1-1/4"

Plastic tags may be used for outside diameters under 3/4"

- B. Plastic Nameplates: Laminated three-layer phenolic with engraved black, 1/4" minimum letters on light contrasting background.
- C. Plastic Tags: Minimum 1-1/2" square or round laminated three-layer phenolic with engraved, 1/4" minimum black letters on light contrasting background.
- D. Vinyl Pipe Markers: Colored vinyl with permanent pressure sensitive adhesive backing.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all products per manufacturer's recommendations.
- B. Degrease and clean surfaces to receive adhesive for identification materials.
- C. Valves:
- All valves (except shutoff valves at equipment) shall have numbered tags.
 - Provide or replace numbered tags on all existing valves that are connected to new systems or that have been revised.
 - Provide all existing valves used to extend utilities to this project with numbered tags. Review tag numbering sequence with the Owner prior to ordering tags.
 - Secure tags with heavy duty key chain and brass "S" link or with mechanically fastened plastic straps.
 - Attach to handwheel or around valve stem.
 - Number all tags and show the service of the pipe.
 - Provide two sets of laminated 8-1/2" x 11" (letter size) copies of a valve directory listing all valves, with respective tag numbers, uses, and locations. The directory shall be reviewed by the Owner and Architect/Engineer prior to laminating final copies. Laminated copies shall have brass eyelet in at least one corner for easy hanging.
- D. Pipe Markers:
- Adhesive Backed Markers: Use Brady Style 1, 2, or 3 on pipes 3" diameter and larger. Use Brady Style 4, 6, or 8 on pipes under 3" diameter. Similar styles by other listed manufacturers are acceptable. Secure all markers at both ends with a wrap of pressure sensitive tape completely around the pipe.
 - Snap-on Markers: Use Seton "Setmark" on pipes up to 5-7/8" OD. Use Seton "Setmark" with nylon or Velcro ties for pipes 6" OD and over. Similar styles by other listed manufacturers are acceptable.

3. Apply markers and arrows in the following locations where clearly visible:
 - a. At each valve.
 - b. On both sides of walls that pipes penetrate.
 - c. At least every 20 feet along all pipes.
 - d. On each riser and each leg of each "T" joint.
 - e. At least once in every room and each story traversed.

E. Equipment:

1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.
2. Fasten nameplates or plastic tags with stainless steel self-tapping screws or permanently bonding cement.
3. Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act (NAECA) of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE 90.1.

3.2 SCHEDULE

- A. Pipes to be marked shall be labeled with text shown as follows, regardless of which method or material is used:
 1. SPRINKLER WATER: White lettering; red background

END OF SECTION

SECTION 210800
COMMISSIONING OF FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Description
- B. Responsibilities
- C. Related Work
- D. Test Equipment

1.2 DESCRIPTION

- A. The purpose of this section is to specify Division 21 responsibilities in the commissioning process.
- B. The systems to be commissioned are listed in Section 019100.
- C. Commissioning requires the participation of the Division 21 Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Section 019100. Division 21 Contractor shall be familiar with all parts of Section 019100 and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

1.3 RESPONSIBILITIES

- A. Refer to Section 019100.

1.4 RELATED WORK

- A. Specific commissioning requirements are given in the following sections of these specifications. All the following sections apply to the Work of this section.
 - 1. Section 017823 - Operations and Maintenance
 - 2. Section 017900 - Demonstration and Training
 - 3. Section 019100 - Commissioning
 - 4. Section 220800 - Commissioning of Plumbing
 - 5. Section 230800 - Commissioning of HVAC
 - 6. Section 260800 - Commissioning of Electrical
 - 7. Section 270800 - Commissioning of Communications
 - 8. Section 280800 - Commissioning of Electronic Safety and Security

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. The Contractor shall provide all test equipment necessary to fulfill the testing requirements of this Division. This equipment includes, but is not limited to, the following:
 - 1. Handheld temperature meter.
 - 2. Infrared thermometer gun.
- B. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the related specifications. If not otherwise noted, the following minimum requirements apply:
 - 1. Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of +/- 0.1°F.
 - 2. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.
- C. Refer to Section 019100 for additional Division 21 requirements.

PART 3 - EXECUTION

- A. Refer to Section 019100.

END OF SECTION

SECTION 211300
FIRE PROTECTION SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pipe, Fittings, Valves, and Connections for Fire Protection System.
- B. Wet-Pipe Sprinkler System.

1.2 QUALITY ASSURANCE

- A. Welding Materials and Procedures: Conform to ASME Code.
- B. Equipment and Components: Bear UL label or marking.
- C. Valves: Bear UL label or marking. Provide manufacturer's name and pressure rating marked on valve body. Pressure rating shall match specified pipe system pressure rating. Remanufactured valves are not acceptable.
- D. Sprinkler design drawings submitted by the Contractor shall be prepared by a NICET Water-Based Fire Protection Systems Layout Level III or Level IV designer or PE.

1.3 REFERENCES

- A. ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
- B. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings, Class 150 and 300.
- C. ANSI/ASME B16.4 - Cast Iron Threaded Fittings, Class 125 and 250.
- D. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.
- E. ANSI/ASME B16.9 - Factory-made Wrought Steel Butt-Welding Fittings.
- F. ANSI/ASME B16.11 - Forged Steel Fittings, Socket-Welding and Threaded.
- G. ANSI/ASME B16.25 - Butt-Welding Ends.
- H. ANSI/ASME B36.10 - Welded and Seamless Wrought Steel Pipe.
- I. ANSI/ASME Section 9 - Welding and Brazing Qualifications.
- J. ANSI/ASTM A47 - Malleable Iron Castings.
- K. ANSI/ASTM A135 - Electric-Resistance-Welded Steel Pipe.

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- L. ANSI/AWWA C110 - Ductile Iron and Gray Iron Fittings.
- M. ANSI/AWWA C151 - Ductile Iron Pipe, Centrifugally Cast.
- N. ASME - Boiler and Pressure Vessel Code - Section IX, Welding and Brazing Requirements.
- O. ASTM A153 - Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.
- P. AWS A5.8 - Brazing Filler Metal.
- Q. AWS B2.2 - Standard for Brazing Procedure and Performance Qualification.
- R. AWS D10.9 - Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.
- S. IBC - International Building Code.
- T. MSS SP-73 - Brazing Joints for Wrought and Cast Copper Alloy Solder Joint and Pressure Fittings.
- U. NFPA 101 - Life Safety Code,
- V. NFPA 13 - Standard for the Installation of Sprinkler Systems.
- W. UL - Underwriter's Laboratory Fire Protection Equipment Directory.

1.4 SUBMITTALS

- A. Submit shop drawings per Section 210500. Indicate pipe materials, joining methods, supports, floor and wall penetration seals, sprinklers, equipment data and ratings, and hydraulic calculations.
- B. Submit detailed pipe and sprinkler layout and other calculations and forms as described in NFPA 13.
- C. Submit detailed working drawings and obtain review of them in the following order:
 - 1. Engineer/Architect
 - 2. State Fire Marshal/Authority Having Jurisdiction
 - 3. Owner's Insurance Company
- D. Working drawings shall include piping and sprinkler layout, sprinkler types and ratings, sections and elevations at critical points. Show coordination with lighting, ductwork, and diffusers, and indicate basic flow and hydraulic design information, including main location and date that the test was taken.

1.5 EXTRA STOCK

- A. Provide metal storage cabinet, wrenches for each sprinkler type, and extra sprinklers per NFPA 13 and applicable building code.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store valves and sprinklers in shipping containers, with labels in place.
- B. Provide temporary protective coating on iron and steel valves.
- C. Maintain temporary end caps and closures in place until installation.

1.7 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A. Furnish sleeves to General Contractor for placement in walls and floors. Sleeve location to be determined by the Fire Protection Contractor prior to construction. If additional sleeves are required, they shall be core drilled by the Fire Protection Contractor.

1.8 SYSTEM DESCRIPTION

- A. Contractor shall design and extend the existing following water-based fire protection systems for the areas noted on the contract documents:
 - 1. Ohio Building Wet pipe sprinkler system(s)
 - 2. Forest Building Wet pipe sprinkler system(s)
- B. Sprinkler systems shall be designed and installed according to the following standard(s):
 - 1. NFPA 13 - Standard for the Installation of Sprinkler Systems
- C. System design and installation shall include all requirements by the Authority Having Jurisdiction, local and state building codes, and Owner's insurance company in addition to the previously listed design standard(s). Those requirements shall take precedence over the contract documents in the case of discrepancies.
- D. Systems shall be hydraulically calculated in accordance with the applicable design standard(s). Contractor is responsible for final pipe sizing based on results from hydraulic calculations. Pipe sizing shown on drawings for service entrance and main risers is preliminary and for coordination purposes only.
- E. The water supply source for this project is the following:
 - 1. Public waterworks system.
 - 2. The system design shall be based on water supply information provided on the contract drawings. Supply shall be presumed to be at the point of connection to existing water supply infrastructure unless noted otherwise. The Fire Protection Contractor is responsible to verify this information and conduct all tests required. Base all pipe sizing and hydraulic calculations on flow test data no older than 12 months.
 - 3. System design shall provide a safety factor when comparing available water supply pressure versus system design pressure at design flow rate (including hose streams). The safety factor shall be the following:
 - a. 5 psig

1.9 COORDINATION DRAWINGS

- A. Reference Coordination Drawings article in Section 210500 for required fire protection systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

1.10 OPERATION AND MAINTENANCE DATA

- A. Submit manufacturers' operation and maintenance data. Include written maintenance data on components of system, servicing requirements, and record drawings.

1.11 JOB CONDITIONS

- A. Fire Protection Contractor shall determine the flow and pressure available at the service connection. The Fire Protection Contractor is responsible to verify this information and make all tests required. Base all pipe sizing and hydraulic calculations on flow test data no older than 18 months.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS - WET PIPE SPRINKLER SYSTEMS

- A. Piping - 2" and Under (Steel Pipe):
 - 1. Design Pressure: 175 psig
 - 2. Pipe: Schedule 40, black steel, ASTM A53, ASTM A795, UL. Inner wall shall be coated with an anti-MIC (microbiologically influenced corrosion) coating.
 - 3. Fittings:
 - a. Threaded:
 - 1) Cast iron, Class 125, black, UL, ANSI/ASME B16.4.
 - 2) Malleable iron, Class 150, black, UL, ANSI/ASME B16.3.
 - 3) Ductile iron, Class 150, black, UL, ANSI/ASME B16.3.
 - b. Grooved:
 - 1) Ductile iron housing ASTM A-536, Grade 65-45-12, UL, enamel coating, Grade E (Type A) EPDM molded pressure-responsive gaskets suited for 40°F to 150°F. Stainless steel bolts and nuts.
 - 4. Flanged:
 - 1) Cast iron, Class 125, black, UL, ANSI/ASME B16.1.
 - 5. Unions: Class 150 malleable iron, ANSI B16.39, ground joint with copper or copper alloy-to-iron seat.

- B. Piping - 2-1/2" and Above (Steel Pipe):
1. Design Pressure: 175 psig
 2. Pipe: Schedule 10, black steel, ASTM A135, ASTM A795, UL. Inner wall shall be coated with an anti-MIC (microbiologically influenced corrosion) coating.
 3. Joints: Grooved or flanged.
 4. Fittings:
 - a. Grooved:
 - 1) Ductile iron housing ASTM A-536, Grade 65-45-12, UL, enamel coating, Grade E (Type A) EPDM molded pressure-responsive gaskets suited for 40°F to 150°F. Stainless steel bolts and nuts.
 - b. Flanged:
 - 1) Cast iron, Class 125, black, UL, ANSI/ASME B16.1.

2.2 FLEXIBLE FIRE SPRINKLER CONNECTIONS

- A. Flexible Connection: Stainless steel hose, 175 psig max working pressure, fully welded non-mechanical fittings, stainless steel braid, maximum of 6' hose length, leak-tested with a minimum 7/8" internal corrugated hose diameter made of 304 stainless steel, end fittings made of carbon or stainless steel. Outlet of end fittings shall be 1/2" or 3/4" to match sprinkler connection. UL.
- B. Ceiling Bracket: G90 galvanized steel, direct attachment type, integrated snap-on clip ends, tamper resistance screws, removable attachment hub with set screw for attachment and adjustment of stainless steel hose.
1. Manufacturers:
 - a. Flexhead Industries
 - b. Victaulic VicFlex,
 - c. Sprinkflex
 - d. or approved equal.

2.3 VALVES

- A. Provide handwheels for gate valves. Provide gear operators for butterfly valves.
- B. Provide all connections to match pipe joints. Valves shall be same size as pipe.

2.4 EQUIPMENT

- A. Equipment shall be as scheduled on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION - PIPING

A. General Installation Requirements:

1. Coordinate piping and sprinkler locations with all other trades. Ductwork, diffusers and light fixture locations shall have priority over sprinkler piping and sprinklers.
2. Ream pipe and tube ends to full inside diameter. Remove burrs. Remove scale and foreign material, inside and outside, before assembly.
3. Die cut screw joints with full cut standard taper pipe threads.
4. Coat threads with pipe joint compound or wrap with Teflon tape.
5. Locate piping to minimize obstruction of other work.
6. Route piping in concealed spaces above finished ceiling.
7. Use full and double lengths of pipe wherever possible.
8. Slope all piping for complete drainage. Install auxiliary drains for all trapped piping per NFPA 13.
9. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
10. Comply with manufacturer's installation instructions.

B. Wall/Floor Penetration:

1. Provide sleeves when penetrating floors and walls.
2. Seal pipes passing through exterior walls with a wall seal per Section 210529. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe. Sleeves through floors shall extend minimum 1.5" above finished floor.
3. Fire seal all pipe and sleeve penetrations (both wall and floor) to maintain fire separation required without restraining pipe.

C. Installation Requirements in Electrical Rooms:

1. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment. Fire protection equipment dedicated to the electrical equipment room or space may be installed above equipment if other alternatives are not available.

D. Hangers and Supports:

1. Provide hangers and supports as required by NFPA 13 and UL, with the following exceptions:
 - a. Do not use powder driven devices, explosive devices, wooden plugs, or plastic inserts.
 - b. Do not install fasteners to carry the load in tension, unless absolutely necessary.

E. Exposed Piping:

1. Install chrome plated steel escutcheons where exposed pipes penetrate walls or floors.
2. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories.

3.2 INSTALLATION - VALVES

- A. Install gate valves with stems upright or horizontal, not inverted.
- B. Shutoff Valve:
 - 1. Provide drain valves at main shutoff valves, low points of piping and apparatus.
 - 2. Provide monitor switches on all shutoff valves.

3.3 INSTALLATION - EQUIPMENT

- A. Coordinate piping and sprinkler locations with all other trades. Ductwork, diffusers and light fixture locations shall have priority over system equipment and sprinklers.
- B. Sprinklers:
 - 1. Locate sprinklers to clear lights, ducts and diffusers. Do not run sprinkler pipes through ducts. Ductwork has priority over sprinkler pipes. Offset pipes as needed.
 - 2. Center sprinklers in two directions in ceiling tiles and provide offsets as required.
 - 3. Do not allow concealed sprinkler cover plates to be painted. Sprinkler cover plates are to be factory painted only. Do not field paint.
 - 4. Apply strippable or paper covers so concealed sprinkler cover plates do not receive field paint finish.

3.4 SYSTEMS CLEANING AND TESTING

- A. General Requirement:
 - 1. All water used for testing and remaining in the piping system shall be obtained from a potable water source.
- B. Interior Piping:
 - 1. Verify adequate water flow at the inspector's test connection.
 - 2. Flush all interior piping to remove scale and other foreign material before placing system into service.
 - 3. Hydrostatically test the entire interior piping system at a minimum of 200 psig or 50 psig more than the normal system working pressure for systems subjected to pressures more than 150 psig. Maintain test pressure for 2 hours without loss of pressure.
- C. Fire Alarm System:
 - 1. Test the alarm system by operating the inspector's test connection or the alarm test valves. Verify that the building fire alarm system activates.
 - 2. Adjust all monitor switches for proper operation.

END OF SECTION

SECTION 220500
BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Requirements applicable to all Division 22 Sections. Also refer to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

- A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.
- B. Separate contracts will be awarded for the following work:
- C. Scope of Work:
 - 1. Plumbing Work shall include, but is not necessarily limited to:
 - a. Furnish and install all items listed in the Plumbing Material List.
 - b. Extend existing domestic water piping system including cold, hot, and hot water circulating piping within the building. Insulate all piping as specified.
 - c. Extend existing gas piping system including all meter requirements.
 - d. Extend existing compressed air system.
 - e. Extend existing sanitary sewer and vent system.
 - 2. Heating Work: Refer to Section 230500 "Basic HVAC Requirements".
 - 3. Air Conditioning and Ventilating Work: Refer to Section 230500 "Basic HVAC Requirements".
 - 4. Temperature Control Work: Refer to Section 230500 "Basic HVAC Requirements".
 - 5. Fire Protection Work: Refer to Section 210500 "Basic Fire Suppression Requirements".
 - 6. Testing, Adjusting, and Balancing Work: Refer to Section 230500 "Basic HVAC Requirements".

1.3 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

- A. Definitions:
 - 1. "Mechanical Contractors" refers to the following:
 - a. Plumbing Contractor.
 - b. Heating Contractor.

- c. Air Conditioning and Ventilating Contractor.
 - d. Temperature Control Contractor.
 - e. Fire Protection Contractor.
 - f. Testing, Adjusting, and Balancing Contractor.
2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
 3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
 4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.
 5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.
 - a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.
 6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
 7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.

3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.
4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.
5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:
 - a. Light fixtures.
 - b. Gravity flow piping, including condensate.
 - c. Electrical busduct.
 - d. Sheet metal.
 - e. Electrical cable trays, including access space.
 - f. Sprinkler piping and other piping.
 - g. Electrical conduits and wireway.

C. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:
 - a. Burners.
 - b. Condensing Units.
 - c. Makeup Air Units.
 - d. Packaged Rooftop Units.
 - e. Split Systems
 - f. Furnaces
2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
3. Shall verify all existing equipment sizes and capacities where units are to be modified, moved or replaced. Contractor shall notify Architect/Engineer of any discrepancies prior to ordering new units or replacement parts, including replacements of equipment motors.
4. Temperature Control Subcontractor's Responsibility:
 - a. Wiring of all devices needed to make the Temperature Control System functional.
 - b. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Subcontractor.
 - c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

D. Electrical Contractor's Responsibility:

1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.

2. Installs and wires all remote control devices furnished by the Mechanical Contractor or Temperature Control Subcontractor when so noted on the Electrical Drawings.
3. Provides motor control and temperature control wiring, where so noted on the drawings.
4. Coordinate with the Mechanical Contractor for size of motors and/or other electrical devices involved with repair or replacement of existing equipment.
5. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
6. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.4 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, and any item that may impact coordination with other disciplines.
 - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - d. Maintenance clearances and code-required dedicated space shall be included.
 - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.
 - a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.
3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.

2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the General Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.

6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
 - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
 - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.5 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.
2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of Des Moines, Iowa's Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all State Codes.
3. Conform to Federal Act S.3874 requiring the reduction of lead in drinking water.
4. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
5. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
6. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
7. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
8. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.

E. Utility Company Requirements:

1. Secure from the appropriate private or public utility company all applicable requirements.
2. Comply with all utility company requirements.
3. Make application for and pay for all meters and metering systems required by the utility company.

F. Examination of Drawings:

1. The drawings for the plumbing work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
3. Scaling of the drawings is not sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.

5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
8. Where used in mechanical documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.
 - a. Any item listed as furnished shall also be installed, unless otherwise noted.
 - b. Any item listed as installed shall also be furnished, unless otherwise noted.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

H. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

1.6 WEB-BASED PROJECT SOFTWARE

- A. The General Contractor shall provide a web-based project software site for the purpose of hosting and managing project communication and documentation until completion of the warranty phase.
- B. The web-based project software shall include, at a minimum, the following features: construction schedule, submittals, RFIs, ASIs, construction change directives, change orders, drawing management, specification management, payment applications, contract modifications, meeting minutes, construction progress photos.

- C. Provide web-based project software user licenses for use by the Architect/Engineer. Access will be provided from the start of the project through the completion of the warranty phase.
- D. At project completion, provide digital archive of entire project in format that is readable by common desktop software applications in format acceptable to Architect/Engineer. Provide data in locked format to prevent further changes.

1.7 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

- 1. Submittals List:

Referenced Specification Section	Submittal Item
22 05 00	Owner Training Agenda
22 07 19	Plumbing Pipe Insulation
22 10 00	Plumbing Piping Systems and Valves
22 10 23	Natural Gas Piping Systems
22 10 30	Plumbing Specialties
22 15 19	Compressed Air Systems
22 40 00	Plumbing Fixtures

- B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

- 1. Transmittal: Each transmittal shall include the following:

- a. Date
- b. Project title and number
- c. Contractor's name and address
- d. Division of work (e.g., plumbing, heating, ventilating, etc.)
- e. Description of items submitted and relevant specification number
- f. Notations of deviations from the contract documents
- g. Other pertinent data

- 2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

- a. Date
- b. Project title and number
- c. Architect/Engineer
- d. Contractor and subcontractors' names and addresses
- e. Supplier and manufacturer's names and addresses
- f. Division of work (e.g., plumbing, heating, ventilating, etc.)
- g. Description of item submitted (using project nomenclature) and relevant specification number
- h. Notations of deviations from the contract documents
- i. Other pertinent data
- j. Provide space for Contractor's review stamps

3. Composition:
 - a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
 - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
 - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g., voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:
 - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
 - a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.
16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 22 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 22 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.8 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 1.
- B. Format:
 1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
 2. Submit in Excel format.
 3. Support values given with substantiating data.
- C. Preparation:
 1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
 2. Break down all costs into:
 - a. Material: Delivered cost of product with taxes paid.
 - b. Labor: Labor cost, excluding overhead and profit.
- D. Update Schedule of Values when:
 1. Indicated by Architect/Engineer.
 2. Change of subcontractor or supplier occurs.
 3. Change of product or equipment occurs.

1.9 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.
- B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.
- C. Change order work shall not proceed until authorized.

1.10 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:
 1. Fire Seal Systems

- B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.
- C. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner's Operation and Maintenance Manuals.

1.11 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.
- B. Protect equipment, components, and openings with airtight covers and exercise care at every stage of storage, handling, and installation of equipment to prevent airborne dust and dirt from entering or fouling equipment to include, but not limited to:
 - 1. Motor windings and ventilation openings.
 - 2. Bearings.
 - 3. Equipment Pipe and Accessories connection openings. (e.g. boiler connections, coil connections, etc.)
 - 4. Starter and control cabinets.
- C. Equipment and components that are visibly damaged or have been subject to environmental conditions prior to building turnover to Owner that could shorten the life of the component (for example, water damage, humidity, dust and debris, excessive hot or cold storage location, etc.) shall be repaired or replaced with new equipment or components without additional cost to the building owner.
- D. Keep all bearings properly lubricated and all belts properly tensioned and aligned.
- E. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- F. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

1.12 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.13 WARRANTY

- A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.14 INSURANCE

- A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.15 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the first manufacturer is the basis for job design and establishes the quality.
- B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections, piping and ductwork connections and arrangement, plumbing connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.
- D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractor's part or on the part of other Contractors whose work is affected.
- E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.
- F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

1.16 PROJECT COMMISSIONING

- A. The Contractor shall work with the Commissioning Agent (CxA) as described in Section 01 91 00 and 22 08 00 and provide all services as described in the Commissioning Plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 EXCAVATION, FILL, BACKFILL, COMPACTION

- A. General:
 - 1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found at the following website (<https://call811.com/>) or by calling 811.
 - 2. The Contractor shall do all excavating, filling, backfilling and compacting associated with the work.
- B. Excavation:
 - 1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
 - 2. Where excavations are made in error below foundations, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer, shall be placed in such excess excavations. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
 - 3. Trim bottom and sides of excavations to grades required for foundations.
 - 4. Protect excavations against frost and freezing.
 - 5. Take care in excavating not to damage surrounding structures, equipment, or buried pipe. Do not undermine footing or foundation.
 - 6. Perform all trenching in a manner to prevent cave-ins and risk to workers.
 - 7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.

8. Where satisfactory bearing soil for foundations is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately, and no further work shall be done until further instructions are given by the Architect/Engineer or their representative.

C. Dewatering:

1. Contractor shall furnish, install, operate, and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Use great care in making installations near underground obstruction.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

E. Fill and Backfilling:

1. Utilities Bedding: Lay underground utilities on minimum of 6" sand bedding or CA6 crushed stone. Compact bedding under utilities smooth, with no sharp edges protruding, to protect the utilities from puncture. Shape bedding to provide continuous support for bells, joints, and barrels of utilities and for joints and fittings.
2. Envelope Around Utilities to 6" Above Utilities: Place sand or CA6 crushed stone to a height of 6" over utilities in 6" layers. After connection joints are made, any misalignment can be corrected by tamping backfill around the utilities.
3. Backfill From 6" Above Utilities to Earthen Grade: Place all backfill materials above the utilities in uniform layers not exceeding 6" deep.
4. Backfill From 6" Above Utilities to Below Slabs or Paved Area: Where the sand or CA6 crushed stone fill and backfill will ultimately be under a building, floor or paving, each layer of backfill materials shall be compacted to 95% of the maximum density determined by AASHTO Designation T 99 or ASTM Designation D 698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content determined by AASHTO T 99 or ASTM D 698 test.
5. Backfill Materials:
 - a. Sand, CA6: Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
 - b. Native Soil: Native soil materials may be used as backfill if approved by the Geotechnical Engineer. Native soils shall be free of rock or gravel larger than 3" in any dimension and shall be free of debris, waste, frozen materials, vegetation, high void content, and other deleterious materials. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
 - c. Flowable Fill: Cementitious, self-leveling, self-compacting slurry as defined by the ACI with compressive strength of 50-100psi at 28 days; consisting of a mixture of fine aggregate or filler, water and cementitious materials. Filler material consist of sand, fly ash, spent foundry sand, quarry fines, baghouse dust. Cementitious materials consist of Portland cement, pozzolanic materials, and self-cementing materials. Flowable fill may be placed in a pour instead of 6" layers noted above.
6. Water shall not be permitted to rise in unbackfilled trenches.
7. Dispose of excess excavated earth as directed.

8. Backfill all trenches and excavations immediately after installing utilities or removal of forms, unless other protection is provided.
9. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Fill and backfill materials shall be spread in 6 inch uniform horizontal layers with each layer compacted separately to required density.

F. Surface Restoration:

1. Where trenches are cut through existing graded, planted, or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.

3.3 ARCHITECT/ENGINEER OBSERVATION OF WORK

A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:

1. Placing fill over underground and underslab utilities.
2. Covering exterior walls, interior partitions and chases.
3. Installing hard or suspended ceilings and soffits.

B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation

1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
 - a. Pipe insulation is installed and fully sealed.
 - b. Pipe wall penetrations are sealed.
 - c. Pipe identification and valve tags are installed.
2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

3.4 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 1.
- B. Final Jobsite Observation:
 - 1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
 - 2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
 - 3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
 - 4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.
- C. Before final payment is authorized, this Contractor must submit the following:
 - 1. Operation and maintenance manuals with copies of approved shop drawings.
 - 2. Record documents including marked-up drawings and specifications.
 - 3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
 - 4. Start-up reports on all equipment requiring a factory installation inspection or start-up.
 - 5. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site; receipt by Architect/Engineer required prior to final payment approval.

3.5 OPERATION AND MAINTENANCE MANUALS

- A. General:
 - 1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
 - 2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.
- B. Electronic Submittal Procedures:
 - 1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
 - 2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
 - 3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.

4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div22.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div22.contractor.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.
16. Owner and Contractor attendance list for domestic water systems operation, maintenance, and flushing training.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVES

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. Contractor shall make a DVD video recording of instructions to the Owner while explaining the system so additional personnel may view the instructions at a later date. The video recording shall be the property of the Owner.
- D. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- E. The instructions shall include:
 - 1. Explanation of all system flow diagrams.
 - 2. Maintenance of equipment.
 - 3. Start-up procedures for all major equipment.
 - 4. Explanation of seasonal system changes.
 - 5. Explanation of Owner's Responsibilities to operate, maintain, and flush domestic water system (i.e., ASHRAE Standard 188).
- F. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can attend if desired.
- G. Minimum hours of instruction for each item shall be:
 - 1. All Domestic Water Systems operation, maintenance and flushing of all fixtures and dead legs - 1 hours
- H. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of two weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.
- I. Operating Instructions:
 - 1. Contractor is responsible for all instructions to the Owner's representatives for the mechanical and control systems.
 - 2. If the Contractor does not have staff that can adequately provide the required instructions the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 SYSTEM STARTING AND ADJUSTING

- A. The plumbing systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final adjustments as required.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.
- C. Contractor shall adjust the plumbing systems and controls at season changes during the one year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.
- D. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.
- E. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.8 RECORD DOCUMENTS

- A. The following paragraphs supplement Division 1 requirements.
- B. Maintain at the job site a separate and complete set of plumbing drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.
- C. Mark drawings to indicate revisions to piping size and location, both exterior and interior; including locations devices, requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located; Change Orders; concealed control system devices.
- D. Before completion of the project, a set of reproducible plumbing drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.
- E. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.
- F. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.

- G. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

3.9 PAINTING

- A. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.
- B. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, the Contractor shall have the equipment and all its supports, hangers, etc., painted to match the room decor.
- C. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.
- D. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer the color preference and furnish this color.
- E. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.
- F. Paint all outdoor exposed natural gas piping the color selected by Owner or Architect/Engineer.
- G. After surfaces have been thoroughly cleaned and are free of oil, dirt, and other foreign matter; paint all pipes and equipment with the following:
 - 1. Bare Metal Surfaces - Apply one coat of primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
 - 2. Insulated Surfaces - Paint insulation jackets with two coats of semi-gloss acrylic latex paint.

3.10 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.
- B. Clean all areas where moisture is present. Immediately report any mold, biological growth, or water damage.
- C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed piping, hangers, and accessories.
- D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.11 SPECIAL REQUIREMENTS

- A. Contractor shall coordinate the installation of all equipment, valves, dampers, operators, etc., with other trades to maintain clear access area for servicing.
- B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

3.12 IAQ MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

- A. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:
 - 1. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:
 - a. Minimizing the amount of dust generated.
 - b. Reducing solvent fumes and VOC emissions.
 - c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.
 - d. Protect stored on-site and installed absorptive materials from moisture damage.
 - 2. Request that the Owner designate an IAQ representative.
 - 3. Review and receive approval from the Owner's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
 - 4. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
 - 5. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner's IAQ representative during unoccupied periods.
 - 6. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
 - 7. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
 - 8. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings Under Construction".

3.13 UTILITY REBATE

- A. Submit utility rebate forms, where offered at project location, with rebate items completed. Rebate may include lighting, lighting controls, variable speed drives, heat pumps, package terminal A/C, air conditioners, chillers, water heaters, programmable thermostats, and motors.
 - 1. Contractor must submit notification of any value engineering or product substitution that will affect the utility rebate amount prior to approval.

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READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All pumps operating and balanced.
3. All plumbing fixtures installed and caulked.
4. Pipe insulation complete, pipes labeled, and valves tagged.
5. Owner and Contractor attendance list for domestic water systems operation, maintenance, and flushing training.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

END OF SECTION

SECTION 220505

PLUMBING DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Mechanical Demolition.
- B. Cutting and Patching.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall be as specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. THE DRAWINGS ARE INTENDED TO INDICATE THE GENERAL SCOPE OF WORK AND DO NOT SHOW EVERY PIPE, DUCT, OR PIECE OF EQUIPMENT THAT MUST BE REMOVED. THE CONTRACTOR SHALL VISIT THE SITE AND VERIFY CONDITIONS PRIOR TO SUBMITTING A BID.
- B. Where walls, ceilings, etc., are shown as being removed on general drawings, the Contractor shall remove all mechanical equipment, devices, fixtures, piping, ducts, systems, etc., from the removed area.
- C. Where ceilings, walls, partitions, etc., are temporarily removed and replaced by others, This Contractor shall remove, store, and replace equipment, devices, fixtures, pipes, ducts, systems, etc.
- D. Verify that abandoned utilities serve only abandoned equipment or facilities. Extend services to facilities or equipment that shall remain in operation following demolition.
- E. Coordinate work with all other Contractors and the Owner. Schedule removal of equipment to avoid conflicts.
- F. This Contractor shall verify all existing equipment sizes and capacities where equipment is scheduled to be replaced or modified, prior to ordering new equipment.
- G. Bid submittal shall mean the Contractor has visited the project site and verified existing conditions and scope of work.

3.2 PREPARATION

- A. Disconnect plumbing systems in walls, floors, and ceilings scheduled for removal.
- B. Provide temporary connections to maintain existing systems in service during construction. When work must be performed on operating equipment, use personnel experienced in such operations.
- C. Existing Plumbing System: Maintain service to all plumbing fixtures until new piping is installed. Obtain permission from Owner at least 48 hours before shutting down system for any reason. Make changeover to new piping with minimum outage. Do not disconnect any roof drainage piping until new piping is in place and operational.

3.3 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

- A. Demolish and extend existing plumbing work under provisions of Division 2 and this Section.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned piping to source of supply and/or main lines.
- D. Remove exposed abandoned pipes, including abandoned pipes above accessible ceilings. Cut pipes above ceilings, below floors and behind walls. Cap remaining lines. Repair building construction to match original. Remove all clamps, hangers, supports, etc. associated with pipe and duct removal.
- E. Disconnect and remove mechanical devices and equipment serving equipment that has been removed.
- F. Repair adjacent construction and finishes damaged during demolition and extension work.
- G. Extend existing installations using materials and methods compatible with existing installations, or as specified.
- H. Remove unused sections of domestic water piping back to mains and cap. Capped pipe shall be less than 2 feet from main to prevent "dead legs".
- I. Temporarily cap all openings to the sanitary and vent system to prevent odor from entering the work area and building.

3.4 CUTTING AND PATCHING

- A. This Contractor is responsible for all penetrations of existing construction required to complete the work of this project. Refer to Section 220529 for additional requirements.
- B. Penetrations in existing construction should be reviewed carefully prior to proceeding with any work.
- C. Penetrations shall be neat and clean with smooth and/or finished edges. Core drill where possible for clean opening.

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- D. Repair existing construction as required after penetration is complete to restore to original condition. Use similar materials and match adjacent construction unless otherwise noted or agreed to by the Architect/Engineer prior to start of work.
- E. 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.

3.5 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment which remain or are to be reused.
- B. Clean all systems adjacent to project which are affected by the dust and debris caused by this construction.
- C. PLUMBING ITEMS REMOVED AND NOT RELOCATED REMAIN THE PROPERTY OF THE OWNER. CONTRACTOR SHALL PLACE ITEMS RETAINED BY THE OWNER IN A LOCATION COORDINATED WITH THE OWNER. THE CONTRACTOR SHALL DISPOSE OF MATERIAL THE OWNER DOES NOT WANT TO REUSE OR RETAIN FOR MAINTENANCE PURPOSES.

3.6 SPECIAL REQUIREMENTS

- A. Review locations of all new penetrations in existing floor slabs or walls. Determine construction type and review for possible interferences. Bring all concerns to the attention of the Architect/Engineer before proceeding.

END OF SECTION

SECTION 220529

PLUMBING SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Hangers, Supports, and Associated Anchors.
- B. Cutting of Openings.
- C. Escutcheon Plates and Trim.

1.2 REFERENCES

- A. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
- B. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.
- C. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices

1.3 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

PART 2 - PRODUCTS

2.1 HANGER RODS

- A. Hanger rods for single rod hangers shall conform to the following:
 - 1. Steel, Cast Iron, Pipe:
 - a. Hanger Rod Diameter:
 - 1) 2-1/2" and smaller: 3/8"
 - 2) 3" through 3-5/8": 3/8"
 - 3) 4" through 6": 1/2"
 - 2. Copper Pipe:
 - a. Hanger Rod Diameter:
 - 1) 2-1/2" and smaller: 3/8"
 - 2) 3" through 3-5/8": 3/8"

- 3) 4" through 6": 1/2"
- 4) 8": 5/8"

- B. Rods for double rod hangers may be reduced one size. Minimum rod diameter is 3/8 inches.
- C. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

2.2 PIPE AND STRUCTURAL SUPPORTS

A. General:

- 1. Pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS SP-58, -69, and -89 (where applicable).
- 2. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Refer to insulation specifications for materials and additional information.
- 3. Copper piping located in an exposed area, including indirect waste piping in janitor's closets, shall use split ring standoff hangers for copper tubing. Support shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, nVent Cushion Clamp or Eaton Vibra-Clamp. Use electro-galvanized or more corrosion resistant and threaded rod for floor applications. Use anchors applicable to the wall type with corrosion resistant threaded rod for wall applications.

a. Products:

- 1) nVent/M-Co Model #456
- 2) Eaton Fig. 3198HCT
- 3) Anvil Fig. CT138R

B. Vertical Supports:

- 1. Support and laterally brace vertical pipes at every floor level in multi-story structures, unless otherwise noted by applicable codes, but never at intervals over 15 feet Support vertical pipes with riser clamps installed below hubs, couplings, or lugs. Provide sufficient flexibility to accommodate expansion and contraction to avoid compromising fire barrier penetrations or stressing piping at fixed takeoff locations.

a. Products:

- 1) Eaton Fig B3373 Series
- 2) nVent 510 Series
- 3) Anvil Fig. 90

- 2. Wall supports shall be used where vertical height of structure exceeds minimum spacing requirements. Install wall supports at same spacing as hangers or strut supports along vertical length of pipe runs. Wall supports shall be coordinated with the Structural Engineer.

C. Hangers and Clamps:

1. Oversize all hangers, clamps, and supports on insulated piping to allow insulation and jacket to pass through unbroken. This applies to both hot and cold pipes.
2. Hangers in direct contact with bare copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, nVent Cushion Clamp or Eaton Vibra-Clamp within their temperature limits of -65°F to +275°F.
3. Vertical cold pipe drops and rough-ins to fixtures shall be supported by insulated pipe clamps to prevent thermal bridging and condensation.
4. On all insulated piping, provide a semi-cylindrical metallic shield and vapor barrier jacket.
5. Unless otherwise indicated, hangers shall be as follows:
 - a. Clevis Type: Bare Metal Pipe, Insulated Cold Pipe, Insulated Hot Pipe - 3 inches & Smaller
 - 1) Products: Bare Steel or Insulated Pipe:
 - a) Anvil Fig. 260
 - b) Eaton Fig. 3100
 - c) nVent Model 400
 - b. Adjustable Swivel Ring Type: Bare Metal Pipe - 4 inches and Smaller
 - 1) Products: Bare Steel Pipe:
 - a) Anvil Fig. 69
 - b) Eaton Fig. B3170NF
 - c) nVent Model 115
6. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per manufacturer's installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.
 - a. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

D. Upper (Structural) Attachments:

1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:
 - a. Steel Structure Clamps: C-Type Wide Flange Beam Clamps (for use on top and/or bottom of wide flanges. Not permitted for use with bar-joists.):
 - 1) Products:
 - a) Anvil Fig. 86
 - b) Eaton Fig. B3033/B3034
 - c) nVent Model 300 & 310

- b. Steel Structure Clamps: Scissor Type Beam Clamps (for use with bar-joists and wide flange):
 - 1) Products:
 - a) Anvil Fig. 228, 292
 - b) Eaton Fig. B3054
 - c) nVent Model 360
- c. Concentrically Loaded Open Web Joist Hangers (for use with bar joists):
 - 1) Products:
 - a) MCL. M1, M2 or M3

2.3 OPENINGS IN FLOORS, WALLS AND CEILINGS

- A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.
- B. Coordinate all openings with other Contractors.
- C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.
- D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at Contractor's expense.
- E. Do not cut structural members without written approval of the Architect or Structural Engineer.
- F. Exposed Housing Penetrations: Seal pipes with surface temperature below 150°F, penetrating housings with conical stepped, white silicone, EPDM or neoprene pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots or Pipetite.

2.4 ESCUTCHEON PLATES AND TRIM

- A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.
- B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.
- C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes pipe openings.

2.5 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 PLUMBING SUPPORTS AND ANCHORS

- A. General Installation Requirements:

1. Install all items per manufacturer's instructions.
2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
4. Supports shall extend directly to building structure. Do not support piping from duct hangers unless coordinated with Sheet Metal Contractor prior to installation. Do not allow lighting or ceiling supports to be hung from piping supports.

- B. Supports Requirements:

1. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
2. Set all concrete inserts in place before pouring concrete.
3. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
4. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
5. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

- C. Pipe Requirements:

1. Support all piping and equipment, including valves, strainers, traps and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
4. Piping shall not introduce strains or distortion to connected equipment.
5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.
6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.
8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.

- D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:
1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
 2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:
 - a. The hanger is attached within 6" from a web/chord joint.
 - b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.
 3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
 4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.
- E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.
- F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.
- H. Steel/Concrete Structure: Spacing of hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:
1. Steel and Fiberglass (Std. Weight or Heavier - Liquid Service):
 - a. Maximum Spacing:
 - 1) 1-1/4" & under: 7'-0"
 - 2) 1-1/2": 9'-0"
 - 3) 2": 10'-0"
 - 4) 2-1/2": 11'-0"
 - 5) 3": 12'-0"
 - 6) 4" & larger: 12'-0"
 2. Steel (Std. Weight or Heavier - Vapor Service):
 - a. Maximum Spacing:
 - 1) 1-1/4" and under: 9'-0"
 - 2) 1-1/2": 12'-0"
 - 3) 2" & larger: 12'-0"

3. Hard Drawn Copper & Brass (Liquid Service):

a. Maximum Spacing:

- 1) 3/4" and under: 5'-0"
- 2) 1": 6'-0"
- 3) 1-1/4": 7'-0"
- 4) 1-1/2": 8'-0"
- 5) 2": 8'-0"
- 6) 2-1/2": 9'-0"
- 7) 3": 10'-0"
- 8) 4": 12'-0"
- 9) 6": 12'-0"

4. Hard Drawn Copper & Brass (Vapor Service):

a. Maximum Spacing:

- 1) 3/4" & under: 7'-0"
- 2) 1": 8'-0"
- 3) 1-1/4": 9'-0"
- 4) 1-1/2": 10'-0"
- 5) 2": 11'-0"
- 6) 2-1/2" & larger: 12'-0"

- I. Installation of hangers shall conform to MSS SP-58, -69, -89, and the applicable Plumbing Code.

END OF SECTION

SECTION 220530

ROOF SUPPORT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Rooftop Pipe Support

1.2 QUALITY ASSURANCE

- A. Manufacturer:
 - 1. System Supports/Restraints: Company specializing in the manufacture of products specified in this section.
- B. Installer: Installed by Contractor.

1.3 REFERENCES

- A. International Building Code 2021

1.4 SUBMITTALS

- A. Submit under provisions of Section 220500.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, protect and handle products to site. Accept material on site in factory containers and packing. Inspect for damage. Protect from damage and contamination by maintaining factory packaging until installation. Follow manufacturer's instructions for storage.

1.6 COORDINATION

- A. Coordinate layout and installation of anchoring with building structural systems and architectural features, and with mechanical, fire-protection, electrical and other building features in the vicinity.

1.7 WARRANTY

- A. Provide one-year warranty on parts and labor for manufacturer defects and installation workmanship.

PART 2 - PRODUCTS

2.1 ROOF PIPING SUPPORTS

- A. Non-Penetrating Pillow Block Supports:
 - 1. Provide pre-fabricated non-penetrating pillow block roof pipe supports for all piping installed on the roof.
 - 2. Pillow block base shall be UV resistant polycarbonate rounded to prevent damage to the roof, and drainage holes shall prevent ponding of water in the support.
 - 3. Acceptable Products:
 - a. Anvil International HBS-Base Series
 - b. Cooper B-Line Dura-Blok
 - c. Erico Caddy Pyramid 50, 150, 300, or 600 (to match load)
 - d. Miro Industries 1.5, 3-R, 4-R or 5-R (to match pipe)

PART 3 - EXECUTION

3.1 GENERAL

- A. Install all items per manufacturer's instructions.
- B. Piping crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the pipe, equipment connections, or support connections. Pipe offsets, loops, anchors, and guides shall be installed as required to provide required motion capability and limit motion of adjacent piping.
- C. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- D. Supports shall extend directly to building structure.
- E. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the drawings as being by others.
- F. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.

3.2 ROOF PIPING SUPPORTS

- A. Roof Supports: Install per manufacturer's requirements. Coordinate with Roofing Contractor.
- B. Install roof pipe supports to resist wind movement per manufacturer's recommendations. Method of securing base to roof shall be compatible with roofing materials.
- C. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

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- D. Support all piping and equipment, including valves, strainers, traps and other specialties and accessories, to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
- E. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
- F. Support piping at equipment and valves so it can be disconnected and removed without further supporting the piping.
- G. Piping shall not introduce strains or distortion to connected equipment.
- H. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, and at equipment connections and heavy fittings.
- I. Spacing: Refer to Supports and Anchors section for pipe spacing requirements.

END OF SECTION

SECTION 220553
PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Identification of products installed under Division 22.

1.2 REFERENCES

- A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 220500. Include list of items identified, wording, letter sizes, and color coding.
- B. Include valve chart and schedule listing valve tag number, location, function, and valve manufacturer's name and model number.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 1. 3M
- 2. Bunting
- 3. Calpico
- 4. Craftmark
- 5. Emedco
- 6. Kolbi Industries
- 7. Seton
- 8. W. H. Brady
- 9. Marking Services

2.2 MATERIALS

- A. All pipe markers (purchased or stenciled) shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

OD of Pipe or Insulation	Marker Length	Size of Letters
Up to and including 1-1/4"	8"	1/2"
1-1/2" to 2"	8"	3/4"
2-1/2" to 6"	12"	1-1/4"

Plastic tags may be used for outside diameters under 3/4"

- B. Plastic Nameplates: Laminated three-layer phenolic with engraved black, 1/4" minimum letters on light contrasting background.
- C. Plastic Tags: Minimum 1-1/2" square or round laminated three-layer phenolic with engraved, 1/4" minimum black letters on light contrasting background.
- D. Vinyl Pipe Markers: Colored vinyl with permanent pressure sensitive adhesive backing.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all products per manufacturer's recommendations.
- B. Degrease and clean surfaces to receive adhesive for identification materials.
- C. Valves:
- All valves (except shutoff valves at equipment) shall have numbered tags.
 - Provide or replace numbered tags on all existing valves that are connected to new systems or that have been revised.
 - Provide all existing valves used to extend utilities to this project with numbered tags. Review tag numbering sequence with the Owner prior to ordering tags.
 - Secure tags with heavy duty key chain and brass "S" link or with mechanically fastened plastic straps.
 - Attach to handwheel or around valve stem.
 - Number all tags and show the service of the pipe.
 - Provide two sets of laminated 8-1/2" x 11" (letter size) copies of a valve directory listing all valves, with respective tag numbers, uses, and locations. The directory shall be reviewed by the Owner and Architect/Engineer prior to laminating final copies. Laminated copies shall have brass eyelet in at least one corner for easy hanging.
- D. Pipe Markers:
- Adhesive Backed Markers: Use Brady Style 1, 2, or 3 on pipes 3" diameter and larger. Use Brady Style 4, 6, or 8 on pipes under 3" diameter. Similar styles by other listed manufacturers are acceptable. Secure all markers at both ends with a wrap of pressure sensitive tape completely around the pipe.
 - Snap-on Markers: Use Seton "Setmark" on pipes up to 5-7/8" OD. Use Seton "Setmark" with nylon or Velcro ties for pipes 6" OD and over. Similar styles by other listed manufacturers are acceptable.

3. Apply markers and arrows in the following locations where clearly visible:
 - a. At each valve.
 - b. On both sides of walls that pipes penetrate.
 - c. At least every 20 feet along all pipes.
 - d. On each riser and each leg of each "T" joint.
 - e. At least once in every room and each story traversed.

E. Equipment:

1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.
2. Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act (NAECA) of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE 90.1.

3.2 SCHEDULE

- A. Pipes to be marked shall be labeled with text as follows, regardless of which method or material is used:
1. CONDENSATE DRAIN: White lettering; green background
 2. COMPRESSED AIR: White lettering; green background
 3. DOMESTIC COLD WATER: White lettering; green background
 4. DOMESTIC HOT WATER - 115°F: White lettering; green background
 5. DOMESTIC HOT WATER CIRCULATING - 115°F: White lettering; green background
 6. SANITARY SEWER: Black lettering; yellow background
 7. VENT: Black lettering; yellow background
 8. NATURAL GAS: Black lettering; yellow background

END OF SECTION

SECTION 220719
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Piping Insulation.
- B. Insulation Jackets.

1.2 QUALITY ASSURANCE

- A. Materials: Listed and labeled for flame spread/smoke developed rating of no more than 25/50 when tested per ASTM E84 or UL 723 as required by code. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

1.3 REFERENCES

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. ANSI/ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.
- C. ANSI/ASTM C534 - Elastomeric Foam Insulation.
- D. ASTM C591 - Unfaced Preformed Rigid Cellular Polyisocyanurate Insulation.
- E. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
- F. ASTM C1729 - Standard Specification for Aluminum Jacketing for Insulation.
- G. ASTM E84 - Surface Burning Characteristics of Building Materials.
- H. NFPA 255 - Surface Burning Characteristics of Building Materials.
- I. UL 723 - Surface Burning Characteristics of Building Materials.

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- J. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.

1.4 SUBMITTALS

- A. Submit shop drawings per Section 220500. Include product description, list of materials and thickness for each service, and locations.

PART 2 - PRODUCTS

2.1 INSULATION

- A. Type A: Glass fiber; ANSI/ASTM C547; 0.24 maximum 'K' value at 75°F; non-combustible. All-purpose polymer or polypropylene service jacket, listed and labeled at no more than 25/50 when tested per ASTM E84 or UL 723 as required by code.
- B. Type B: Flexible elastomeric foam insulation; closed-cell, sponge or expanded rubber (polyethylene type is not permitted); ANSI/ASTM C534 Grade 1 Type I for tubular materials; flexible plastic; 0.25 maximum 'K' value at 75°F, listed and labeled at no more than 25/50 when tested per ASTM E84 or UL 723 as required by code. Maximum 1" thick per layer where multiple layers are specified.
- C. Type C: Molded rigid cellular glass; ANSI/ASTM C-552; 0.29 maximum 'K' value at 75°F; density 7.3lb/ft; minimum compressive strength 90 psi parallel to rise; moisture resistant, non-combustible; suitable for -100°F to +900°F. For below grade installations, use asphaltic mastic paper vapor barrier jacket. Use self-seal all-purpose polymer or polypropylene service jacket for above grade installations.

2.2 JACKET COVERINGS

- A. Aluminum Jackets: ASTM C1729; 0.016" thick (thicker where required by ASTM C1729); stucco embossed finish with Z edge seams and aluminum bands for outdoor use. Where colored jacket covers are called for, provide factory-applied hard film acrylic paint in color selected by Architect.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Install insulation after piping has been tested. Pipe shall be clean, dry and free of rust before applying insulation.

3.2 INSTALLATION

- A. General Installation Requirements:
 - 1. Install materials per manufacturer's instructions, building codes and industry standards.
 - 2. Continue insulation with vapor barrier through penetrations. This applies to all insulated piping. Maintain fire rating of all penetrations.
- B. Insulated Piping Operating Below 60°F:
 - 1. Insulate fittings, valves, unions, flanges, strainers, flexible connections, flexible hoses, and expansion joints. Seal all penetrations of vapor barrier.
 - 2. On piping operating below 60°F in locations that are not mechanically cooled (e.g., penthouses, mechanical rooms, tunnels, chases at exterior walls, etc.), Type B insulation shall be used.
 - 3. All balance valves with fluid operating below 60°F shall be insulated with a removable plug wrapped with vapor barrier tape to allow reading and adjusting of the valve.
- C. Insulated Piping Operating Between 60°F and 140°F:
 - 1. Do not insulate flanges and unions, but bevel and seal ends of insulation at such locations. Insulate all fittings, valves and strainers.
- D. Exposed Piping:
 - 1. Locate and cover seams in least visible locations.
 - 2. Where exposed insulated piping extends above the floor, provide a sheet metal guard around the insulation extending 12" above the floor. Guard shall be 0.016" cylindrical smooth or stucco aluminum and shall fit tightly to the insulation.
 - 3. On exposed piping serving kitchen equipment or plumbing fixtures, the piping shall be insulated unless local code allows it to be uninsulated. In no instance should the uninsulated portion of the piping be more than 4ft in developed length.

3.3 SUPPORT PROTECTION

- A. Provide a shield on all insulated piping at each support between the insulation jacket and the support.
- B. On all insulated piping greater than 1-1/2", provide shield with insulation insert of same thickness and contour as adjoining insulation at each support, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Inserts shall be as follows:
 - 1. The insert shall be suitable for planned temperatures, be suitable for use with specific pipe material, and shall be a minimum 180° cylindrical segment the same length as metal shields. Inserts shall be:
 - a. Cellular glass (Type C) (for all temperature ranges) with a minimum compressive strength of 90 psi is acceptable for pipe sizes 14" and below. For pipe sizes larger than 14", provide rolled steel plate in addition to the shield.
 - b. Molded hydrous calcium silicate (Type D) (only use for pipes with operating temperatures above 90°F, with a minimum compressive strength of 100 psi is acceptable for pipe sizes 14" and below. For pipe sizes larger than 14", provide rolled steel plate in addition to the shield.

- c. Polyisocyanurate insulation (Type E) (for pipes below 300°F with a minimum compressive strength of 24 psi is acceptable for pipe sizes 3" and below, minimum 60 psi for pipe sizes 4" to 10". For pipe sizes larger than 10", provide rolled steel plate in addition to the shield Where insulation is installed on piping located within return air plenums and mechanical rooms, insulation shall be listed and labeled at no more than 25/50 when tested per ASTM E84 or UL 723 as required by code.
- d. As an alternative to separate pipe insulation insert and saddle, properly sized manufactured integral rigid insulation insert and shield assemblies may be used.
 - 1) Products:
 - a) Buckaroo CoolDry
 - b) Cooper/B-Line Fig. B3380 through B3384
 - c) Pipe Shields A1000, A2000
- e. Insulation Couplings:
 - 1) Molded thermoplastic slip coupling, -65°F to 275°F, sizes up to 4-1/8" OD, and receive insulation thickness up to 1". Suitable for use indoors or outdoors with UV stabilizers. Vertical insulation riser clamps shall have a 1,000lb vertical load rating. On cold pipes operating below 60°F, cover joint and coupling with vapor barrier mastic to ensure continuous vapor barrier.
 - 2) PET thermoplastic foam load bearing core with elastomeric foam ends and lap-seal jacket.
 - 3) Horizontal Strut Mounted Insulated Pipe Manufacturers:
 - a) Klo-Shure or equal
 - b) Armafix Ecolight
 - 4) Vertical:
 - a) Manufacturers: Klo-Shure Titan or equal
- f. Rectangular blocks, plugs, or wood material are not acceptable.
- g. Temporary wood blocking may be used by the Piping Contractor for proper height; however, these must be removed and replaced with proper inserts by the Insulation Contractor. Refer to Supports and Anchors specification section for additional information.

C. Neatly finish insulation at supports, protrusions, and interruptions.

D. Install metal shields between all hangers or supports and the pipe insulation. Shields shall be galvanized sheet metal, half-round with flared edges. Adhere shields to insulation. On cold piping, seal the shields vapor-tight to the insulation as required to maintain the vapor barrier, or add separate vapor barrier jacket.

E. Shields shall be at least the following lengths and gauges:

Pipe Size	Shield Size
1/2" to 3-1/2"	12" long x 18 gauge
4"	12" long x 16 gauge
5" to 6"	18" long x 16 gauge

- F. Elastomeric foam insulation shields/saddle; molded thermoplastic rigid pipe saddle sized for insulation outside diameter. Length as indicated above.
- G. Minimum 1/4" rolled galvanized steel plates shall be provided in addition to the sleeves as reinforcement on large pipes to reduce point loading on roller, trapeze hanger and strut support locations depending on insulation compressive strength. Refer to section above for exact locations.

3.4 INSULATION

A. Type A Insulation:

1. All Service Jackets: Seal all longitudinal joints with self-seal laps using a single pressure sensitive adhesive system. Do not staple.
2. Insulation without self-seal lap may be used if installed with Benjamin Foster 85-20 or equivalent Chicago Mastic, 3M or Childers lap adhesive.
3. Apply insulation with laps on top of pipe.
4. Fittings, Valve Bodies and Flanges: For 4" and smaller pipes, insulate with 1 lb. density insulation wrapped under compression to a thickness equal to the adjacent pipe insulation. For pipes over 4", use mitered segments of pipe insulation. Finish with preformed plastic fitting covers. Secure fitting covers with pressure sensitive tape at each end. Overlap tape at least 2" on itself. For pipes operating below 60°F seal fitting covers with vapor retarder mastic in addition to tape.

B. Type B Insulation:

1. Install per manufacturer's instructions or ASTM C1710.
2. Elastomeric Cellular Foam: Where possible, slip insulation over the open end of pipe without slitting. Seal all butt ends, longitudinal seams, and fittings with adhesive. At elbows and tees, use mitered connections. Do not compress or crush insulation at cemented joints. Joints shall be sealed completely and not pucker or wrinkle. Exterior installations shall contain factory applied polymeric, moisture, and UV resistant covering with ends sealed with adhesive and similar cover; or Contractor shall paint the outside of outdoor insulation with two coats of latex enamel paint recommended by the manufacturer.
3. Insulation Installation on Straight Pipes and Tubes:
 - a. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 - b. Insulation must be installed in compression to allow for expansion and contraction. Insulation shall be pushed onto the pipe, never pulled. Stretching of insulation may result in open seams and joints.
4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed sections of same material as straight segments of pipe insulation when available.
 - b. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 - c. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

C. Type C Insulation:

1. Seal all longitudinal joints with manufacturer approved adhesive. Secure butt joint strips in a similar manner.
2. Insulate fittings with prefabricated fittings.

3.5 JACKET COVER INSTALLATION

A. Metal Covering:

1. Provide vapor barrier as specified for insulation type. Cover with aluminum jacket covering with seams located on the bottom of horizontal piping. Include fittings, joints and valves.
2. Seal all interior and exterior butt joints with metal draw bands and sealant. Seal all exterior joints watertight.
3. Interior joints do not need to be sealed.
4. Use metal covering on the following pipes:
 - a. All exposed piping in finished spaces unless noted otherwise on the drawings.
 - b. All exposed piping in unfinished areas as noted on drawings (e.g., storage rooms, janitor's closets, utility rooms, etc.).
 - c. All exposed piping in rooms below 8'-0" above floor.
 - d. All exposed piping in mechanical rooms that is subject to damage from normal operations. (Example: Piping that must be stepped over routinely.)

3.6 SCHEDULE

- A. Refer to drawings for insulation schedule.

END OF SECTION

SECTION 220800
COMMISSIONING OF PLUMBING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Description
- B. Responsibilities
- C. Related Work
- D. Test Equipment

1.2 DESCRIPTION

- A. The purpose of this section is to specify Division 22 responsibilities in the commissioning process.
- B. The systems to be commissioned are listed in Section 019100.
- C. Commissioning requires the participation of the Division 22 Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Section 019100. Division 22 Contractor shall be familiar with all parts of Section 019100 and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

1.3 RESPONSIBILITIES

- A. Refer to Section 019100.

1.4 RELATED WORK

- A. Specific commissioning requirements are given in the following sections of these specifications. All the following sections apply to the Work of this section.
 - 1. Section 017823 - Operations and Maintenance
 - 2. Section 017900 - Demonstration and Training
 - 3. Section 019100 - Commissioning
 - 4. Section 210800 - Commissioning of Fire Suppression
 - 5. Section 230800 - Commissioning of HVAC
 - 6. Section 260800 - Commissioning of Electrical
 - 7. Section 270800 - Commissioning of Communications
 - 8. Section 280800 - Commissioning of Electronic Safety and Security

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. The Contractor shall provide all test equipment necessary to fulfill the testing requirements of this Division. This equipment includes, but is not limited to, the following:
 - 1. Handheld temperature and relative humidity meter.
 - 2. Infrared thermometer gun.
 - 3. Analog differential pressure gauge and associated tubing.
 - 4. Portable computer with access to the building automation system.
- B. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the related specifications. If not otherwise noted, the following minimum requirements apply:
 - 1. Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of +/- 0.1°F.
 - 2. Pressure sensors shall have an accuracy of +/- 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.
 - 3. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.
- C. Refer to Section 019100 for additional Division 22 requirements.

PART 3 - EXECUTION

- A. Refer to Section 019100.

END OF SECTION

SECTION 221000

PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pipe and Pipe Fittings.
- B. Valves.
- C. Check Valves.

1.2 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.
- B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.
- C. Welders Certification: In accordance with ANSI/ASME Sec 9 or ANSI/AWS D1.1.
- D. Piping, Fittings, Valves, and Flux for Potable Water Systems: All components shall be lead free per Federal Act S.3874, Reduction of Lead in Drinking Water Act.

1.3 REFERENCES

- A. ANSI/ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings.
- B. ANSI/ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.
- C. ANSI/ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
- D. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 NS 300.
- E. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.
- F. ANSI/ASME B16.9 - Factory-Made Wrought Steel Butt Welding Fittings.
- G. ANSI/ASME Sec 9 - Welding and Brazing Qualifications.
- H. ANSI/ASTM B32 - Solder Metal.
- I. ANSI/ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

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- J. ANSI/ASTM D2466 - PVC Plastic Pipe Fittings, Schedule 40.
- K. ANSI/AWS D1.1 - Structural Welding Code.
- L. ANSI/AWWA C110 - Ductile Iron and Gray Iron Fittings 3" through 48", for Water and Other Liquids.
- M. ANSI/AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.
- N. ANSI/AWWA C151 - Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- O. ANSI/AWWA C153 - Compact Ductile Iron Fittings 3" through 48", for Water and Other Liquids.
- P. ASME - Boiler and Pressure Vessel Code.
- Q. ASSE 1003 - Water Pressure Reducing Valves for Domestic Water Supply Systems.
- R. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- S. ASTM A74 - Hub and Spigot Cast Iron Soil Pipe and Fittings.
- T. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- U. ASTM A674 - Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids.
- V. ASTM A888 - Hubless Cast Iron Soil Pipe and Fittings.
- W. ASTM B88 - Seamless Copper Water Tube.
- X. ASTM B306 - Copper Drainage Tube (DWV).
- Y. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- Z. ASTM C1540 - Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.
- AA. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- BB. ASTM D1785 - Polyvinylchloride (PVC) Plastic Pipe, Schedules 40, 80 and 120.
- CC. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- DD. ASTM D2661 - ABS DWV Pipe & Fittings.
- EE. ASTM D2665 - PVC DWV Pipe & Fittings.
- FF. ASTM F402 - Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.

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- GG. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipes.
- HH. ASTM F656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
- II. AWS A5.8 - Brazed Filler Metal.
- JJ. AWWA C651 - Disinfecting Water Mains.
- KK. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.
- LL. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.
- MM. FM 1680 - Couplings Used in Hubless Cast Iron Systems.
- NN. NFPA 54 - National Fuel Gas Code.
- OO. NSF - National Sanitation Foundation

1.4 SUBMITTALS

- A. Submit shop drawings per Section 220500.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers with labeling in place.

1.6 COORDINATION DRAWINGS

- A. Reference Coordination Drawings article in Section 220500 for required plumbing systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

PART 2 - PRODUCTS

2.1 CAST IRON PIPE

- A. Cast Iron; Standard Weight; Hub and Spigot Joints:
 1. Pipe: Standard weight hub and spigot cast iron soil pipe, bituminous corrosion protective coating inside and outside, CISPI 301 or ASTM A74.
 2. Design Pressure: Gravity Maximum Design Temperature: 180°F
 3. Joints: Compression gasket, ASTM C564.
 4. Restraints: Install pipe and fittings per the Cast Iron Soil Pipe Institute's Designation 301. Restrain pipe and fittings using an engineered and tested product manufactured for restraining no-hub cast iron soil pipe. Install per manufacturer's recommendations.

5. Adapters: Heavy duty no-hub transition for joining cast iron and PVC pipe. Adapters shall be tested and certified to ASTM C 1460 and be constructed with Type 304 stainless steel shield, thickness 0.015" shield, gasket material to meet ASTM C564, 1-1/2" to 4" will be 3" wide with four 304 stainless steel bands, and 6" to 10" will be 4" wide with six 304 stainless steel bands and 3/8" 305 stainless steel hex head screws torqued to 80 inch pounds.

B. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets:

1. Pipe: Standard weight no-hub cast iron soil pipe, bituminous corrosion protective coating inside and outside, CISPI 301 or ASTM A888.
2. Design Pressure: Gravity Maximum Design Temperature: 180°F
3. Joints: ASTM C1540, FM 1680, and ASTM C-564.
 - a. Super Duty, Shielded Stainless Steel Couplings: Neoprene sleeve gasket, 0.015" thick 304 stainless steel shield, stainless steel 3/8" screw type clamps, minimum of four clamps for 1-1/2" to 4" and six clamps for 5" and larger pipe sizes. Clamps shall be tightened to minimum 80 inch pounds or as manufacturer requires. Husky SD-4000 or equal.
 - b. Heavy Duty, Shielded Stainless Steel Couplings: Neoprene sleeve gasket, 0.010" thick 304 stainless steel shield, stainless steel 5/16" screw type clamps, minimum of four clamps for 1-1/2" to 4" and six clamps for 5" and larger pipe sizes. Clamps shall be tightened to minimum 80 inch pounds or as manufacturer requires. Husky HD-2000 or equal.
4. Restraints: Install pipe and fittings per the Cast Iron Soil Pipe Institute's Designation 310. Restrain pipe and fittings using an engineered and tested product manufactured for restraining no-hub cast iron soil pipe. Install per manufacturer's recommendations.
5. Adapters: Transition from cast iron soil pipe to other pipe materials with manufactured adapters specifically for the application. Adapter must meet the same requirements as the joints listed above. ASTM C1460. Sticker identifying transition fitting application must be visible to view. For example, the most commonly used transition fitting from cast iron no-hub to PVC would be the Husky SD-4200 series.

2.2 COPPER PIPE

A. Copper Pipe; Type L; Solder Joints:

1. Pipe: Type L hard drawn seamless copper tube, ASTM B88.
2. Design Pressure: 175 psi; Maximum Design Temperature: 200°F.
3. Joints: Solder with 100% lead-free solder and flux, ASTM B32.
4. Fittings: Wrought copper solder joint, ANSI B16.22.

B. Copper Pipe; Type L; Mechanical Press Connection:

1. Pipe: Type L hard drawn seamless copper tube, ASTM B88.
2. Design Pressure: 175 psi; Maximum Design Temperature: 200°F.
3. Joints: Mechanical press connection.
4. Fittings: Copper, ANSI B-16.22, with embedded EPDM O-ring / sealing element engineered for this application, NSF-61.

5. Fitting Identification: Press ends shall provide the ability to identify an unpressed fitting from the floor prior to testing. The function of this feature is to provide the installer quick and easy identification of connections that have not been pressed prior to putting the system into operation.
6. Special Requirements: Mechanical press fitting manufacturer shall provide Contractor training prior to installation.
7. Manufacturers:
 - a. Viega ProPress
 - b. Apollo Press, a division of Aalberts - IPS
 - c. NIBCO Press System Fittings and Valves
 - d. Merit Brass
 - e. Mueller Streamline PRS

C. Copper Pipe: Type M; Solder Joints:

1. Pipe: Type M hard temper seamless copper drainage tube, ASTM B306.
2. Design Pressure: Gravity Maximum Design Temperature: 180°F
3. Joints: Solder with 100% lead-free solder and flux, ASTM B32.
4. Fittings: Cast brass solder joint drainage type, ANSI B16.23 or wrought copper solder joint drainage type, ANSI B16.29.

2.3 PLASTIC PIPE

A. PVC-DWV or ABS-DWV; Schedule 40; Solvent Weld Joints:

1. Pipe: Schedule 40 rigid, PVC-DWV, or ABS-DWV, cell classification 12454 for PVC per ASTM D1784 or 42222 for ABS per ASTM D3965, with plain ends, conforming to ASTM Standards D2665 or D2661. Cellular core piping is not acceptable.
2. Design Pressure/Temperature: Gravity at 140°F.
3. Joints: Solvent-weld socket type with solvent recommended by pipe manufacturer.
4. Fittings: PVC-DWV, or ABS-DWV, cell classification 12454 for PVC per ASTM D1784 or 42222 for ABS per ASTM D3965, with solvent-weld socket type ends for Schedule 40 pipe.
5. Limits: Schedule 40 PVC-DWV, or ABS-DWV pipe must not be threaded. Do not use where exposed or in return air plenums.
6. Use: Use PVC or ABS only where allowed by local jurisdiction. Comply with all special requirements or limitations.

2.4 VALVES

A. Shutoff Valves:

1. For pipe systems where mechanical press connections are allowed, shutoff valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.

2. Ball Valves:

- a. BA-1: 3" and under, 150 psi saturated steam, 600 psi CWP, full port, threaded or solder ends (acceptable only if rated for soldering in line with 470°F melting point of lead-free solder), stainless steel ball and trim, Teflon seats and seals.
 - 1) Body: Lead free NSF-372, two-piece bronze of a copper alloy containing less than 15% zinc. Apollo Valves; a division of Aalberts-IPS #77CLF140/240 Series, Milwaukee #UPBA450S, Watts #LFB6080G2-SS, NIBCO #T-585-66-LF, Jomar T-200CSSG.
 - 2) Body: Dezincification resistant brass alloy, lead free NSF-372. Jomar T-100CSSG.
 - 3) Provide solid extended shaft for all insulated piping. (For example, Apollo adds option -04 Stem Extension, NIBCO Nib-Seal Handle-NS, and Jomar modifies valve part number with -IH for insulated handle.)
 - 4) Provide lock out trim for all valves opening to atmosphere installed in domestic water piping over 120°F. Solid extended shaft is not required on valves with lockout trim. (For example, Jomar and NIBCO modify valve part number with -LH for locking handle.)
- b. BA-1A: 2-1/2" and 3", 150 psi saturated steam, 275 psi CWP ANSI Class, 150 psi standard port, carbon steel body, stainless steel ball and trim, Teflon seats and seals. Apollo Valves, a division of Aalberts-IPS #88A-140, NIBCO #F510-CS/66, Milwaukee #F90.
 - 1) Provide extended shaft for all valves in insulated piping.
 - 2) Provide lock out trim for all valves opening to atmosphere installed in domestic water piping over 120°F, heating water piping over 120°F, steam, condensate, boiler feed water piping, and gasoline/kerosene piping, and as indicated on the drawings. Solid extended shaft is not required on valves with lock out trim.

2.5 STRAINERS

- A. For pipe systems where mechanical press connections are allowed, strainers with mechanical press connections are acceptable subject to the requirements in the paragraphs below.
- B. ST-1: Threaded Ends, 4" and under, lead free bronze or 304 stainless steel body, threaded connections, threaded removable cover, 0.045" 304 stainless steel perforated screen, 125 psi S @ 350°F, 200 psi CWP @ 150°F. Apollo Valves, a division of Aalberts-IPS YB-LF (59LF), Metraflex SSFT, Mueller / Watts LF351, Watts LF777, Jomar T-651G, Zurn SXL.

2.6 CHECK VALVES

- A. For pipe systems where mechanical press connections are allowed, check valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.
- B. CK-1: Threaded Ends, 2" and under, 125 psi steam @ 406°F, 200 psi CWP @ 150°F, threaded connection, lead free bronze body with brass or bronze disc, horizontal swing. Hammond #UP904, Milwaukee #UP509, NIBCO T-413-Y-LF, Jomar T-511G, Apollo Valves, a division of Aalberts-IPS #161T-LF.

2.7 CONNECTIONS BETWEEN DISSIMILAR METALS

- A. Connections between dissimilar metals shall be insulating dielectric types that provide a water gap between the connected metals, and that either allow no metal path for electron transfer or that provide a wide water gap lined with a non-conductive material to impede electron transfer through the water path.
- B. Joints shall be rated for the temperature, pressure, and other characteristics of the service in which they are used, including testing procedure.
- C. Aluminum, iron, steel, brass, copper, bronze, galvanized steel and stainless steel are commonly used and require isolation from each other with the following exceptions:
 - 1. Iron and steel connected to each other.
 - 2. Brass, copper, and bronze connected to each other.
 - 3. Brass or bronze valves and specialties connected in closed systems with steel, iron, or stainless steel on both sides of the brass or bronze valves and specialties. Where two or more brass or bronze items occur together, they shall be connected with brass nipples. Brass or bronze valves and specialties cannot be used as a dielectric separation between pipe materials.
- D. Dielectric protection is required at connections to equipment of a material different than the piping.
- E. Screwed and/or Grooved Joints (acceptable up to 4" size):
 - 1. Dielectric waterway rated for 300 psi CWP and 225°F.
 - 2. Optional: Copper-silicon casting conforming to UNS C87850 with grooved and/or threaded ends.
 - 3. UL classified in accordance with ANSI / NSF-61 for potable water service.
 - 4. Manufacturers:
 - a. Elster Group ClearFlow fittings
 - b. Victaulic Series 647
 - c. Grinnell Series 407
 - d. Matco-Norca
- F. Flanged Joints (any size):
 - 1. Use 1/8" minimum thickness, non-conductive, full-face gaskets.
 - 2. Employ one-piece molded sleeve-washer combinations to break the electrical path through the bolts.
 - 3. Sleeve-washers are required on one side only, with sleeves minimum 1/32" thick and washers minimum 1/8" thick.
 - 4. Install steel washers on both sides of flanges to prevent damage to the sleeve-washer.
 - 5. Separate sleeves and washers may be used only if the sleeves are manufactured to exact lengths and installed carefully so the sleeves must extend partially past each steel washer when tightened.
 - 6. Manufacturers:
 - a. EPCO
 - b. Central Plastics
 - c. Pipeline Seal and Insulator

- d. F. H. Maloney
- e. Calpico

PART 3 - EXECUTION

3.1 PREPARATION

- A. Install all products per manufacturer's recommendations.
- B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- C. Remove scale and dirt, on inside and outside, before assembly.
- D. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories in preparation to be painted.
- E. Connect to equipment with flanges or unions. Unions or flanges for servicing and disconnect are not required in installations using grooved joint couplings.
- F. Use only piping materials rated for the maximum temperature of the application, e.g., do not use PVC for dishwasher drainage or piping that receives boiler blowdown.
- G. Roof Penetration (Vent) Flashing:
 - 1. Built-up Roofing: Flash vents with 3# seamless sheet lead of sufficient size to extend 15" into roofing felts for built-up roofs.
- H. Existing building sewers or building drains which are shown on the documents to be reused shall be inspected and recorded by closed circuit television for their condition. Report findings back to the Architect, Engineer, and Owner before proceeding with work so any necessary rework can take place if needed.

3.2 SYSTEM, PIPING AND VALVE SCHEDULE

- A. Cold Water, Hot Water, Tempered Water, Reclaimed Water - Potable and Non-Potable (Above Ground):
 - 1. Copper Pipe; Type L; Solder Joints: All Sizes
 - 2. Copper Pipe; Type L; Mechanical Press Connection: 4" and Under
 - 3. Shutoff Valves:, BA-1
 - 4. Check Valves: CK-1
 - 5. Strainers: ST-1
- B. Sanitary Waste and Vent, Gravity (Above Ground):
 - 1. Cast Iron; Standard Weight; Hub and Spigot Joints: All Sizes
- C. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15" Sanitary Indirect Drainage (Above Ground):
 - 1. Cast Iron; Standard Weight; Hub and Spigot Joints: All Sizes

- D. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15" Sanitary Waste and Vent, Gravity (Underground - Inside Building):
 - 1. PVC-DWV or ABS-DWV; Schedule 40; Solvent Weld Joints: All Sizes
- E. |Condensate/Equipment Drainage:
 - 1. Copper Pipe: Type M; Solder Joints: 1-1/4" to 4"

3.3 TESTING PIPING

- A. Sanitary Drainage, Sanitary Vent:
 - 1. Test all piping with water to prove tight.
 - 2. Test piping before insulation is applied.
 - 3. Hydrostatically test all soil, waste, and vent piping inside of building with 10 feet head of water for 15 minutes. Inspect before fixtures are connected. If leaks appear, repair them and repeat the test.
 - 4. Hydrostatically test interior downspouts with 10 feet head of water for 15 minutes with no leaks.
 - 5. A smoke/air test at the same pressure may be used in lieu of the hydrostatic water test. Exception: Smoke/air test shall not be performed on plastic piping.
 - 6. Test force mains with water at 105% of the operating pump discharge pressure for 15 minutes.
 - 7. Test pressures stated above shall be as listed or as required by the Authority Having Jurisdiction, whichever is most stringent.
- B. Hot Water - Potable, Cold Water - Potable:
 - 1. Test pipes underground or in chases and walls before piping is concealed.
 - 2. Test all pipes before the insulation is applied. If insulation is applied before the pipe is tested and a leak develops which ruins the insulation, replace damaged insulation.
 - 3. Test the pipe with 100 psig water pressure or equal inert gas such as nitrogen. Exception: Inert gas test shall not be used to test plastic piping.
 - 4. Hold test pressure for at least 2 hours.
 - 5. Test to be witnessed by the Architect/Engineer's representative, if requested by the Architect/Engineer.
- C. All Other Piping:
 - 1. Test piping at 150% of normal operating pressure.
 - 2. Piping shall hold this pressure for one hour with no drop in pressure.
 - 3. Test piping using water, nitrogen, or air as compatible with the final service of the pipe. Do not use combustible fluids.
 - 4. Drain and clean all piping after testing is complete.

3.4 CLEANING PIPING

A. All Water Piping:

1. Flush all piping using faucets, flush valves, etc. until the flow is clean.
2. After flushing, thoroughly clean all inlet strainers, aerators, and other such devices.
3. If necessary, remove valves to clean out all foreign material.

3.5 INSTALLATION

A. General Installation Requirements:

1. Provide dielectric connections between dissimilar metals.
2. Route piping in orderly manner and maintain gradient. Install to conserve building space.
3. Group piping whenever practical at common elevations.
4. Install piping to allow for expansion and contraction without stressing pipe, joints, or equipment.
5. Slope water piping and arrange to drain at low points.
6. Install bell and spigot piping with bells upstream.
7. Where pipe supports are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
8. Seal pipes passing through exterior walls with a wall seal per Section 220529. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe.
9. All vertical pipe drops to sinks or other equipment installed below the ceiling shall be routed within a wall cavity, unless specifically noted otherwise to be surface mounted. For renovation projects, this Contractor is responsible for opening and patching existing walls for installation of piping. Wall patching shall match existing condition.

B. Installation Requirements in Electrical Rooms:

1. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.

C. Valves/Fittings and Accessories:

1. Install shutoff valves that permit the isolation of equipment/fixtures in each room without isolating any other room or portion of the building. Individual fixture angle stops do not meet this requirement. Exception: Back-to-back rooms in no more than two adjacent rooms.
2. Provide clearance for installation of insulation and access to valves and fittings.
3. Provide access doors for concealed valves and fittings.
4. Install valve stems upright or horizontal, not inverted.
5. Provide one plug valve wrench for every ten plug valves 2" and smaller, minimum of one. Provide each plug valve 2-1/2" and larger with a wrench with set screw.

D. Underground Piping:

1. Refer to Section 220500 for Excavation, Fill, Backfill and Compaction requirements
2. Install buried borosilicate glass pipe with the protective polystyrene covering intact. Lay the pipe on bedding and backfill per manufacturer instructions.

3. Direct buried, uninsulated steel pipe shall have a factory applied external protective coating consisting of two coats with an intermediate layer of 18 mil fibrous glass mat. Coating thickness shall total not less than 3/32". The outer coating shall be further protected by a wrapping of heavy Kraft paper. This external protection shall extend and be exposed for a minimum of 1 foot beyond the buried or concealed portion of the pipe.
 - a. Manufacturers:
 - 1) Pipe Line Service Co., Franklin Park, Illinois
 - 2) Lithcote Corp., Melrose Park, Illinois
4. As an option, the Contractor may provide factory applied protective coatings consisting of a polyethylene plastic film bonded to the pipe surface by a hot applied thermo-plastic adhesive.
 - a. Manufacturers:
 - 1) Republic Steel Corp. "X-Tru-Coat"
5. Exercise care in handling, storing and laying pipe to avoid damaging factory applied coatings. If any damage occurs, repair the coating to a condition equal to the original.
6. Field application of protective coatings to joints, fittings and to any damaged factory applied coatings shall be similar to factory applied coatings specified above and shall be done in strict accordance with recommendations of the supplier of pipe coatings.
7. After completion of the fabrication, laying and field coating of the joints and fittings, but prior to backfilling, inspect the entire line in the presence of the Architect/Engineer's representative with an electronic holiday detector. Any defects in the protective coatings shall be repaired in accordance with requirements for original coatings.
8. Coat flange bolts and nuts in pits and below ground at the time of installation with a corrosion protective coating.

E. Sanitary Piping:

1. Install all sanitary and storm piping inside the building with a slope as shown on the drawings.
2. Install horizontal offset at all connections to roof drains to allow for pipe expansion.
3. Slope sanitary and storm piping outside the building to meet invert elevations shown on drawings and to maintain a minimum velocity of 2 feet per second.
4. Sway Bracing: Where horizontal sanitary and/or storm pipes 4 inches and larger change flow direction greater than 45°, rigid bracing or thrust restraints shall be installed to resist movement of the upstream pipe in the direction of pipe flow. The rigid bracing or thrust restraint shall be connected to structure. A change of flow direction from horizontal into a vertical pipe does not require the upstream pipe to be braced.
5. Starter fittings with internal baffles are not permitted.

3.6 PIPE ERECTION AND LAYING

- A. Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be removed from the job immediately.

- B. All pipe, fittings, valves, equipment and accessories shall have factory applied markings, stampings, or nameplates with sufficient data to determine their conformance with specified requirements.
- C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not install any item that is not clean.
- D. Until system is fully operational, all openings in piping and equipment shall be kept closed except when actual work is being performed on that item or system. Closures shall be plugs, caps, blind flanges or other items specifically designed and intended for this purpose.
- E. Run pipes straight and true, parallel to building lines with minimum use of offsets and couplings. Provide only offsets required to provide needed headroom or clearance and to provide needed flexibility in pipe lines.
- F. Make changes in direction of pipes only with fittings or pipe bends. Changes in size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. All fittings shall be of the long radius type, unless otherwise shown on the drawings or specified.
- G. Provide flanges or unions at all final connections to equipment, traps and valves.
- H. Arrange piping and connections so equipment served may be totally removed without disturbing piping beyond final connections and associated shutoff valves.
- I. Use full and double lengths of pipe wherever possible.
- J. Unless otherwise indicated, install all piping, including shutoff valves and strainers, to coils, pumps and other equipment at line size with reduction in size being made only at control valve or equipment.
- K. Cut all pipe to exact measurement and install without springing or forcing except in the case of expansion loops where cold springing is indicated on the drawings.
- L. Underground pipe shall be laid in dry trenches maintained free of accumulated water. Refer to Section 220500 for Excavation, Fill, Backfill and Compaction requirements.
- M. Unless otherwise indicated, branch take-offs shall be from top of mains or headers at either a 45° or 90° angle from the horizontal plane for air lines, and from top, bottom or side for liquids.

3.7 DRAINING AND VENTING

- A. Unless otherwise indicated on the drawings, all horizontal water lines, including branches, shall pitch 1" in 40 feet to low points for complete drainage, removal of condensate and venting.
- B. Maintain accurate grade where pipes pitch or slope for venting and drainage. No pipes shall have pockets due to changes in elevation.
- C. Provide drain valves at all low points of water piping systems for complete or sectionalized draining.

- D. Use eccentric reducing fittings on horizontal runs when changing size of pipes for proper drainage and venting. Install gravity drain pipes with bottom of pipe and eccentric reducers in a continuous line; all other liquid lines with top of pipe and eccentric reducers in a continuous line.
- E. Provide air vents at high points and wherever else required to eliminate air in all water piping systems.
- F. Install air vents in accessible locations. If necessary to trap and vent air in a remote location, install an 1/8" pipe from the tapping location to an accessible location and terminate with a venting device.
- G. All vent and drain piping shall be of same materials and construction for the service involved.

3.8 PLUMBING VENTS

- A. Vent as shown on the drawings and in accordance with all codes having jurisdiction.
- B. Extend the high side of the soil and waste stacks at least 12" above roof.
- C. Flash pipes at the roof with 3# lead sheet. Extend flashing under roofing 15" in all directions from pipe to be flashed. Extend a lead collar up on the outside of pipe to be flashed and extend 1" beyond the top of the pipe. The 1" excess length of collar shall be turned down into the top of the pipe where it shall fit tight to the inside of the pipe.
- D. Flash pipes at roof with premolded EPDM pipe flashing cones adhered to roof membrane by General Contractor. Secure top of cone with stainless steel clamp and seal watertight.
- E. Increase vent pipes through the roof two pipe sizes with long increasers located at least 12" below the roof.
- F. In no case shall the vent through the roof be less than 4" in diameter.
- G. Vent pipes through the roof shall be located a minimum of from any air intake opening on the roof.

3.9 BRANCH CONNECTIONS

- A. For domestic water and vent systems only, make branch connections with standard tee or cross fittings of the type required for the service.
- B. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
- C. Do not use double wye or double combination wye and eighth bend DWV fittings in horizontal piping.
- D. Branch connections from the headers and mains may be mechanically formed using an extraction device. The branch piping connection shall be brazed connection for the following services only:
 - 1. Domestic water piping above ground.

- E. Further limit use of mechanically formed fittings as follows:
 - 1. Must have at least same pressure rating as the main.
 - 2. Main must be Type K or L copper tubing.
 - 3. Permanent marking shall indicate insertion depth and orientation.
 - 4. Branch pipe shall conform to the inner curve of the piping main.
 - 5. Main must be 1" or larger.
 - 6. Branch must be 3/4" or larger.

- F. Forged weld-on fittings are limited as follows:
 - 1. Must have at least same pressure rating as the main.
 - 2. Main must be 2-1/2" or larger.
 - 3. Branch line is at least two pipe sizes under main size.

3.10 JOINING OF PIPE

- A. Solder Joints (Copper Pipe):
 - 1. Make up joints with 100% lead-free solder, ASTM B32. Cut tubing so ends are perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt and grease just prior to soldering. Apply flux evenly, but sparingly, over all surfaces to be joined. Heat joints uniformly so solder will flow to all mated surfaces. Wipe excess solder, leaving a uniform fillet around cup of fitting.
 - 2. Flux shall be non-acid type.
 - 3. Solder end valves may be installed directly in the piping system if the entire valve is suitable for use with 470°F melting point solder. Remove discs and seals during soldering if they are not suitable for 470°F.

- B. Mechanical Press Connection (Copper Pipe):
 - 1. Copper press fitting shall be made in accordance with the manufacturer's installation instructions.
 - 2. Fully insert tubing into the fitting and mark tubing.
 - 3. Prior to making connection, the fitting alignment shall be checked against the mark made on the tube to ensure the tubing is fully engaged in the fitting.
 - 4. Joint shall be pressed with a tool approved by the manufacturer.
 - 5. Installers shall be trained by manufacturer personnel or representative. Provide documentation upon request.

- C. Hub and Spigot Joints - Sanitary Pipe (Cast Iron Pipe):
 - 1. Lead and Oakum Joints: Pack joint with oakum made of vegetable fiber, cotton, or hemp. Pour joint with molten lead up to top of hub. Ensure leak-free joints by working joint with inside and outside caulking irons.
 - 2. Compression Gasket Joints: Joint shall be one-piece double seal compression type gasket made specifically for joining cast iron soil pipe. Gasket shall be neoprene, permitting joint to flex as much as 5 degrees without loss of seal. Gasket shall be extra heavy weight class, conforming to ASTM C-564.

- D. Solvent Weld Joints (PVC):
 - 1. Make joints with a two-step process. Use primer conforming to ASTM F656 and solvent cement conforming to ASTM D2564.
 - 2. All contractor personnel that will prepare solvent cemented joints shall be qualified for such bonding practices according to the bonding qualifications procedures described in ASME B31.3, Chapter VII for bonding of plastic piping.
- E. Couplings: Assemblies with combinations of clamps, gaskets, sleeves, and threaded or flanged parts; compatible with piping and system liquid; and made by piping manufacturer for joining system piping.
- F. Adapters and Transition Fittings: Assemblies with combinations of clamps, couplings, adapters, gaskets, and threaded or flanged parts; compatible with piping and system liquid; and made for joining different piping materials.
- G. Flanges: Assemblies of companion flanges and gaskets complying with ASME B16.21 and compatible with system liquid, and bolts and nuts.

3.11 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfection of the domestic water piping shall be completed within three (3) weeks prior to building occupancy. Contractor is responsible for disinfecting water piping if used by workers during construction; disinfection during construction does not eliminate the requirement for final disinfection prior to occupancy. Flushing of piping shall be completed within two (2) weeks prior to building occupancy.
- B. Provide necessary connections at the start of individual sections of mains for adding chlorine.
- C. Before starting work, verify system is complete, flushed and clean.
- D. Follow the disinfection of potable water procedure outlined in this project's applicable plumbing code. For example: IPC 610.1, UPC 609.10, CPC 609.9, and Illinois 890.1180. Where local codes do not outline a disinfection procedure, follow the International Plumbing Code procedure 610.1.
- E. Bleed water from all outlets to ensure chlorine distribution throughout the entire domestic water system.
- F. Take water samples, no sooner than 24 hours after flushing, from 2% of outlets and from water entry. Obtain, analyze, and test samples in accordance with AWWA C651, Section 5 - Verification.

END OF SECTION

SECTION 221023
NATURAL GAS PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pipe and Pipe Fittings.
- B. Valves.
- C. Natural Gas Piping System.

1.2 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.
- B. Welding Materials, Procedures, and Operators: Conform to ASME Section 9, ANSI/AWS D1.1, and applicable state labor regulations.
- C. Welders Certification: In accordance with ANSI/ASME Sec 9 or ANSI/AWS D1.1.

1.3 REFERENCES

- A. ANSI/AWS D1.1 - Structural Welding Code.
- B. ANSI AGA-LC1 - Standards for Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing.
- C. ANSI/AWWA C111/A21.11 - Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
- D. ASME - Boiler and Pressure Vessel Code - Section 9.
- E. ASME B1.20.1 - Pipe Threads, General Purpose.
- F. ASME B16.3 - Malleable Iron Threaded Fittings Class 150 and 300.
- G. ASME B16.5 - Pipe Flanges and Flanged Fittings.
- H. ASME B16.9 - Factory-Made Wrought Steel Butt Welding Fittings.
- I. ASME B16.11 - Forged Steel Fittings, Socket-Welding and Threaded.
- J. ASME B16.21 - Nonmetallic Flat Gaskets for Pipes Flanges.
- K. ASME B16.39 - Malleable Iron Threaded Pipe Unions.

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- L. ASME B18.2.1 - Square and Hex Bolts and Screws, Inch Series.
- M. ASME B18.2.2 - Square and Hex Nuts, Inch Series.
- N. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- O. ASTM A105 - Standard Specification for Carbon Steel Forgings for Piping Applications.
- P. ASTM A181 - Forgings, Carbon Steel for General Purpose Piping.
- Q. ASTM A197 - Standard Specification for Cupola Malleable Iron.
- R. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- S. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- T. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- U. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- V. NFPA 54 - National Fuel Gas Code.

1.4 SUBMITTALS

- A. Submit product data under provisions of Section 22 05 00. Include data on pipe materials, fittings, valves, and accessories.
- B. Test Reports: Provide results of piping system pressure test.
- C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store and protect piping to prevent entrance of foreign matter into pipe and to prevent exterior corrosion.
- B. Deliver and store valves in shipping containers with labeling in place.

1.6 COORDINATION DRAWINGS

- A. Reference Coordination Drawings article in Section 22 05 00 for the required natural gas piping system electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

PART 2 - PRODUCTS

2.1 NATURAL GAS (0 to 125 PSI)

- A. Design Pressure: 125 psi. Maximum Design Temperature: 350°F
- B. Piping - 2" and Under:
 - 1. Pipe: Standard weight black steel, threaded and coupled, ASTM A53.
 - 2. Joints: Screwed. (NOTE: For below ground, all sizes to have welded joints.)
 - 3. Fittings: 150# steam - 300# CWP, black malleable iron, banded, ASTM A197, ANSI B16.3.
 - 4. Unions: 250# - 500# CWP, black malleable iron, ANSI B16.39, ground joint with brass seat.
- C. Piping - 2-1/2" and Over:
 - 1. Pipe: Standard weight black steel, beveled ends, ASTM A53.
 - 2. Joints: Butt welded or flanged.
 - 3. Fittings: Standard weight seamless steel, butt weld type, ASTM A234, Grade I, ANSI B16.9.
 - 4. Flanges: 150# forged steel, weld neck or slip-on, ASTM A181, Grade I, ANSI B16.5. Flange face seal weld (backweld) is required for slip-on flanges.
- D. Shutoff Valves/Throttling Valves:
 - 1. For pipe systems where mechanical press connections are allowed, shutoff valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.
 - 2. BA-13: 2" and under, threaded 600 psi CWP; UL listed for 250# LP, flammable liquid, heating oil, natural and manufactured gases, 150 psi steam, bronze body and chrome plated brass ball, Teflon seats and packing.
 - a. Body: Bronze.
 - 1) Manufacturers:
 - a) Apollo #80-100
 - b) Nibco #T580-70-UL or #T585-70-UL
 - b. Body: Dezincification resistant brass alloy. Jomar T-100NE.
- E. Check Valves:
 - 1. For pipe systems where mechanical press connections are allowed, check valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.

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2. CK-1: 2" and under, 125# steam @ 406°F, 200# CWP @ 150°F, screwed, bronze, horizontal swing.
 - a. Manufacturers:
 - 1) Crane #37
 - 2) Hammond #IB904
 - 3) Stockham #B319-Y
 - 4) Walworth #3406
 - 5) Milwaukee #509
 - 6) Watts #B-5000
 - 7) Nibco Y-413B

PART 3 - EXECUTION

3.1 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. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories in preparation to be painted.
- D. Connect to all equipment with flanges or unions.
- E. After completion, fill, clean, and treat systems. Refer to Section 232500 for treatment.

3.2 TESTING PIPING

- A. Low Pressure - Up to 1 psi:
 1. Test piping with 20 psi air pressure. System must hold this pressure without adding air for two hours.
- B. High Pressure - Above 1 psi:
 1. Test piping with compressed air at twice the operating gas pressure, but at least 20 psi. System must hold this pressure without adding air for two hours.
- C. A non-combustible odorant, such as oil of wintergreen, may be added to help locate leaks.

3.3 CLEANING PIPING

- A. Assembly:
 1. Prior to assembly of pipe and piping components, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer. Blow chips and burrs out of pipe before assembly. Wipe cutting oil from internal and external surfaces.

2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing to the degree consistent with good piping practices.
3. Notify the Architect/Engineer prior to starting any post erection cleaning operation in time to allow witnessing the operation. Properly dispose of cleaning and flushing fluids.
4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, control valves, and balance valves, and verify all strainer screens are in place.

3.4 INSTALLATION

- A. Route piping in orderly manner, straight, plumb, with consistent pitch, parallel to building structure, with minimum use of offsets and couplings. Provide only offsets required for needed headroom or clearance and needed flexibility in pipe system.
- B. Install piping to conserve building space, and not interfere with other work.
- C. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Install thrust blocking and restraints on all buried piping at elbows and other changes in pipe direction.
- G. Provide chain operators for all valves over 2" size that are over 10'-0" above finished floor. Extend to 7'-0" above finished floor.
- H. Provide valve position indicator on all valves 10'-0" or greater above finish floor and not located above ceiling.
- I. Provide clearance for access to valves and fittings.
- J. Provide access doors where valves are not exposed.
- K. Prepare pipe, fittings, supports, and accessories for finish painting.
- L. Install valves with stems upright or horizontal, not inverted.
- M. Provide shutoff valves and flanges or unions at all connections to equipment, traps, and items that require servicing.
- N. Provide shutoff valves to isolate part of systems and vertical risers.
- O. Provide shutoff valves to boilers and water heaters in readily accessible location, maximum 6 feet above finished floor, within 6 feet of boiler connection per ASME CSD-1.
- P. Arrange piping and piping connections so equipment may be serviced or totally removed without disturbing piping beyond final connections and associated shutoff valves.

- Q. Reducers are generally not shown. Where pipe sizes are not shown, the larger size in either direction shall continue through the fitting nearest to the indication of a smaller pipe size.
- R. Seal pipes passing through exterior walls with a wall seal per Section 230529. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe.
- S. All vertical pipe drops to equipment installed below the ceiling shall be routed within a wall cavity, unless specifically noted otherwise to be surface mounted. For renovation projects, this Contractor is responsible for opening and patching existing walls for installation of piping. Wall patching shall match existing condition.

3.5 BONDING AND GROUNDING

- A. Each above ground portion of a corrugated stainless steel tubing gas piping systems shall be bonded to the electrical service grounding electrode system. The bonding jumper shall connect to a metallic pipe or fitting between the point of delivery and the first downstream corrugated stainless steel tube fitting. The bonding jumper shall not be smaller than 6 AWG copper wire or equivalent. Gas piping systems that contain one or more segments of corrugated stainless steel tubing shall be bonded in accordance with this section.
- B. Each above ground portion of a gas piping system, other than corrugated stainless steel tubing systems, that is likely to become energized shall be electrically continuous and bonded to an effective ground-fault current path. Gas piping, other than corrugated stainless steel tubing, shall be considered to be bonded when it is connected to appliances that are connected to the appliance grounding conductor of the circuit supplying that appliance.
- C. Gas piping shall not be used as a grounding conductor or electrode.
- D. Where a lightning protection system is installed, the bonding of the gas piping shall be in accordance with NFPA 780, Standard for the Installation of Lightning Protection Systems.

3.6 PIPE ERECTION AND LAYING

- A. Carefully inspect all pipe, fittings, valves, equipment and accessories prior to installation. Immediately reject and remove from the job any items which are unsuitable, cracked or otherwise defective.
- B. All pipe, fittings, valves, equipment and accessories shall have factory-applied markings, stampings, or nameplates sufficient to determine their conformance with specified requirements.
- C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not erect or install any unclean item.
- D. During construction, until system is fully operational, keep all openings in piping and equipment closed at all times except when actual work is being performed on that item. Closures shall be plugs, caps, blind flanges or other items designed for this purpose.

- E. Change direction of pipes only with fittings or pipe bends. Change size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. All fittings shall be long radius type, unless otherwise shown on the drawings or specified. Construct welded elbows of angles not available as standard fittings by cutting and welding standard elbows to form smooth, long radius fittings.
- F. Use full and double lengths of pipe wherever possible.
- G. Cut all pipe to exact measurement and install without springing or forcing.
- H. Do not create, even temporarily, undue loads, forces or strains on valves, equipment or building elements.

3.7 DRAINING AND VENTING

- A. Unless otherwise indicated on the drawings, all horizontal pipes, including branches, shall pitch 1" in 40 feet to low points for complete drainage.
- B. Use eccentric reducing fittings on horizontal runs when changing size for proper drainage and venting. Install gas pipes with bottom of pipe and eccentric reducers in a continuous line.
- C. Provide drip legs at low points and at the base of all risers in gas pipes. Drip legs shall be full line size on pipes through 4" and at least 4", but not less than half line size over 4". Drip legs shall be 12" minimum length, capped with a reducer to a drain valve.

3.8 BRANCH CONNECTIONS

- A. Make branch connections with standard tee or cross fittings of the type required for the service unless otherwise specified herein or detailed on the drawings.
- B. At the option of the Contractor, branch connections from headers and mains may be cut into black steel pipe using forged weld-on fittings.
- C. Use of forged weld-on fittings is also limited as follows:
 - 1. Must have at least same pressure rating as the main.
 - 2. Header or main must be 2-1/2" or over.
 - 3. Branch line is at least two pipe sizes under header or main size.
- D. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
- E. All branch piping connections for natural gas shall take off on the top or on the side of the main.

3.9 JOINING OF PIPE

- A. Threaded Joints:
 - 1. Ream pipe ends and remove all burrs and chips.
 - 2. Protect plated pipe and valve bodies from wrench marks when making up joints.
 - 3. Apply gas-rated Teflon tape or thread compound to male threads.

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B. Welded Joints:

1. Welding of all pipe joints, both as to procedures and qualification of welders, shall be in accordance with Section IX, ASME "Boiler & Pressure Vessel Code" unless local codes take precedence.
2. Furnish certificates qualifying each welder to the Owner's Representative prior to start of work.
3. The Owner's Representative reserves the right to require qualifying demonstration, at the Contractor's expense, of any welders assigned to the job.
4. Ends of pipe and fittings to be joined by butt-welding shall be beveled, cleaned to bare metal and internal diameters aligned before tack welding.

3.10 PAINTING EXPOSED PIPE

- A. Paint all outdoor exposed natural gas piping the color selected by Owner or Architect/Engineer.

END OF SECTION

SECTION 221030
PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Cleanouts.
- B. Traps.
- C. Trap Seals.
- D. Floor Drains and Sinks
- E. Backflow Preventers.
- F. Strainers.
- G. Unions.
- H. Dielectric Fittings (Connections Between Dissimilar Metals).
- I. Air Vents.
- J. Drain Valves.

1.2 QUALITY ASSURANCE

- A. Manufacturer: For each product specified, provide components by same manufacturer throughout.
- B. Piping, Fittings, Valves, and Flux for Potable Water Systems: All components shall be lead free per Federal Act S.3874, Reduction of Lead in Drinking Water Act.

1.3 REFERENCES

- A. ANSI A112.21.1 - Floor Drains.
- B. ASSE 1010 - Water Hammer Arresters.
- C. ANSI A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers.
- D. ANSI 1011 - Hose Connection Vacuum Breakers; American Society of Sanitary Engineering.
- E. PDI WH-201 - Water Hammer Arresters.

1.4 SUBMITTALS

- A. Submit shop drawings under provisions of Section 220500.
- B. Include sizes, rough-in requirements, service sizes, and finishes.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Provide cleanouts as shown and specified on the drawings as well as required by code.
- B. Coordinate floor cleanout cover with surrounding floor finish. Provide either solid, recessed for tile or terrazzo or carpet marker as applicable.
- C. Cleanouts on exposed pipes shall be cast iron with heavy duty cast brass plug with raised head.
- D. Cleanout shall be same size as the pipe up to 6" and 6" for larger pipes.

2.2 TRAPS

- A. Provide all individual connections to the sanitary system with P-traps, except where such drains discharge directly into a properly trapped collection basin or sump. Unless otherwise specified or shown, traps shall be:
 - 1. Chromium plated cast brass when used with plumbing fixtures or when installed exposed in finished spaces.
 - 2. Insulated at accessible lavatories.
 - 3. Cast iron, deep-seal pattern where concealed above ceiling, below grade or in unfinished areas.
 - 4. Deep-seal pattern of the same material and/or coating where drainage lines are of special materials or coatings such as polypropylene, PVDF, CPVC, etc.
- B. All traps shall have accessible, removable cleanouts, except where installed on floor drains with removable strainers.
- C. Each trap shall be completely filled with water at the end of construction but before building turnover to the Owner. All floor drains, floor sinks, trench drains, etc. shall be filled with water.

2.3 TRAP SEALS AND TRAP PRIMERS

- A. Provide trap seals as specified on the drawings.
- B. Provide trap primers as shown and specified on the drawings.
- C. Where trap primers are shown on drawings, coordinate with corresponding floor drains to ensure they include a side inlet connection for the trap primer line.

2.4 FLOOR DRAINS AND SINKS

- A. Floor drains and sinks shall be in the form of a receptor with grate/strainer set flush with the surrounding floor.
- B. Provide floor drains and sinks as shown and specified on the drawings as well as required by code.

2.5 STRAINERS

- A. Unless otherwise indicated, strainers shall be Y-pattern and have stainless steel screens with perforations as follows:
 - 1. Water:
 - a. 1/4" - 2": 3/64" perforations
- B. Furnish pipe nipple with shutoff valve to blow down all strainer screens.
- C. Use bronze body strainers in copper piping and iron body strainers in ferrous piping.

2.6 UNIONS

- A. Copper pipe - wrought copper fitting - ground joint.
- B. Black Steel (Schedule 40) Pipe - malleable iron, ground joint, 150 psi, bronze to bronze seat.
- C. Galvanized Steel Pipe - galvanized malleable iron, ground joint, 150 psi, bronze to bronze seat.

2.7 DIELECTRIC FITTINGS (CONNECTIONS BETWEEN DISSIMILAR METALS)

- A. Connections between dissimilar metals shall be insulating dielectric types that provide a water gap between the connected metals, and that either allow no metal path for electron transfer or that provide a wide water gap lined with a non-conductive material to impede electron transfer through the water path.
- B. Joints shall be rated for the temperature, pressure, and other characteristics of the service in which they are used, including testing procedure.
- C. Aluminum, iron, steel, brass, copper, bronze, and stainless steel are commonly used and require isolation from each other with the following exceptions:
 - 1. Iron, steel, and stainless steel connected to each other.
 - 2. Brass, copper, and bronze connected to each other.
 - 3. Brass or bronze valves and specialties connected in closed systems with steel, iron, or stainless steel on both sides of the brass or bronze valves and specialties. Where two or more brass or bronze items occur together, they shall be connected with brass nipples. Brass or bronze valves and specialties cannot be used as a dielectric separation between pipe materials.

- D. Dielectric protection is required at connections to equipment of a material different than the piping.
- E. Screwed Joints (acceptable up to 2" size):
 - 1. Dielectric waterway rated for 300 psi CWP and 225°F.
 - 2. Acceptable Manufacturers: Elster Group ClearFlow fittings, Victaulic Series 47, Grinnell Series 407, Matco-Norca.
- F. Flanged Joints (any size):
 - 1. Use 1/8" minimum thickness, non-conductive, full-face gaskets.
 - 2. Employ one-piece molded sleeve-washer combinations to break the electrical path through the bolts.
 - 3. Sleeve-washers are required on one side only, with sleeves minimum 1/32" thick and washers minimum 1/8" thick.
 - 4. Install steel washers on both sides of flanges to prevent damage to the sleeve-washer.
 - 5. Separate sleeves and washers may be used only if the sleeves are manufactured to exact lengths and installed carefully so the sleeves must extend partially past each steel washer when tightened.
 - 6. Acceptable Manufacturers: EPCO, Central Plastics, Pipeline Seal and Insulator, F. H. Maloney, or Calpico.

2.8 AIR VENTS

- A. Provide means for venting air at all high points in the piping system and at all other points where air may be trapped.
- B. At end of main and other points where large volume of air may be trapped - Use 1/4" globe valve, angle type, 125 psi, Crane #89, attached to coupling in top of main, 1/4" discharge pipe turned down with cap.

2.9 DRAIN VALVES

- A. Drain valves shall be shutoff valves as specified for the intended service with added 3/4" male hose thread outlet and cap.

PART 3 - EXECUTION

3.1 INSTALLATION AND APPLICATION

- A. Coordinate construction to receive drains at required invert elevations.
- B. Install all items per manufacturer's instructions.

C. Cleanouts:

1. Provide cleanouts where shown on the drawings and as required by code, but in no case farther apart than 50 feet. Provide cleanouts at bases of all sanitary and storm risers as shown on the drawings and as required by code.
2. Provide a cleanout at the upstream end of a horizontal waste pipe in a plumbing chase serving multiple plumbing fixtures; for example a bank of water closets or lavatories.
3. Provide cleanouts on the branch line connected to individual plumbing fixtures as required by code; for example just below a sink, lavatory or urinal.
4. Extend underfloor cleanouts up to the floor with long sweep elbows.
5. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with graphite and linseed oil. Ensure clearance at cleanouts for rodding of drainage system.
6. Wall cleanouts shall be installed above the flow line of the pipe they serve, but no less than 12" above the finished floor.

D. Floor Drains and Floor Sinks:

1. Drains in upper floors shall have a flashing of EPDM or similar membrane sheet. The sheet shall be at least 36" X 36" square with the drain in the center. Clamp membrane in auxiliary clamping ring of floor drain.
2. Use alternate sealing method when installing drains in existing floor slabs.
3. Coordinate sloping requirements with the architectural plans and specifications.
4. Top of floor drain and sinks grate/strainer shall not extend above the finished floor elevation.
5. Top of floor drain and sink grate/strainer shall not extend above the finished floor elevation. Grate/strainer shall be installed flush with surrounding finished floor. Should the Plumbing Contractor believe this presents a conflict with code, the issue should be evaluated before installation of the floor drain or sink begins. Proceeding with installing a floor drain or sink raised above the finished floor without prior approval will result in the Contractor being required to remove the drain or sink in question and reinstall it at the approved elevation.

END OF SECTION

SECTION 221519
COMPRESSED AIR SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Compressed Air Piping (Non-Medical)
- B. Shutoff Valves
- C. Automatic Drain Valves
- D. Safety Relief Valves
- E. Strainers
- F. Filter
- G. Filter / Regulator
- H. Pressure Gauge
- I. Hose Reels
- J. Point-of-Use Couplings

1.2 REFERENCES

- A. ANSI/ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings.
- B. ANSI/ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
- C. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 NS 300.
- D. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.
- E. ANSI/ASME B16.9 - Factory-Made Wrought Steel Butt Welding Fittings.
- F. ANSI/ASME Sec 9 - Welding and Brazing Qualifications.
- G. ANSI/ASTM B32 - Solder Metal.
- H. ANSI/AWS D1.1 - Structural Welding Code.
- I. ASME - Boiler and Pressure Vessel Code.

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- J. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- K. ASTM A181 - Carbon Steel Forgings for General Purpose Piping.
- L. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- M. ASTM A270 - Seamless and Welded Austenitic and Ferritic/Austenitic Stainless Steel Sanitary Tubing.
- N. ASTM A312 - Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
- O. ASTM A351 - Castings, Austenitic for Pressure-containing Parts.
- P. ASTM B88 - Seamless Copper Water Tube.

1.3 SUBMITTALS

- A. Submit shop drawings per Section 220500.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.1 COMPRESSED AIR PIPING (NON-MEDICAL)

- A. Design Pressure: 125 psi; Maximum Design Temperature: 150°F
- B. Piping - 2" and Under:
 - 1. Pipe: Standard weight carbon steel, threaded and coupled, ASTM A53.
 - 2. Joints: Screwed.
 - 3. Fittings: 150# steam 300# CWP, black malleable iron, banded, ASTM A47, ASTM A197, ANSI B16.3.
 - 4. Unions: 250# steam - 500# CWP, black malleable iron, ANSI B16.39, ground joint with brass seat.

2.2 SHUTOFF VALVES

- A. Ball Valves:
 - 1. BA-1: 3" and under, 150 psi saturated steam, 600 psi CWP, full port, vented, screwed or solder ends (acceptable only if rated for soldering in line with 470°F melting point of lead-free solder), bronze body of a copper alloy containing less than 15% zinc, stainless steel ball and trim, Teflon seats and seals.

- a. Body: Bronze of a copper alloy containing less than 15% zinc.
 - 1) Manufacturers:
 - a) Apollo #77C-140
 - b) Stockham #S-255-FB-P-UL
 - c) Milwaukee #BA-400
 - d) Watts
 - e) Nibco #585-70-66
 - f) National Utilities Co.
 - g) RUB
 - h) Jomar T/S-200CSSG-LH

2.3 AUTOMATIC DRAIN VALVES

A. Zero Loss Drain:

- 1. Electronic Operation: Electronic level control to monitor liquid level in the drain. Electronic control opens drain valve to discharge condensate and closes before compressed air is lost. 120VAC, alarm mode with visual signal and potential-free contact.
 - a. Manufacturers:
 - 1) Gardner Denver EEDS series
 - 2) Parker Finite series
 - 3) Ingersoll-Rand ENL series
 - 4) Quincy Q-MAT series

2.4 SAFETY RELIEF VALVES

- A. Bronze body, test lever, metal seat, bronze disc, ASME Section VIII Air/Gas code stamped, factory set pressure as scheduled.
 - 1. Manufacturers:
 - a. Kunkle Series 6000
 - b. Approved equal

2.5 STRAINERS

- A. ST-2: Cast iron body, 125 lb. flanged ends, bolted cover, 125 psi steam @ 350°F, 175 psi CWP @ 150°F.
 - 1. Manufacturers:
 - a. Armstrong #A1FL
 - b. Metraflex #TF
 - c. Mueller Steam Specialty Co.#751
 - d. Sarco #CI-125
 - e. Watts #77F-D

2.6 FILTER

- A. Particulate: Aluminum or brass body, 125 psi minimum rating, compact modular assembly, NBR seals, metal bowl with poly sight gauge, automatic drain, cellulose cartridge filter capable of removing liquids and solids of 5 microns or larger, capacity shall be for rated flow of equipment ASCO Series 65X.

2.7 FILTER / REGULATOR

- A. Adjustable: Diaphragm type, air loaded, tight closing single seat, aluminum or brass body with integral particulate filter and bowl.

- 1. Manufacturer:
 - a. ASCO Series 65X

2.8 PRESSURE GAUGE

- A. Accuracy Grade 1A (+/- 1% full range), dry for air service, with stainless steel or brass case, non-shatterable safety glass, pressure blowout back, 3-1/2" minimum diameter dial, dial range 0 psi to 200 psi, ASME B40.100 compliant.

- 1. Manufacturer:
 - a. Ashcroft 1009

2.9 HOSE REELS

- A. Steel heavy duty construction, open type, spring return, 4-way hose rollers, 3/8" x 50' rubber hose, adjustable hose stop, 250 psi minimum rating, adjustable guide arm for multiple mounting positions.

- 1. Manufacturers:
 - a. Reelcraft 7000 & HD70000 series
 - b. Coxreels SH series
 - c. Hannay N700 series

2.10 POINT-OF-USE COUPLINGS

- A. Non-exhausting Type: All brass construction, 1/4" body size, 125 psi minimum working pressure rating, general purpose, manual connect, industrial interchange style, coupling shall have female NPT connection with automatic shutoff, plug shall have male NPT connection.

- 1. Manufacturers:
 - a. Milton, Parker 20 Series
 - b. Approved equal

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- B. Exhausting Type: All brass construction, 1/4" body size , 125 psi minimum working pressure rating, general purpose, push-to-connect, industrial interchange style, coupling shall have female NPT connection with automatic shutoff, plug shall have male NPT connection and ball check to bleed pressure from hose.
 - 1. Manufacturers:
 - a. Parker E-z-mate series

2.11 VALVE CONNECTIONS

- A. Provide all connections to match pipe joints. Valves shall be same size as pipe unless noted otherwise.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Install all products per manufacturer's recommendations.
- B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- C. Remove scale and dirt on inside and outside before assembly.
- D. Connect to equipment with flanges or unions.

3.2 TESTING PIPING

- A. Compressed Air Piping, Condensate Piping:
 - 1. Test piping using compressed air per ASME 31.9 requirements.
 - 2. Test piping at 125% of normal operating pressure in accordance with ASME 31.9.
 - 3. Piping shall hold this pressure for one hour with no drop in pressure.

3.3 CLEANING PIPING

- A. Assembly:
 - 1. Before assembling pipe systems, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer's representative. Blow chips and burrs from machinery or thread cutting operation out of pipe before assembly. Wipe cutting oil from internal and external surfaces.
 - 2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing.
 - 3. Notify the Architect/Engineer's representative before starting any post erection cleaning in sufficient time to allow witnessing the operation. Consult with and obtain approval from the Architect/Engineer's representative regarding specific procedures and scheduling. Dispose of cleaning and flushing fluids properly.

4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, and be certain all strainer screens are in place.

B. Air Blow:

1. Blow out pipe and components with clean compressed air. Instrument air lines shall be blown out with dry, oil free air or nitrogen gas. "Oil Free" is defined as air compressed in a centrifugal, Teflon ring, carbon ring or water pumped air compressor. Where air supply is judged to be inadequate to continually attain cleaning velocity, alternate pressurization and sudden relief procedure may be used until discharge at all blowout points is clean. Use 80-90 psig pressure unless otherwise indicated.

3.4 INSTALLATION

A. General Installation Requirements:

1. Provide dielectric connections between dissimilar metals.
2. Route piping in orderly manner and maintain gradient. Install to conserve building space.
3. Group piping whenever practical at common elevations.
4. Install piping to allow for expansion and contraction without stressing pipe, joints, or equipment.
5. Where pipe supports are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
6. Seal pipes passing through exterior walls with a wall seal per Section 220529. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe.

B. Installation Requirements In Electrical Rooms:

1. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.

3.5 DRAINING AND VENTING

- A. Unless otherwise indicated on the drawings, all condensate and compressed air lines, including branches, shall pitch 1" in 40 feet in the direction of airflow to low points for complete drainage, removal of condensate.
- B. Maintain accurate grade where pipes pitch or slope for venting and drainage. No pipes shall have pockets due to changes in elevation.
- C. Provide drip legs at low points and at the base of all risers in compressed air pipes. Drip legs shall be full line size on pipes through 4" and at least 4", but not less than half line size over 4". Drip legs shall be 12" minimum length, capped with a reducer to a drain valve.
- D. Use eccentric reducing fittings on horizontal runs when changing size of pipes for proper drainage and venting. Install compressed air and gravity drain pipes with bottom of pipe and eccentric reducers in a continuous line; all other liquid lines with top of pipe and eccentric reducers in a continuous line.
- E. Provide air vents at high points and wherever else required to eliminate air in all condensate piping systems.

3.6 BRANCH CONNECTIONS

- A. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
- B. Do not use double wye or double combination wye and eighth bend DWV fittings in horizontal piping.
- C. Branch connections from headers and mains may be cut into black steel pipe using forged weld-on fittings.
- D. Forged weld-on fittings are limited as follows:
 - 1. Must have at least same pressure rating as the main.
 - 2. Main must be 2-1/2" or larger.
 - 3. Branch line is at least two pipe sizes under main size.

3.7 JOINING OF PIPE

- A. Threaded Joints:
 - 1. Threads shall conform to ANSI B2.1 "Pipe Threads".
 - 2. Ream pipe ends and remove all burrs and chips formed in cutting and threading.
 - 3. Protect plated pipe and valve bodies from wrench marks when making up joints.
 - 4. Apply PTFE thread lubricant to male threads

END OF SECTION

SECTION 224000
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. All plumbing fixtures.

1.2 REFERENCES

- A. ANSI A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use.
- B. ANSI A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.
- C. ANSI A112.19.1M - Enameled Cast Iron Plumbing Fixtures.
- D. ANSI A112.19.2M - Vitreous China Plumbing Fixtures.
- E. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.
- F. ANSI A112.19.5 - Trim for Water-Closet Bowls, Tanks, and Urinals.
- G. AHRI 1010 - Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers.
- H. ASSE 1002 - Water Closet Flush Tank Ball Cocks.
- I. Americans with Disabilities Act (ADA), Title III.
- J. The Energy Policy Act (EPAAct) of 2005.

1.3 SUBMITTALS

- A. Submit product data under provisions of Section 220500. Submittals shall include fixture carriers for record purposes only. Architect/Engineer does not review or approve carriers except for manufacturer.
- B. Include fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. For fixtures and trim requiring electrical connections, submit product data indicating general assembly, components, electrical power/controls wiring diagrams, and service connections.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All fixtures shall be as shown on the drawings and as scheduled in the plumbing material list. Additional requirements below:
- B. All vitreous china fixtures shall be from the same manufacturer where possible.
- C. All lavatory and sink trim shall be from the same manufacturer where possible.
- D. All fixtures shall be lead free. Faucets, traps, stops, and other fixture accessories shall not contain more lead than allowed per the latest State or Federal Act.
- E. P-Traps and Tailpieces:
 - 1. Sinks:
 - a. Accessible Type: 1-1/2" chrome plated 17-gauge cast brass offset tailpiece and p-trap with cleanout on bottom of trap.
 - b. Non-Accessible Type: Offset not required for tailpiece, otherwise same.
 - 2. Acceptable Manufacturers:
 - a. McGuire
 - b. Keeney
 - c. Dearborn Brass
 - d. Zurn
 - e. Chicago Faucet
- F. Insulation Covers and Enclosures for Accessible Lavatories and Sinks:
 - 1. Premanufactured cover for P-trap, stop valves, and supply lines.
 - a. 1/8" thick vinyl construction, paintable, tool free installation,
 - b. Acceptable Manufacturers:
 - 1) Truebro (Lav Guard 2)
 - 2) Plumberex (Pro-Extreme)
 - 3) McGuire (Prowrap)
 - 4) Buckaroos Inc.
 - 5) Zurn
 - 2. Premanufactured rigid enclosure for concealing lavatory P-trap, stop valves, and supply lines,
 - a. Rigid, high impact PVC, paintable, stainless steel fasteners for anchoring and removal.
 - b. Acceptable Manufacturers:
 - 1) Truebro (Lav Shield #2018)
 - 2) Zurn (Z6900-VG)
 - 3) Approved equal

3. Premanufactured rigid enclosure for concealing sink P-trap, stop valves, supply lines, garbage disposal, etc.
 - a. Rigid, high impact PVC, white or beige (Color by architect), paintable, 36" or 42" widths, stainless steel fasteners for anchoring and removal.
 - b. Acceptable Manufacturers:
 - 1) Truebro (Basin Guard)
 - 2) Approved equal

G. Angle Stops and Supplies:

1. Lavatories, Sinks and Tank Type Water Closets:
 - a. Lead-free, 3/8" chrome plated brass, quarter turn ball valve type with loose key stops, solder or compression or threaded connection type.
 - b. Lead-free, 3/8" chrome plated soft copper risers.
 - c. Acceptable Manufacturers:
 - 1) McGuire
 - 2) BrassCraft
 - 3) Keeney
 - 4) Zurn
 - 5) Chicago Faucet

H. Wall Hung Fixture Carriers:

1. Material: All Metal, ASME/ANSI A112.6.1M.
2. Lavatory carrier shall be rated to support 250 lbs. unless noted otherwise on the drawings.
3. Water closet carrier shall be rated to support 500 lbs. unless noted otherwise on the drawings
4. Manufacturers:
 - a. Zurn
 - b. JR Smith
 - c. Wade
 - d. Josam
 - e. Watts
 - f. Mifab
 - g. Sun Drainage Products
 - h. Sioux Chief

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Installation Requirements:

1. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

2. Install each fixture with trap easily removable for servicing and cleaning. Use screwed tailpiece couplings. Connect fixture waste to stack with slip fitting.
3. Provide fixtures with supply lines, stop valves, reducers, escutcheons, and any other items required for a complete and operational plumbing fixture assembly.
4. Install components level and plumb.
5. Caulk joint between finish floor and floor mounted fixtures and between finish walls and wall mounted fixtures with silicon caulk. Caulk the joint, between rim and fixture where a fixture builds into a counter top, with caulking compound. Refer to DIVISION 7 for "Caulking" requirements. Color to match fixture.
6. Where there is a possibility of water following pipe brackets, etc., into a wall; caulk escutcheons, space around brackets, etc., to exclude water. Refer to DIVISION 7 for "Caulking" requirements.
7. Refer to Plumbing Material List for fixture mounting heights.
8. All non-potable outlets shall be clearly marked with a permanently affixed laminated sign with 3/8" high lettering saying "Non-Potable Water Not for Human Consumption." Sign shall have black lettering on a yellow background.

B. Wall-Mounted Fixture Requirements:

1. All wall-mounted fixtures shall have compatible carriers designed for their intended service and suitable for the space available and configuration of fixtures. All carriers shall extend to the floor and be anchored to the slab as intended by the carrier manufacturer.

C. Floor-Mounted Fixture Requirements:

1. Where floor mounted fixtures are installed on a sloped floor, the open void below the fixture shall be grouted, leveled, and caulked to eliminate stress on the fixture and to prevent water migration to the floor below.

D. Exposed or Inside Accessible Cabinets Traps, Valve and Pipe Requirements:

1. All water or waste piping for plumbing fixtures that is exposed or inside cabinets shall be chrome plated.
2. All exposed flush valves for water closets and urinals shall have a chrome plated hanger to anchor the piping to the wall.
3. All exposed water supply piping and fittings in a finished space to a shower valve, hose bibb, or other water outlet shall be chrome plated.

E. ADA Accessible Exposed Sink and Lavatory Trim:

1. All exposed sink and lavatory traps, piping and angle stops installed at accessible sink and lavatory locations shall include offset style drain tailpiece, p-trap installed near and parallel with back wall, and insulation kit specially manufactured for this installation. Armaflex with duct tape is not acceptable.

F. ADA Accessible Water Closet Requirements:

1. Handicapped accessible water closet flush valve or flush tank handles shall be on the left hand or right hand side of the fixture, whichever is nearer to the center of the stall.
2. Coordinate flush valves in handicap accessible locations with grab bars installed by the General Contractor. Make modifications as necessary to flush valve piping to avoid conflict with grab bars. Common solutions include shortened or offset vacuum breaker tailpieces.

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3.2 ADJUSTING AND CLEANING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.
- B. At completion, clean plumbing fixtures, equipment, and faucet aerator screens.

3.3 FIXTURE ROUGH-IN SCHEDULE

- A. Rough-in fixture piping connections in accordance with table on plumbing drawings of minimum sizes for particular fixtures.

END OF SECTION

SECTION 230500
BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Requirements applicable to all Division 23 Sections. Also refer to Division 01 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

- A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.
- B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make the portion of the Mechanical Work a finished and working system.
- C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- D. Scope of Work:
 - 1. Plumbing Work: Refer to Section 220500 "Basic Plumbing Requirements".
 - 2. Heating Work shall include, but is not necessarily limited to:
 - a. Furnish and install refrigerant piping, accessories, and final charge of refrigerant.
 - b. Furnish and install condensate drain piping from cooling related equipment such as air handlers and cooling coil drain pans.
 - 3. Air Conditioning and Ventilating Work shall include, but is not necessarily limited to:
 - a. Furnish and install package air rotation units complete with dampers, filters, coils, fans, and motors.
 - b. Furnish and install package rooftop air handling units complete with curbs.
 - c. Furnish and install air-cooled condensing units and curbs.
 - d. Furnish and install complete supply air ductwork systems including all fittings, insulation, and outlets.
 - e. Furnish and install complete return air ductwork systems including all fittings, insulation, and inlets.
 - f. Furnish and install complete exhaust ductwork systems including all fittings, insulation, inlets, and fans.

4. Temperature Control Work shall include, but is not necessarily limited to:
 - a. Furnish and install a complete temperature control system as specified in Section 230900.
 - b. Temperature control system shall consist of a full Direct Digital Control (DDC) system including all accessories, sensors, and programming.
 - c. Furnish automatic control valves and dampers for installation by others.
 - d. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
5. Fire Protection Work: Refer to Section 210500 "Basic Fire Suppression Requirements".
6. Testing, Adjusting, and Balancing Work shall include, but is not necessarily limited to:
 - a. Furnish complete testing, adjusting, and balancing as specified in Section 230593, including, but not limited to, air systems, hydronic systems, plumbing systems, and verification of control systems.

1.3 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

A. Definitions:

1. "Mechanical Contractors" refers to the following:
 - a. Plumbing Contractor.
 - b. Heating Contractor.
 - c. Air Conditioning and Ventilating Contractor.
 - d. Temperature Control Contractor.
 - e. Fire Protection Contractor.
 - f. Testing, Adjusting, and Balancing Contractor.
2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.
5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.
 - a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.

- 6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
- 7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

B. General:

- 1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
- 2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
- 3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.
- 4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.
- 5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:
 - a. Light fixtures.
 - b. Gravity flow piping, including condensate.
 - c. Electrical busduct.
 - d. Sheet metal.
 - e. Electrical cable trays, including access space.
 - f. Sprinkler piping and other piping.
 - g. Electrical conduits and wireway.

C. Mechanical Contractor's Responsibility:

- 1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:
 - a. Burners.
 - b. Condensing Units.

- c. Package Air Rotation Units.
 - d. Packaged Rooftop Units.
 - e. Split Systems
 - f. Furnaces
2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
 3. Shall verify all existing equipment sizes and capacities where units are to be modified, moved or replaced. Contractor shall notify Architect/Engineer of any discrepancies prior to ordering new units or replacement parts, including replacements of equipment motors.
 4. Temperature Control Subcontractor's Responsibility:
 - a. Wiring of all devices needed to make the Temperature Control System functional.
 - b. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Subcontractor.
 - c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.
 5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

D. Electrical Contractor's Responsibility:

1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
2. Installs and wires all remote control devices furnished by the Mechanical Contractor or Temperature Control Subcontractor when so noted on the Electrical Drawings.
3. Provides motor control and temperature control wiring, where so noted on the drawings.
4. Coordinate with the Mechanical Contractor for size of motors and/or other electrical devices involved with repair or replacement of existing equipment.
5. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
6. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.4 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, and any item that may impact coordination with other disciplines.

- b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" (40 mm) and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" (40 mm) and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - d. Maintenance clearances and code-required dedicated space shall be included.
 - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.
 - a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.
 3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the General Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.

- d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
 - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
- 10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
 - 11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
 - 12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.5 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing Data:

- 1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
- 2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

- 1. Only products of reputable manufacturers are acceptable.
- 2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

- 1. Conform to all requirements of the City of Des Moines, Iowa's Codes, Laws, Ordinances and other regulations having jurisdiction.
- 2. Conform to all State Codes.
- 3. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
- 4. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
- 5. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
- 6. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.

7. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.

E. Examination of Drawings:

1. The drawings for the mechanical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
3. Scaling of the drawings is not sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
8. Where used in mechanical documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.
 - a. Any item listed as furnished shall also be installed, unless otherwise noted.
 - b. Any item listed as installed shall also be furnished, unless otherwise noted.

F. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

G. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

1.6 WEB-BASED PROJECT SOFTWARE

- A. The General Contractor shall provide a web-based project software site for the purpose of hosting and managing project communication and documentation until completion of the warranty phase.
- B. The web-based project software shall include, at a minimum, the following features: construction schedule, submittals, RFIs, ASIs, construction change directives, change orders, drawing management, specification management, payment applications, contract modifications, meeting minutes, construction progress photos.
- C. Provide web-based project software user licenses for use by the Architect/Engineer. Access will be provided from the start of the project through the completion of the warranty phase.
- D. At project completion, provide digital archive of entire project in format that is readable by common desktop software applications in format acceptable to Architect/Engineer. Provide data in locked format to prevent further changes.

1.7 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals List:

Referenced Specification Section	Submittal Item
23 05 00	Owner Training Agenda
23 05 13	Motors

Referenced Specification Section	Submittal Item
23 05 93	Testing, Adjusting, and Balancing
23 07 13	Duct Insulation
23 09 00	Controls
23 23 00	Refrigeration Piping and Specialties
23 31 00	Ductwork
23 31 00	Ductwork Layout Drawings
23 34 23	Power Ventilators
23 37 00	Grilles, Registers, and Diffusers
23 37 00	Louvers
23 54 00	Furnaces
23 62 13	Air Cooled Condensing Units
23 72 23	Packaged Air-To-Air Energy Recovery Equipment
23 73 13	Air Rotation Units
23 74 16.12	Packaged Rooftop Air Conditioning Units - 25T and Below
23 81 26	Split System Air Conditioning Units

B. General Submittal Procedures: In addition to the provisions of Division 01, the following are required:

1. Transmittal: Each transmittal shall include the following:
 - a. Date
 - b. Project title and number
 - c. Contractor's name and address
 - d. Division of work (e.g., plumbing, heating, ventilating, etc.)
 - e. Description of items submitted and relevant specification number
 - f. Notations of deviations from the contract documents
 - g. Other pertinent data
2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
 - a. Date
 - b. Project title and number
 - c. Architect/Engineer
 - d. Contractor and subcontractors' names and addresses
 - e. Supplier and manufacturer's names and addresses
 - f. Division of work (e.g., plumbing, heating, ventilating, etc.)
 - g. Description of item submitted (using project nomenclature) and relevant specification number
 - h. Notations of deviations from the contract documents
 - i. Other pertinent data
 - j. Provide space for Contractor's review stamps
3. Composition:
 - a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
 - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).

- c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g., voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.
6. Submittal Identification and Markings:
 - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
7. Schedule submittals to expedite the project. Coordinate submission of related items.

8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions, or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
 - a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.
16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 23 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 23 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.8 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 01.
- B. Format:
 - 1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
 - 2. Submit in Excel format.
 - 3. Support values given with substantiating data.
- C. Preparation:
 - 1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
 - 2. Break down all costs into:
 - a. Material: Delivered cost of product with taxes paid.
 - b. Labor: Labor cost, excluding overhead and profit.
- D. Update Schedule of Values when:
 - 1. Indicated by Architect/Engineer.
 - 2. Change of subcontractor or supplier occurs.
 - 3. Change of product or equipment occurs.

1.9 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.
- B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.
- C. Change order work shall not proceed until authorized.

1.10 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:
 - 1. Condensing Units
 - 2. Gas Fired Makeup Air Units
 - 3. Air Rotation Units

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- B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.
- C. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner's Operation and Maintenance Manuals.

1.11 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.
- B. Protect equipment, components, and openings with airtight covers and exercise care at every stage of storage, handling, and installation of equipment to prevent airborne dust and dirt from entering or fouling equipment to include, but not limited to:
 - 1. Motor windings and ventilation openings.
 - 2. Bearings.
 - 3. Equipment Pipe and Accessories connections openings. (e.g. boiler connections, coil connections, etc.)
 - 4. Equipment Duct and Accessories connections openings. (e.g. AHU/RTU duct connections; Terminal Air Boxes, etc.)
 - 5. Starter and control cabinets.
 - 6. Heat transfer coils.
 - 7. Combustion burner and blower equipment (e.g. combustion air intake, combustion vent/flue, etc.)
- C. Equipment and components that are visibly damaged or have been subject to environmental conditions prior to building turnover to Owner that could shorten the life of the component (for example, water damage, humidity, dust and debris, excessive hot or cold storage location, etc.) shall be repaired or replaced with new equipment or components without additional cost to the building owner.
- D. Keep all bearings properly lubricated and all belts properly tensioned and aligned.
- E. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- F. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

1.12 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.13 WARRANTY

- A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.14 INSURANCE

- A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.15 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the scheduled manufacturer is the basis for job design and establishes the quality required.
- B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections, piping and ductwork connections and arrangement, plumbing connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.
- D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.

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- E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.
- F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 ENGINEER OBSERVATION OF WORK

- A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:
 - 1. Placing fill over underground and underslab utilities.
 - 2. Covering exterior walls, interior partitions and chases.
 - 3. Installing hard or suspended ceilings and soffits.
- B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.
- C. Above-Ceiling Final Observation
 - 1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
 - a. Pipe insulation is installed and fully sealed.
 - b. Pipe and duct wall penetrations are sealed.
 - c. Pipe identification and valve tags are installed.
 - d. Main, branch and flexible ducts are installed.
 - e. Diffusers, registers and grilles are installed and connected to ductwork.
 - 2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.

3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

3.3 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 01.
- B. Final Jobsite Observation:
 1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
 2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
 3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
 4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.
- C. Before final payment is authorized, this Contractor must submit the following:
 1. Operation and maintenance manuals with copies of approved shop drawings.
 2. Record documents including marked-up drawings and specifications.
 3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
 4. Inspection by State Boiler Inspector.
 5. Start-up reports on all equipment requiring a factory installation inspection or start-up.
 6. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site; receipt by Architect/Engineer required prior to final payment approval.

3.4 OPERATION AND MAINTENANCE MANUALS

- A. General:
 1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
 2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div23.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div23.contractor.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Refer to Section 230900 for additional requirements for Temperature Control submittals.
5. Copy of final approved test and balance reports.
6. Copies of all factory inspections and/or equipment startup reports.
7. Copies of warranties.
8. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
9. Dimensional drawings of equipment.
10. Capacities and utility consumption of equipment.
11. Detailed parts lists with lists of suppliers.
12. Operating procedures for each system.
13. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.

14. Repair procedures for major components.
15. List of lubricants in all equipment and recommended frequency of lubrication.
16. Instruction books, cards, and manuals furnished with the equipment.

3.5 INSTRUCTING THE OWNER'S REPRESENTATIVES

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representatives by **FACTORY PERSONNEL** in the care, maintenance, and operation of the equipment and systems.
- C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- D. The instructions shall include:
 1. Explanation of all system flow diagrams.
 2. Explanation of all air handling systems.
 3. Temperature control system operation including calibration, adjustment and proper operating conditions of all sensors.
 4. Maintenance of equipment.
 5. Start-up procedures for all major equipment.
 6. Explanation of seasonal system changes.
 7. Description of emergency system operation.
- E. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can attend if desired.
- F. Minimum hours of instruction for each item shall be:
 1. Air Handling System(s) - 4 hours.
 2. Exhaust System(s) - 2 hours.
 3. Temperature Controls - As defined in Section 230900.
- G. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of two weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.
- H. Operating Instructions:
 1. Contractor is responsible for all instructions to the Owner's representatives for the mechanical and control systems.
 2. If the Contractor does not have staff that can adequately provide the required instructions the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.6 SYSTEM STARTING AND ADJUSTING

- A. The mechanical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final comfort adjustments as required.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.
- C. Operate all HVAC systems continuously for at least one week prior to occupancy to bring construction materials to suitable moisture levels. Areas with mechanical cooling shall be maintained below 60% RH.
- D. Contractor shall adjust the mechanical systems and controls at season changes during the one year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.
- E. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.
- F. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.7 RECORD DOCUMENTS

- A. The following paragraphs supplement Division 01 requirements.
- B. Maintain at the job site a separate and complete set of mechanical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.
- C. Mark drawings to indicate revisions to piping and ductwork, size and location, both exterior and interior; including locations of coils, dampers, other control devices, filters, and other units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (e.g., traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.
- D. Refer to Section 230900 for additional requirements for Temperature Control documents.

- E. Before completion of the project, a set of reproducible mechanical drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.
- F. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.
- G. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.
- H. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

3.8 PAINTING

- A. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.
- B. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, the Contractor shall have the equipment and all its supports, hangers, etc., painted to match the room decor.
- C. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.
- D. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer the color preference and furnish this color.
- E. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.
- F. Paint all outdoor uninsulated steel piping the color selected by Owner or Architect/Engineer.
- G. After surfaces have been thoroughly cleaned and are free of oil, dirt, and other foreign matter; paint all pipes and equipment with the following:
 - 1. Bare Metal Surfaces - Apply one coat of primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
 - 2. Insulated Surfaces - Paint insulation jackets with two coats of semi-gloss acrylic latex paint.

3.9 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.
- B. Clean all drain pans and areas where moisture is present. Immediately report any mold, biological growth, or water damage.
- C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed bare metal ductwork, piping, hangers, and accessories.
- D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.10 SPECIAL REQUIREMENTS

- A. Contractor shall coordinate the installation of all equipment, valves, dampers, operators, etc., with other trades to maintain clear access area for servicing.
- B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

3.11 IAQ MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

- A. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:
 - 1. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:
 - a. Minimizing the amount of dust generated.
 - b. Reducing solvent fumes and VOC emissions.
 - c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.
 - d. Protect stored on-site and installed absorptive materials from moisture damage.
 - 2. Request that the Owner designate an IAQ representative.
 - 3. Review and receive approval from the Owner's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
 - 4. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
 - 5. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner's IAQ representative during unoccupied periods.
 - 6. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.

7. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
8. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings Under Construction".
9. If permanently installed air handlers are used to serve both construction and occupied areas, all return grilles throughout construction areas shall be sealed to prevent air from construction areas being supplied to occupied areas.
10. If permanently installed air handlers are used during construction to serve only construction areas and do not supply air to adjacent occupied areas, MERV 8 filtration media shall be used to protect each return air grille or opening. The intent of this will be to prevent construction dust and debris from entering any return or supply air ductwork in the facility. All filtration media shall be replaced immediately prior to occupancy.
11. For each area under construction, the Contractor shall install a negative pressure indicator equivalent to Lamiflow Model L-102F as manufactured by Lamiflow Technologies. Contractor shall regularly monitor and record the negative pressure condition of the construction areas as called for in the Owner's ICRA.

3.12 MAINTAINING CLEAN DUCTWORK THROUGHOUT CONSTRUCTION

- A. Throughout the duration of construction, all ductwork shall be capped or sealed with sheet metal caps, polyethylene film, or other airtight protective to keep dust, dirt, and construction debris out of ducts. Similar means shall be used to seal air-side connections of HVAC equipment to include, but not limited to, air handling units, fans, fan coil units, cabinet heaters, and the like.
- B. When air terminal devices are installed, contractors shall seal all supply, return, and exhaust grilles with polyethylene film or other airtight protective to keep dust, dirt, and construction debris out of ducts.
- C. Should HVAC equipment be started during construction, Contractor shall remove airtight protectives and shall install one-inch thick MERV 8 filter media over all return and exhaust grilles to prevent dust, dirt, and construction debris from entering ductwork. Filter media shall cover the entire grille face and shall be secured such that air cannot bypass filter media.
- D. Should filter media become laden with dust and dirt, Contractor shall replace filter media with new media to prevent damage to air distribution system and equipment.
- E. The following steps shall be taken during testing, adjusting, and balancing of each air system:
 1. All construction activities in all spaces served by the air system shall stop.
 2. All airtight protectives and temporary filter media shall be removed from all portions of the air system.
 3. Testing, adjusting, and balancing work shall not commence until all construction activity is stopped and all airtight protectives and temporary filter media is removed.
 4. Once testing, adjusting, and balancing work is complete for the air system, airtight protectives or temporary filter media shall be installed over all ductwork openings and air terminals on the air system prior to resuming construction activities in any spaces served by the air system.
- F. The Owner shall agree the building is sufficiently clean prior to the removal of any filtration media and airtight protectives from air terminal devices.

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READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All air handling units operating and balanced.
3. All fans shall be operating and balanced.
4. All miscellaneous mechanical systems (unit heaters, fan coil units, cabinet heaters, etc.) operating.
5. All temperature control systems operating, programmed and calibrated.
6. Pipe insulation complete, pipes labeled, and valves tagged.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

END OF SECTION

SECTION 230505

HVAC DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Mechanical demolition.
- B. Cutting and Patching.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall be as specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. THE DRAWINGS ARE INTENDED TO INDICATE THE GENERAL SCOPE OF WORK AND DO NOT SHOW EVERY PIPE, DUCT, OR PIECE OF EQUIPMENT THAT MUST BE REMOVED. THE CONTRACTOR SHALL VISIT THE SITE AND VERIFY CONDITIONS PRIOR TO SUBMITTING A BID.
- B. Where walls, ceilings, etc., are shown as being removed on general drawings, the Contractor shall remove all mechanical equipment, devices, fixtures, piping, ducts, systems, etc., from the removed area.
- C. Where ceilings, walls, partitions, etc., are temporarily removed and replaced by others, This Contractor shall remove, store, and replace equipment, devices, fixtures, pipes, ducts, systems, etc.
- D. Verify that abandoned utilities serve only abandoned equipment or facilities. Extend services to facilities or equipment that shall remain in operation following demolition.
- E. Coordinate work with all other Contractors and the Owner. Schedule removal of equipment to avoid conflicts.
- F. This Contractor shall verify all existing equipment sizes and capacities where equipment is scheduled to be replaced or modified, prior to ordering new equipment.
- G. Bid submittal shall mean the Contractor has visited the project site and verified existing conditions and scope of work.

3.2 PREPARATION

- A. Disconnect mechanical systems in walls, floors, and ceilings scheduled for removal.
- B. Provide temporary connections to maintain existing systems in service during construction. When work must be performed on operating equipment, use personnel experienced in such operations.
- C. Existing Heating System: Maintain existing system in service until new system is complete and ready for service. Drain system only to make switchovers and connections. Obtain permission from the Owner at least 48 hours before partially or completely draining system. Minimize outage duration.

3.3 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

- A. Demolish and extend existing mechanical work under provisions of Division 2 and this Section.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned ducts and piping to source of supply and/or main lines.
- D. Remove exposed abandoned pipes and ducts, including abandoned pipes and ducts above accessible ceilings. Cut ducts flush with walls and floors, cap duct that remains, and patch surfaces. Cut pipes above ceilings, below floors and behind walls. Cap remaining lines. Repair building construction to match original. Remove all clamps, hangers, supports, etc. associated with pipe and duct removal.
- E. Disconnect and remove mechanical devices and equipment serving equipment that has been removed.
- F. Repair adjacent construction and finishes damaged during demolition and extension work.
- G. Maintain access to existing mechanical installations which remain. Modify installation or provide access panels as appropriate.
- H. Remove unused sections of supply and return air ductwork back to mains. Patch opening with sheet metal and seal airtight. Patch existing insulation to match existing. Where existing ductwork is to be capped and reused, locate the end cap within 6" of the last branch. End caps shall be 3" pressure class and seal class "A".
- I. Extend existing installations using materials and methods compatible with existing installations, or as specified.
- J. Properly reclaim and dispose of all refrigerant in demolished equipment and as required for extension of existing equipment.

3.4 CUTTING AND PATCHING

- A. This Contractor is responsible for all penetrations of existing construction required to complete the work of this project. Refer to Section 230529 for additional requirements.
- B. Penetrations in existing construction should be reviewed carefully prior to proceeding with any work.
- C. Penetrations shall be neat and clean with smooth and/or finished edges. Core drill where possible for clean opening.
- D. Repair existing construction as required after penetration is complete to restore to original condition. Use similar materials and match adjacent construction unless otherwise noted or agreed to by the Architect/Engineer prior to start of work.
- E. 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.

3.5 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment which remain or are to be reused.
- B. Clean all systems adjacent to project which are affected by the dust and debris caused by this construction.
- C. MECHANICAL ITEMS REMOVED AND NOT RELOCATED REMAIN THE PROPERTY OF THE OWNER. CONTRACTOR SHALL PLACE ITEMS RETAINED BY THE OWNER IN A LOCATION COORDINATED WITH THE OWNER. THE CONTRACTOR SHALL DISPOSE OF MATERIAL THE OWNER DOES NOT WANT TO REUSE OR RETAIN FOR MAINTENANCE PURPOSES.

END OF SECTION

SECTION 230513

MOTORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Single Phase and Three Phase Electric Motors.

1.2 REFERENCES

- A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- C. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- D. ANSI/IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.
- E. ANSI/NEMA MG 1 - Motors and Generators.
- F. ANSI/NFPA 70 - National Electrical Code.
- G. Energy Independence and Security Act of 2007.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof coverings. For extended outdoor storage, follow manufacturer's recommendations for equipment and motor.

1.4 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data including assembly drawings, bearing data including replacement sizes, and lubrication instructions.

PART 2 - PRODUCTS

2.1 MOTORS - GENERAL CONSTRUCTION AND REQUIREMENTS

- A. Refer to the drawings for required electrical characteristics. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

- B. Design motors for continuous operation in 40°C environment, and for temperature rise in accordance with ANSI/NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
- C. Visible Nameplate: Indicating horsepower, voltage, phase, hertz, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, insulation class.
- D. Electrical Connection: Boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.
- E. Unless otherwise indicated, motors 3/4 HP and smaller shall be single phase, 60 hertz, open drip-proof or totally enclosed fan-cooled type.
- F. Unless otherwise indicated, motors 1 HP and larger shall be three phase, 60 hertz, squirrel cage type, NEMA Design Code B (low current in-rush, normal starting torque), open drip-proof or totally enclosed fan-cooled type.
- G. Each contractor shall set all motors furnished by him.
- H. All motors shall have a minimum service factor of 1.15.
- I. All motors shall have ball or roller bearings with a minimum L-10 fatigue life of 150,000 hours in direct-coupled applications and 50,000 hours for belted applications. Belted rating shall be based on radial loads and pulley sizes called out in NEMA MG1-14.43.
- J. Bearings shall be sealed type for 10 HP and smaller motors. Bearings shall be regreasable type for larger motors.
- K. Motor Driven Equipment:
 - 1. No equipment shall be selected or operate above 90% of its motor nameplate rating. Motor size may not be increased to compensate for equipment with efficiency lower than that specified.
 - 2. If a larger motor than specified is required on equipment, the contractor supplying the equipment is responsible for all additional costs due to larger starters, wiring, etc.

- L. Provide all belted motors with a means of moving and securing the motor to tighten belts. Motors over 2 HP shall have screw type tension adjustment. Slide bases shall conform to NEMA standards.
- M. Motors for fans and pumps 1/12 HP or greater and less than 1 HP shall be electronically-commutated motors or shall have a minimum motor efficiency of 70% when rated in accordance with DOE 10 CFR 431. These motors shall also have the means to adjust motor speed for either balancing or remote control. Belt-driven fans may use sheave adjustments for airflow balancing in lieu of varying motor speed.

2.2 ELECTRONICALLY COMMUTATED MOTORS (ECM)

- A. Motor shall be variable speed, constant torque, brushless DC motor for direct-drive applications. Electronics shall be encapsulated for moisture protection and shall integral surge protection. Motor shall be pre-wired for specific voltage and phase.
- B. Motor frame shall be NEMA 48; UL recognized components shall be provided for the motor construction.
- C. All EC motors shall be a minimum of 85% efficient at all speeds.
- D. Motors shall be permanently lubricated; utilize ball bearings to match with the connected driven equipment.
- E. Provide motor with on-board motor control module. Motor speed shall be limited to provide electronic over current protection. Starter shall provide soft start to reduce inrush current and shall be controllable from 20% to 100% of full rated speed.
- F. Operational mode shall be as scheduled and shall be one of the following:
 - 1. Constant Flow
 - 2. Constant Temperature
 - 3. Constant Pressure

2.3 PREMIUM EFFICIENCY MOTORS (INCLUDING MOST 3-PHASE GENERAL PURPOSE MOTORS)

- A. All motors, unless exempted by EAct legislation that became federal law on December 19, 2010, shall comply with the efficiencies listed in that standard, which are reprinted below. These match the 2010 NEMA premium efficiency ratings. All ratings listed are nominal full load efficiencies, verified in accordance with IEEE Standard 112, Test Method B. Average expected (not guaranteed minimum) power factors shall also be at least the following:

HP	Full-Load Efficiencies %					
	Open Drip-Proof			Totally Enclosed Fan Cooled		
	1200 rpm	1800 rpm	3600 rpm	1200 rpm	1800 rpm	3600 rpm
1.0	82.5	85.5	77.0	82.5	85.5	77.0
1.5	86.5	86.5	84.0	87.5	86.5	84.0
2.0	87.5	86.5	85.5	88.5	86.5	85.5
3.0	88.5	89.5	85.5	89.5	89.5	86.5
5.0	89.5	89.5	86.5	89.5	89.5	88.5

HP	Full-Load Efficiencies %					
	Open Drip-Proof			Totally Enclosed Fan Cooled		
	1200 rpm	1800 rpm	3600 rpm	1200 rpm	1800 rpm	3600 rpm
7.5	90.2	91.0	88.5	91.0	91.7	89.5
10.0	91.7	91.7	89.5	91.0	91.7	90.2
15.0	91.7	93.0	90.2	91.7	92.4	91.0
20.0	92.4	93.0	91.0	91.7	93.0	91.0

- B. Motor nameplate shall be noted with the above ratings.

2.4 MOTORS ON VARIABLE FREQUENCY DRIVES

- A. All motors driven by VFDs shall be premium efficiency type.
- B. Motors shall be designed for use with VFDs in variable torque applications with 1.15 service factor. Motors shall not be equipped with auxiliary blowers.
- C. Motors driven by VFDs shall have Class F or H insulation and be designated by the motor manufacturer to be suitable for inverter duty service in accordance with NEMA MG 1 Section IV, "Performance Standards Applying to All Machines," Part 31 "Definite-Purpose Inverter-Fed Polyphase Motors.
- D. All 480 volt motors driven by VFDs shall be provided with shaft grounding rings or grounding brushes as a means to protect bearings from adverse shaft currents.
 1. Providing grounding rings internal to the motor housing is an acceptable solution, provided the motor is affixed with a label clearly indicating the presence of a grounding assembly. The grounding ring shall be listed for 40,000 hours of motor service and shall be accessible via the drive endplate.
 2. Motor shafts 2" and larger require shaft grounding on the drive end and the non-drive end. This Contractor shall ensure (via field observation and measurement) that the shaft is effectively grounded upon startup.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.
- B. For flexible coupled drive motors, mount coupling to the shafts in accordance with the coupling manufacturer's recommendations. Align shafts to manufacturer's requirements or within 0.002 inch per inch diameter of coupling hub.

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- C. For belt drive motors, mount sheaves on the appropriate shafts per manufacturer's instructions. Use a straight edge to check alignment of the sheaves. Reposition sheaves as necessary so the straight edge contacts both sheave faces squarely. After sheaves are aligned, loosen the adjustable motor base so the belt(s) can be added, and tighten the base so the belt tension is in accordance with the drive manufacturer's recommendations. Frequently check belt tension and adjust, if necessary, during the first day of operation and again after 80 hours of operation.

END OF SECTION

SECTION 230529

HVAC SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Equipment Bases and Supports.
- B. Sleeves and Seals.
- C. Flashing and Sealing of Equipment and Pipe Stacks.

1.2 REFERENCES

- A. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
- B. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.
- C. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.3 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

PART 2 - PRODUCTS

2.1 FOUNDATIONS, BASES, AND SUPPORTS

- A. Basic Requirements:
 - 1. Furnish and install foundations, bases, and supports (not specifically indicated on the Drawings or in the Specifications of either the General Construction or Mechanical work as provided by another Contractor) for mechanical equipment.
 - 2. All concrete foundations, bases and supports, shall be reinforced. All steel bases and supports shall receive a prime coat of zinc chromate or red metal primer. After completion of work, give steel supports a final coat of gray enamel.
- B. Concrete Bases (Housekeeping Pads):
 - 1. Unless shown otherwise on the drawings, concrete bases shall be nominal 4 inches thick and shall extend 3 inches on all sides of the equipment (6 inches larger than factory base), except where pad extension would interfere with working space at equipment control panels and electrical panels.

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2. Where a base is less than 12 inches from a wall, extend the base to the wall to prevent a "dirt-trap".
 3. Concrete materials and workmanship required for the Contractor's work shall be provided by the Contractor. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6"x6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at 28 days (be 20 MPa strength).
 4. Equipment requiring bases is as follows:
 - a. Air Rotation Unit
 - b. ERV
 - c. Furnace
- C. Supports:
1. Provide sufficient clips, inserts, hangers, racks, rods, and auxiliary steel to securely support all suspended material, equipment and conduit without sag.
 2. Hang heavy equipment from concrete floors or ceilings with Architect/Engineer-approved concrete inserts, furnished and installed by the Contractor whose work requires them, except where indicated otherwise.
- D. Grout:
1. Grout shall be non-shrinking premixed (Master Builders Company "Embecco"), unless otherwise indicated on the drawings or approved by the Architect/Engineer.
 2. Use Mix No. 1 for clearances of 1" or less, and Mix No. 2 for all larger clearances.
 3. Grout under equipment bases, around pipes, at pipe sleeves, etc., and where shown on the drawings.

2.2 OPENINGS IN FLOORS, WALLS AND CEILINGS

- A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.
- B. Coordinate all openings with other Contractors.
- C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.
- D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at Contractor's expense.
- E. Do not cut structural members without written approval of the Architect or Structural Engineer.

2.3 SLEEVES AND LINTELS

- A. Each Contractor shall provide sleeves and lintels for all duct and pipe openings required for the Contractor's work in masonry walls and floors, unless specifically shown as being by others.
- B. Fabricate all sleeves from standard weight black steel pipe or as indicated on the drawings. Provide continuous sleeve. Cut or split sleeves are not acceptable.
- C. Fabricate all lintels for masonry walls from structural steel shapes or as indicated on the drawings. Have all lintels approved by the Architect or Structural Engineer.
- D. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.
- E. Sleeves shall not penetrate structural members or masonry walls without approval from the Structural Engineer. Sleeves shall then comply with the Architect/Engineer's design.
- F. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.
- G. Install all sleeves concentric with pipes. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
- H. Where pipes rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (e.g., foam, rubber, asphalt-coated fiber, bituminous-impregnated felt, or cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
- I. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.

<u>Model</u>	<u>Service</u>	<u>Element Material</u>	<u>Temperature Range</u>
S	Standard (Stainless)	EPDM	-40°F to 250°F
T	High/Low Temperature (Steam)	Silicone	-67°F to 400°F
T	Fire Seals (1 hour)	Silicone	-67°F to 400°F
FS	Fire Seals (3 hours)	Silicone	-67°F to 400°F
OS	Oil Resistant/Stainless	Nitrile	-40°F to 210°F

2.4 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 HVAC SUPPORTS AND ANCHORS

- A. General Installation Requirements:
 - 1. Install all items per manufacturer's instructions.
 - 2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
 - 3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
 - 4. Supports shall extend directly to building structure. Do not support piping from duct hangers unless coordinated with Sheet Metal Contractor prior to installation. Do not allow lighting or ceiling supports to be hung from piping supports.

- B. Supports Requirements:
 - 1. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
 - 2. Set all concrete inserts in place before pouring concrete.
 - 3. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
 - 4. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
 - 5. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

- C. Installation of hangers shall conform to MSS SP-58, -69, and -89.

END OF SECTION

SECTION 230593
TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Testing, adjusting, and balancing of air systems.
- B. Testing, adjusting, and balancing of heating systems.
- C. Testing, adjusting, and balancing of cooling systems.
- D. Testing, adjusting, and balancing of energy recovery systems.

1.2 REFERENCES

- A. AABC - National Standards for Total System Balance, Seventh Edition.
- B. ADC - Test Code for Grilles, Registers, and Diffusers.
- C. AMCA - Publication 203-90; Field Performance Measurement of Fan Systems.
- D. ASHRAE - 2019 HVAC Applications Handbook; Chapter 39, Testing, Adjusting and Balancing.
- E. ASHRAE/ANSI - Standard 111-2008; Practices for Measurement, Testing, Adjusting and Balancing of Building HVAC&R Systems.
- F. NEBB - Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems, Ninth Edition, 2019.
- G. SMACNA - HVAC Systems; Testing, Adjusting and Balancing (latest edition).
- H. TABB - International Standards for Environmental Systems Balance.

1.3 SUBMITTALS

- A. Submit copies of report forms, balancing procedures, and the name and qualifications of testing and balancing agency for approval within 30 days after award of Contract.
- B. Electronic Copies:
 - 1. Submit a certified copy of test reports to the Architect/Engineer for approval. Electronic copies shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Copies that are not legible will be returned to the Contractor for resubmittal. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.

2. Electronic file size shall be limited to a maximum of 10MB. Larger files shall be divided into files that are clearly labeled as "1 of 2", "2 of 2", etc.
3. All text shall be searchable.
4. Bookmarks shall be used. All bookmark titles shall be an active link to the index page and index tabs.

1.4 REPORT FORMS

- A. Submit reports on AABC, SMACNA or NEBB forms. Use custom forms approved by the Architect/Engineer when needed to supply specified information.
- B. Include in the final report a schematic drawing showing each system component, including balancing devices, for each system. Each drawing shall be included with the test reports required for that system. The schematic drawings shall identify all testing points and cross-reference these points to the report forms and procedures.
- C. Refer to PART 4 for required reports.

1.5 WARRANTY/GUARANTEE

- A. The TAB Contractor shall include an extended warranty of 90 days after owner receipt of a completed balancing report, during which time the Owner may request a recheck of terminals, or resetting of any outlet, coil, or device listed in the test report. This warranty shall provide a minimum of 24 manhours of onsite service time. If it is determined that the new test results are not within the design criteria, the balancer shall rebalance the system according to design criteria.
- B. Warranty/Guarantee must meet one of the following programs: TABB International Quality Assurance Program, AABC National Project Performance Guarantee, NEBB's Conformance Certification.

1.6 SCHEDULING

- A. Coordinate schedule with other trades. Provide a minimum of seven days' notice to all trades and the Architect/Engineer prior to performing each test.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. All procedures must conform to a published standard listed in the References article of this section. All equipment shall be adjusted in accordance with the manufacturer's recommendations. Any system not listed in this specification but installed under the contract documents shall be balanced using a procedure from a published standard listed in the References article.

- B. The Balancing Contractor shall incorporate all pertinent documented construction changes (e.g. submittals/shop drawings, change orders, RFIs, ASIs, etc.) and include in the balancing report.
- C. Recorded data shall represent actual measured or observed conditions.
- D. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing is complete, close probe holes and patch insulation with new materials as specified. Restore vapor barrier and finish as specified.
- E. Permanently mark setting of valves, dampers, and other adjustment devices allowing for settings to be restored. Set and lock memory stops.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, plugging test holes, and restoring thermostats to specified settings.
- G. Installations with systems consisting of multiple components shall be balanced with all system components operating.

3.2 EXAMINATION

- A. Before beginning work, verify that systems are complete and operable. Ensure the following:
 - 1. General Equipment Requirements:
 - a. Equipment is safe to operate and in normal condition.
 - b. Equipment with moving parts is properly lubricated.
 - c. Temperature control systems are complete and operable.
 - d. Proper thermal overload protection is in place for electrical equipment.
 - e. Direction of rotation of all fans and pumps is correct.
 - f. Access doors are closed and end caps are in place.
 - 2. Duct System Requirements:
 - a. All filters are clean and in place. If required, install temporary media.
 - b. Duct systems are clean and free of debris.
 - c. Air outlets are installed and connected.
 - d. Duct system leakage has been minimized.
- B. Report any defects or deficiencies to Architect/Engineer.
- C. Promptly report items that are abnormal or prevent proper balancing.
- D. If, for design reasons, system cannot be properly balanced, report as soon as observed.
- E. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to the Architect/Engineer for spot checks during testing.
- B. Instruments shall be calibrated within six months of testing performed for project, or more recently if recommended by the instrument manufacturer.

3.4 INSTALLATION TOLERANCES

- A. $\pm 10\%$ of scheduled values:
 - 1. Adjust air inlets and outlets to $\pm 10\%$ of scheduled values.
- B. $+ 5\%$ of scheduled values
 - 1. Adjust outdoor air intakes to within $+ 5\%$ of scheduled values.
 - 2. Adjust exhaust air through energy recovery equipment to within $+5\%$ of scheduled values.
- C. Adjust supply, return, and exhaust air-handling systems to $+10\%$ / -5% of scheduled values.

3.5 ADJUSTING

- A. After adjustment, take measurements to verify balance has not been disrupted or that disruption has been rectified.
- B. Once balancing of systems is complete, at least one damper or valve must be 100% open.
- C. After testing, adjusting and balancing are complete, operate each system and randomly check measurements to verify system is operating as reported in the report. Document any discrepancies.
- D. Contractor responsible for each motor shall also be responsible for replacement sheaves. Coordinate with contractor.
- E. Contractor responsible for pump shall trim impeller to final duty point as instructed by this contractor on all pumps not driven by a VFD. Coordinate with contractor.

3.6 SUBMISSION OF REPORTS

- A. Fill in test results on appropriate forms.

PART 4 - SYSTEMS TO BE TESTED, ADJUSTED AND BALANCED

4.1 VERIFICATION OF EXISTING SYSTEMS.

- A. Perform a pre-balance of systems serving the area of construction prior to the start of any other work. Do not make adjustments to the systems. If the systems are not operating at maximum capacity, temporarily drive system to maximum and take readings for the system. Return the system to its original state when measurements are complete.

1. Rooftop Unit:

a. General Requirements:

- 1) Existing Equipment Tag (if available).
- 2) Location.
- 3) Manufacturer, model, arrangement, class, discharge.
- 4) Fan RPM.

b. Flow Rate:

- 1) Supply flow rate (cfm)
- 2) Return flow rate (cfm)
- 3) Outside flow rate (cfm)
- 4) Exhaust flow rate (cfm)

c. Pressure Drop and Pressure:

- 1) Filter pressure drop.
- 2) Total static pressure. (Indicate if across fan or external to unit).
- 3) Inlet pressure.
- 4) Discharge pressure.

2. Exhaust Fan

- a. Drawing symbol.
- b. Location.
- c. Manufacturer and model.
- d. Flow rate (cfm).
- e. Total static pressure. (Indicate measurement locations).
- f. Inlet pressure.
- g. Discharge pressure.
- h. Fan RPM.

3. Air Terminal (Inlet or Outlet):

- a. Room number/location.
- b. Terminal type and size.
- c. Velocity.
- d. Flow rate (cfm)
- e. Percent of design flow rate.

- B. Report findings to Architect/Engineer on standard forms. Provide four (4) copies of report.

4.2 GENERAL REQUIREMENTS

- A. Title Page:
 - 1. Project name.
 - 2. Project location.
 - 3. Project Architect.
 - 4. Project Engineer (IMEG Corp.).
 - 5. Project General Contractor.
 - 6. TAB Company name, address, phone number.
 - 7. TAB Supervisor's name and certification number.
 - 8. TAB Supervisor's signature and date.
 - 9. Report date.
- B. Report Index
- C. General Information:
 - 1. Test conditions.
 - 2. Nomenclature used throughout report.
 - 3. Notable system characteristics/discrepancies from design.
 - 4. Test standards followed.
 - 5. Any deficiencies noted.
 - 6. Quality assurance statement.
- D. Instrument List:
 - 1. Instrument.
 - 2. Manufacturer, model, and serial number.
 - 3. Range.
 - 4. Calibration date.

4.3 AIR SYSTEMS

- A. Duct Leakage Test:
 - 1. Air system and fan.
 - 2. Leakage class.
 - 3. Test pressure.
 - 4. Construction pressure.
 - 5. Flow rate (cfm): specified and actual.
 - 6. Leakage (refer to Section 233100 in the specifications): specified and actual.
 - 7. Statement that fire dampers, reheat coils and other accessories were included in the test.
 - 8. Pass or Fail.
 - 9. Test performed by.
 - 10. Test witnessed by.
- B. Air Moving Equipment:
 - 1. General Requirements:
 - a. Drawing symbol.
 - b. Location.

- c. Manufacturer, model, arrangement, class, discharge.
- d. Fan RPM.
- e. Multiple RPM fan curve with operating point marked. (Obtain from equipment supplier).
- f. Final frequency of motor at maximum flow rate (on fans driven by VFD).

2. Flow Rate:

- a. Supply flow rate (cfm): specified and actual.
- b. Return flow rate (cfm): specified and actual.
- c. Outside flow rate (cfm): specified and actual.
- d. Exhaust flow rate (cfm): specified and actual.

3. Pressure Drop and Pressure:

- a. Filter pressure drop: specified and actual.
- b. Total static pressure: specified and actual. (Indicate if across fan or external to unit).
- c. Inlet pressure.
- d. Discharge pressure.

C. Fan Data:

1. Drawing symbol.
2. Location.
3. Manufacturer and model.
4. Flow rate (cfm): specified and actual.
5. Total static pressure: specified and actual. (Indicate measurement locations).
6. Inlet pressure.
7. Discharge pressure.
8. Fan RPM.

D. Electric Motors:

1. Drawing symbol of equipment served.
2. Manufacturer, Model, Frame.
3. Nameplate: HP, phase, service factor, RPM, operating amps, efficiency.
4. Measured: Amps in each phase.

E. Air Terminal (Inlet or Outlet):

1. Drawing symbol.
2. Room number/location.
3. Terminal type and size.
4. Velocity: specified and actual.
5. Flow rate (cfm): specified and actual.
6. Percent of design flow rate.

F. Air Flow Measuring Station:

1. Drawing symbol.
2. Service.
3. Location.
4. Manufacturer and model.

5. Size.
6. Flow rate (cfm): specified and actual.
7. Pressure drop: specified and actual.

4.4 HEATING SYSTEMS

A. Heating Coils:

1. General Requirements:
 - a. Drawing symbol.
 - b. Service.
 - c. Location.
 - d. Manufacturer and model.
 - e. Size.
2. Flow Rate:
 - a. Flow rate (cfm): specified and actual.
3. Temperature:
 - a. Entering air temperature: specified and actual.
 - b. Leaving air temperature: specified and actual.
4. Pressure Drop and Pressure:
 - a. Air pressure drop: specified and actual.
5. Energy:
 - a. Air Btuh (cfm x temp rise x 1.09).

B. Terminal Heat Transfer Units:

1. General Requirement:
 - a. Drawing symbol.
 - b. Location.
 - c. Manufacturer and model.
 - d. Include air data only for forced air units.
2. Flow Rate:
 - a. Flow rate (cfm): specified and actual.
3. Temperature:
 - a. Entering air temperature: specified and actual.
 - b. Leaving air temperature: specified and actual.

4. Energy:
 - a. Air Btuh ($\text{cfm} \times \text{temperature rise} \times 1.09$).

4.5 COOLING SYSTEMS

A. Cooling Coils:

1. General Requirements:
 - a. Drawing symbol.
 - b. Service.
 - c. Location.
 - d. Size.
 - e. Manufacturer and model.
2. Temperature:
 - a. Entering air DB temperature: specified and actual.
 - b. Entering air WB temperature: specified and actual.
 - c. Leaving air DB temperature: specified and actual.
 - d. Leaving air WB temperature: specified and actual.
3. Flow Rate:
 - a. Flow rate (cfm): specified and actual.
4. Pressure Drop and Pressure:
 - a. Water pressure drop: specified and actual.
 - b. Air pressure drop: specified and actual.
5. Energy:
 - a. Air Btuh ($\text{cfm} \times \text{enthalpy change} \times 4.5$).

B. Terminal Heat Transfer Units:

1. General Requirements:
 - a. Drawing symbol.
 - b. Location.
 - c. Manufacturer and model.
 - d. Include air data only for forced air units.
2. Temperature:
 - a. Entering air DB temperature: specified and actual.
 - b. Leaving air DB temperature: specified and actual.
3. Flow rate:
 - a. Flow rate (cfm): specified and actual.

4. Energy:
 - a. Air Btuh (cfm x temperature rise x 1.09).

4.6 ENERGY RECOVERY SYSTEMS

A. Air Systems - Air energy recovery devices shall be tested at ambient temperatures of less than 40°F or greater than 85°F.

1. Air to Air Plate Exchanger:
 - a. General Requirements:
 - 1) Drawing Symbol
 - 2) Location.
 - b. Primary Air:
 - 1) Primary Entering Air Temperature.
 - 2) Primary Leaving Air Temperature.
 - 3) Primary Air Flow Rate (cfm).
 - 4) Primary Air Pressure Drop.
 - c. Secondary Air:
 - 1) Secondary Entering Air Temperature.
 - 2) Secondary Leaving Air Temperature.
 - 3) Secondary Air Flow Rate (cfm).
 - 4) Secondary Air Pressure Drop.

END OF SECTION

SECTION 230713
DUCTWORK INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Ductwork Insulation.
- B. Insulation Jackets.

1.2 QUALITY ASSURANCE

- A. Materials:
 - 1. Listed and labeled for flame spread/smoke developed rating of no more than 25/50 when tested per ASTM E84 or UL 723 as required by code.
 - 2. Fungal Resistance: No growth when tested in accordance with ASTM G21 (antifungal test).
 - 3. Rated velocity on coated air side for air erosion in accordance with UL 181 at 5,000 fpm minimum.

1.3 REFERENCES

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. ANSI/ASTM C553 - Mineral Fiber Blanket and Felt Insulation.
- C. ANSI/ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.
- D. ASTM E84 - Surface Burning Characteristics of Building Materials.
- E. ASTM E136 - Standard Test Method for the Behavior of Materials in a Vertical Tube Furnace at 750°C.
- F. ASTM E814 - Fire Tests of Through Penetrations Firestops.
- G. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.
- H. NFPA 255 - Surface Burning Characteristics of Building Materials.
- I. UL - XHEZ - Through Penetration Firestop Systems.
- J. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors.

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- K. UL 263 - Full Scale External Fire Tests with Hose Stream.
- L. UL 723 - Surface Burning Characteristics of Building Materials.
- M. UL 1479 - Fire Tests of Through Penetrations Firestops.

1.4 SUBMITTALS

- A. Submit shop drawings per Section 230500. Include product description, list of materials and thickness for each service, and location.
- B. Submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Type A: Flexible Fiberglass - Outside Wrap; ANSI/ASTM C553; commercial grade; 0.28 / 0.26 (Out-Of-Package/Installed-Compressed 25%) maximum 'K' value at 75°F; foil scrim Kraft facing, 1.0 lb./cu. ft. density. Submit both "Out of Package" and "Installed-Compressed 25%" K and R-values.
- B. Type B: Semi-rigid Fiberglass Board Wrap - Outside Application; ANSI/ASTM C612, Class 1; 0.25 maximum 'K' value at 75°F; foil scrim Kraft facing, 3 lb./cu. ft. density.
- C. Type C: Flexible Fiberglass Liner; ANSI/ASTM C1071; 0.28 maximum 'K' value at 75°F; 1.5 lb/cu ft minimum density; coated air side for 5000 fpm air velocity.

2.2 JACKETS

- A. Vapor Barrier Jackets: Kraft reinforced foil scrim vapor barrier with self-sealing adhesive joints. Beach puncture resistance ratio of at least 25 units. Tensile strength: 35 psi minimum. Single, self-seal acrylic adhesive on longitudinal jacket laps and butt strips.

2.3 JACKET COVERINGS

- A. Stainless Steel Jackets: Type 304 stainless steel; 0.010" thick; smooth finish with Z edge seams and stainless steel bands for outdoor use.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions, codes, and industry standards.
- B. Install materials after ductwork has been tested.

- C. Clean surfaces for adhesives.
- D. Provide insulation with vapor barrier when air conveyed may be below ambient temperature.
- E. Exterior Duct Wrap - Flexible, Type A:
 - 1. Apply with edges tightly butted.
 - 2. Cut slightly longer than perimeter of duct to insure full thickness at corners. Do not wrap excessively tight.
 - 3. Seal joints with adhesive backed tape.
 - 4. Apply so insulation conforms uniformly and firmly to duct.
 - 5. Seal all penetrations of the vapor barrier by strap hangers or slip cable hangers with adhesive backed tape.
 - 6. Provide high-density insulation inserts on rectangular ducts at trapeze duct hangers to prevent crushing of insulation. Provide high-density insulation inserts with clamp-on round ducts requiring two (2) rods or straps to prevent crushing of insulation. Maintain continuous vapor barrier through the hanger.
 - 7. Tape all joints with Royal Tapes #RT 350 (216-439-7229), Venture Tape 1525CW, or Compac Type FSK. No substitutions will be accepted without written permission from the Architect/Engineer.
 - 8. Press tape tightly to the duct covering with a squeegee for a tight continuous seal. Fish mouths and loose tape edges are not acceptable.
 - 9. Staples may be used, but must be covered with tape.
 - 10. Vapor barrier must be continuous.
 - 11. Mechanically fasten on 12" centers at bottom of ducts over 24" wide and on all sides of vertical ducts.
- F. Semi Rigid Fiberglass Board Wrap - Type B (Indoor Use):
 - 1. Impale on pins welded to the duct and secured with speed clips. Clip pins off close to speed clips.
 - 2. Space pins as needed to hold insulation firmly against duct, but not less than one pin per square foot. Pins must be long enough to avoid compressing the insulation.
 - 3. Seal all joints and speed clips with glass fabric set in adhesive or a 3" wide strip of Royal Tapes #RT 350 (216-439-7229), Venture Tape 1525CW, or Compac Type FSK facing tape.
 - 4. For small areas, secure insulation with adhesive over the entire surface of the duct. Use adhesive in addition to pins as needed to prevent sagging on horizontal surfaces.
- G. Semi Rigid Fiberglass Board Wrap - Type B (Outdoor Use):
 - 1. Impale on pins welded to the duct and secured with speed clips. Clip pins off close to speed clips.
 - 2. Space pins as required to hold insulation firmly against duct, but not less than one pin per square foot. Pins must be long enough to avoid compressing the insulation.
 - 3. Seal all joints and speed clips with glass fabric set in adhesive or a 3" wide strip of the same facing tape with adhesive.
 - 4. For small areas, secure insulation with adhesive over the entire surface of the duct. Use adhesive in addition to pins as needed to prevent sagging on horizontal surfaces.
 - 5. Install vapor barrier jacket. Cover with stainless steel jacket covering with seams on the bottom of horizontal ductwork.
 - 6. Seal all butt joints with metal draw bands screwed to jacket and filled with sealant. Seal all joints watertight.
 - 7. Provide positive slope on top of all horizontal surfaces to prevent ponding of water.

H. Interior Insulation - Flexible Duct Liner, Type C:

1. Observation of Duct Lining:
 - a. After installation of ductwork, Architect/Engineer may select random observation points in each system.
 - 1) At each observation point, cut and remove an 18" x 18" section of ductwork and liner for verification of installation.
 - 2) Random observation points based on one opening per 75 lineal ft. of total duct run.
 - b. When any of the observation points shows non-compliance, additional points will be designated by the Architect/Engineer, and observation repeated.
 - c. If 20% of points observed do not comply, remove and replace all lined ducts and repeat tests. Where replacement is not required, correct all non-compliances.
 - d. At end of observation, repair all duct lining and observation holes by installing standard, insulated, hinged access doors per Section 233300.
 - e. Paint or finish to match adjacent duct surfaces.
2. Impale on spindle anchors welded or mechanically fastened to the duct. Adhesive or glue fastened anchors are not acceptable. Maximum anchor spacing per SMACNA Duct Construction Standards or manufacturer's recommendations, whichever is more restrictive. Locate pins less than 3" from corners and at intervals not over 6" around the perimeter at leading and trailing edges. Locate pins within 3" of transverse joints and at intervals not over 16" long the length of the duct. Pins must be long enough to prevent compressing the insulation.
3. In addition to anchors, secure liner with UL listed adhesive covering over 90% of the duct surface.
4. Install per the latest edition of the SMACNA Manual.
5. Leading edges shall be covered as follows:
 - a. For duct velocities below 3000 fpm, coat leading edges with adhesive. Neatly butt liner without gaps at transverse joints. Cut liner flush with end of the duct section for tight joints with no exposed duct. If adhesive is shop installed, field apply additional adhesive to the end of each duct section for complete adhesion of the liner. Protect edges from dirt and debris.
 - b. For duct velocities above 3000 fpm, cover leading edges with metal nosing. Use nosing on upstream edges of each section of duct. If the duct can be installed in either direction, provide nosing on each end or clearly mark the duct to allow visual verification after installation. Verify duct velocities based on the scheduled air flow rates and determine where metal nosing is required.
 - c. Install metal nosing in the following locations (regardless of velocity):
 - 1) The first three fittings downstream of all fans.
 - 2) At all duct liner interruptions. This includes fire dampers, access doors, branch connections, and all other locations where the edge of the liner is exposed.
 - 3) Trailing edges of transverse joints do not require metal nosings.
6. Overlap liner at longitudinal joints. Make longitudinal joints at corners of the duct unless the duct size does not allow this. Coat longitudinal joints with adhesive at velocities over 2500 fpm.

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7. Seal all damaged duct liner with adhesive and glass cloth. Do not damage duct liner surface coatings.
 8. Duct dimensions given are net inside dimensions. Increase sheet metal to allow for insulation thickness.
-
- I. Continue insulation with vapor barrier through penetrations unless code prohibits.
 - J. Provide 2" wide, 24" high, 26 gauge, galvanized sheet metal corner protection angles for all externally insulated ductwork extending to a floor or curb.

3.2 SCHEDULE

- A. Refer to Section 233100 for scheduling of insulation.

END OF SECTION

SECTION 230800
COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Description
- B. Responsibilities
- C. Related Work
- D. Test Equipment

1.2 DESCRIPTION

- A. The purpose of this section is to specify Division 23 responsibilities in the commissioning process.
- B. The systems to be commissioned are listed in Section 019100.
- C. Commissioning requires the participation of the Division 23 Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Section 019100. Division 23 Contractor shall be familiar with all parts of Section 019100 and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

1.3 RESPONSIBILITIES

- A. Refer to Section 019100.

1.4 RELATED WORK

- A. Specific commissioning requirements are given in the following sections of these specifications. All the following sections apply to the Work of this section.
 - 1. Section 017823 - Operations and Maintenance
 - 2. Section 017900 - Demonstration and Training
 - 3. Section 019100 - Commissioning
 - 4. Section 210800 - Commissioning of Fire Suppression
 - 5. Section 220800 - Commissioning of Plumbing
 - 6. Section 260800 - Commissioning of Electrical
 - 7. Section 270800 - Commissioning of Communications
 - 8. Section 280800 - Commissioning of Electronic Safety and Security

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. The Contractor shall provide all test equipment necessary to fulfill the testing requirements of this Division. This equipment includes, but is not limited to, the following:
 - 1. Handheld temperature and relative humidity meter.
 - 2. Infrared thermometer gun.
 - 3. Analog differential pressure gauge and associated tubing.
 - 4. Portable computer with access to the building automation system.

- B. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the related specifications. If not otherwise noted, the following minimum requirements apply:
 - 1. Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of +/- 0.1°F.
 - 2. Pressure sensors shall have an accuracy of +/- 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.
 - 3. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

- C. Refer to Section 019100 for additional Division 23 requirements.

PART 3 - EXECUTION

- A. Refer to Section 019100.

END OF SECTION

SECTION 230900

CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Complete System of Automatic Controls.
- B. Control Devices, Components, Wiring and Material.
- C. Instructions for Owners.
- D. Remodeling.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years' experience.
- B. TCCs are limited to firms regularly employing a minimum of five full-time temperature control technicians within 100 miles of the job site.

1.3 REFERENCES

- A. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
- B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. ANSI/ASHRAE Standard 135-2020: BACnet® - A Data Communication Protocol for Building Automation and Control Networks, including all amendments.
- D. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 volts Maximum).
- E. ANSI/NFPA 70 - National Electrical Code.
- F. ANSI/NFPA 90A - Installation of Air-Conditioning and Ventilation Systems.
- G. ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality.
- H. ASHRAE 85 - Automatic Control Terminology for Heating, Ventilating, Air Conditioning.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.
- B. Factory-Mounted Components: Where control devices specified in this section are indicated to be factory mounted on equipment, arrange for shipping control devices to unit manufacturer.

1.5 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Flow Switches.
- B. Temperature Sensor Sockets.
- C. Automatic Dampers.
- D. Flow Meters.

1.6 AGENCY AND CODE APPROVALS

- A. All products shall have the following agency approvals. Provide verification that the approvals exist for all submitted products with the submittal package.
 - 1. UL-916; Energy Management Systems.
 - 2. C-UL listed to Canadian Standards Association C22.2 No. 205-M1983 "Signal Equipment."
 - 3. EMC Directive 89/336/EEC (European CE Mark).
 - 4. FCC, Part 15, Subpart J, Class A Computing Devices.

1.7 ACRONYMS

- A. Acronyms used in this specification are as follows:
 - 1. B-AAC BACnet Advanced Application Controller
 - 2. B-ASC BACnet Application Specific Controller
 - 3. BTL BACnet Testing Laboratories
 - 4. DDC Direct Digital Controls
 - 5. FMCS Facility Management and Control System
 - 6. GUI Graphic User Interface
 - 7. IBC Interoperable BACnet Controller
 - 8. IDC Interoperable Digital Controller
 - 9. LAN Local Area Network
 - 10. NAC Network Area Controller
 - 11. ODBC Open DataBase Connectivity
 - 12. OOT Object Oriented Technology
 - 13. OPC Open Connectivity via Open Standards
 - 14. PICS Product Interoperability Compliance Statement
 - 15. PMI Power Measurement Interface
 - 16. POT Portable Operator's Terminal
 - 17. TCC Temperature Control Contractor

18. TCS Temperature Control System
19. WAN Wide Area Network
20. WBI Web Browser Interface

1.8 SUMMARY

- A. Provide new standalone FMCS for this project.
- B. Niagara Framework/Tridium Based Control System: The TCS provided by the TCC must use the BACnet communication protocol over the standard network. All DDC controllers used in the HVAC controls and lighting controls must be provided with Tridium AX Wizards for use within the Niagara framework.
- C. TCC shall furnish all labor, materials, equipment, and service necessary for a complete and operating Temperature Control System (TCS) and Facility Management and Control System (FMCS) using Direct Digital Controls as shown on the drawings and as described herein.
- D. All labor, material, equipment and software not specifically referred to herein or on the plans that is required to meet the intent of this specification shall be provided without additional cost to the Owner.
- E. The Owner shall be the named license holder of all software associated with any and all incremental work on the project.

1.9 SYSTEM DESCRIPTION

- A. The entire TCS shall be comprised of a network of interoperable, standalone digital controllers communicating via the following protocol to an NAC. Temperature Control System products shall be as specified below.
- B. The FMCS shall include Network Area Controller or Controllers (NAC) within each facility. The NAC shall connect to the Owner's local or wide area network, depending on configuration. Provide access to the system, either locally in each building or remotely from a central site or sites, through standard Web browsers, via the Internet, and/or via local area network.
- C. Provide materials and labor necessary to connect factory supplied control components.
- D. Provide central and remote hardware, software, and interconnecting wire and conduit.
- E. The FMCS shall include automated alarming software capable of calling e-mail compatible cellular telephones and pagers. The e-mail alarm paging system shall be able to segregate users, time schedules, and equipment and be capable of being programmed by the Owner.
- F. For the dedicated configuration tool provided, it is preferable that it be launched from within the applicable Network Management Software. If not, include any software required for controller configuration as a leave-behind tool with enough license capability to support the installation.
- G. For each operator workstation provided, furnish one legal copy of all software tools, configuration tools, management tools, and utilities used during system commissioning and installation. All tools shall be readily available in the market. Contractor shall convey to the Owner all software tools and their legal licenses at project closeout.

H. Niagara Framework (Definition):

1. Niagara Framework: A set of hardware and software specifications for building and utility control owned by Tridium Inc. and licensed to multiple vendors. The framework consists of front end (M&C) software, web-based clients, field level control hardware, and engineering tools.
2. Niagara Framework Supervisory Gateway: DDC hardware component of the Niagara Framework. A typical Niagara architecture has Niagara-specific supervisory gateways at the IP level and other (non-Niagara specific) controllers on field networks (TP/FT-10, MS/TP, etc.) beneath the Niagara supervisory gateways. The Niagara specific controllers function as a gateway between the Niagara framework protocol (Fox protocol) and the field network beneath. These supervisory gateways may also be used as general-purpose controllers and also have the capability to provide a web-based user interface. Note that different vendors refer to this component by different names. The most common name is "JACE", which is used in this specification generically; other names include (but are not limited to)"EC-BOS", "FX-40", "TMN", "SLX" and "UNC".

I. Connection:

1. System shall be a complete hard-wired system. Wireless control systems/functions are NOT acceptable.

1.10 SOFTWARE LICENSE AGREEMENT

- A. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). In addition, the Owner shall receive ownership of all job-specific configuration documentation, data files, configuration tools, and application-level software developed for the project. This shall include, but is not limited to, all custom, job-specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the NAC, FMCS Server(s), and any related LAN/WAN/intranet and/or Internet connected routers and devices. Provide the Owner with all required IDs and passwords for access to any component or software program. The Owner shall determine which organizations shall be named in the SI organization ID ("orgid") of all software licenses. Owner shall be free to direct the modification of the "orgid" in any software license, regardless of supplier.
- B. For Niagara based systems, it is the express goal of this specification to implement an open system that will allow products from various suppliers to be integrated into a unified system in order to provide flexibility for expansion, maintenance, and service of the system. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s).
 1. All Niagara Framework components have an unrestricted interoperability license with a Niagara Compatibility Statement (NiCS) following the Tridium Open NiCS Specification and have a value of "ALL" for "Station Compatibility In", "Station Compatibility Out", "Tool Compatibility In", and "Tool Compatibility Out". Note that this will result in the following entries in the license file:
 - a. `accept.station.in=""`
 - b. `accept.station.out=""`
 - c. `accept.wb.in=""`
 - d. `accept.wb.out=""`

2. The Owner shall be free to direct the modification of the any software license, regardless of supplier. In addition, the Owner shall receive ownership of all job specific software configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job-specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use within Niagara Framework (Niagara)-based controllers and/or servers and any related LAN/WAN / intranet and internet connected routers and devices. Any and all required IDs and passwords for access to any component or software program shall be provided to the Owner. Provide all software necessary for developing software algorithms in all supervisory, programmable, and application specific direct digital controllers that are licensed to the Owner.
 3. Programming tools for programmable and application specific controllers that use the Niagara Framework shall not be restricted to any specific brand of JACE. Tools and controllers shall be able to connect to any brand of JACE that are provided under this specification section.
 - a. For each application generic controller with a Niagara Framework Wizard and for each application specific controller, provide Niagara Framework Wizards.
 - b. For each Niagara Framework Supervisory Gateway, provide a backup of all software within the Niagara Framework Supervisory Gateway, including configuration settings. This backup must be sufficient to allow restoration of the Niagara Framework Supervisory Gateway or the replacement of the Niagara Framework Supervisory Gateway.
 - c. Provide a Niagara Framework Engineering Tool. Submit software user manuals with the Niagara Framework Engineering Tool submittal.
 - d. Provide the Niagara Station ID for each Niagara Framework Supervisory Gateway.
- C. The energy metering system is a Tridium-based system using JACE's with I/O modules for single inputs and direct communications to meters that provide multiple points of data. All meters, metering points, and wiring are furnished and installed by the TCC.

1.11 JOB CONDITIONS

- A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It is this Contractor's responsibility to check the Contract Documents for possible conflicts between the Work of this section and that of other crafts in equipment location; pipe, duct and conduit runs; electrical outlets and fixtures; air diffusers; and structural and architectural features.

1.12 WARRANTY

- A. Refer to Section 230500 for warranty requirements.
- B. Within the warranty period, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by this Contractor at no expense to the Owner.
- C. Warranty requirements include furnishing and installing all FMCS software upgrades issued by the manufacturer during the one-year warranty period.
- D. Update all software and back-ups during warranty period and all user documentation on the Owner's archived software disks.

1.13 WARRANTY ACCESS

- A. The Owner shall grant to this Contractor reasonable access to the TCS and FMCS during the warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. BACnet Protocol with Tridium Niagara Platform:
 - 1. Automated Logic: WebCTRL
 - 2. Honeywell
 - 3. Johnson Controls: Metasys Extended Architecture
 - 4. Schneider Electric - EcoStruxure Building Operation
 - 5. Distech Controls

2.2 SYSTEM ARCHITECTURE

- A. General:
 - 1. The Temperature Control System (TCS) and Facility Management Control System (FMCS) shall consist of a network of interoperable, standalone digital controllers, a computer system, graphic user interface software, printers, network devices, valves, dampers, sensors, and other devices as specified herein.
 - 2. The installed system shall provide secure password access to all features, functions and data contained in the overall FMCS.
- B. Open, Interoperable, Integrated Architectures:
 - 1. All components and controllers supplied under this Division shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data are not acceptable.
 - 2. The supplied system must be able to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. An Open DataBase Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs are not acceptable.
 - 3. Hierarchical or "flat" topologies are required to have system response times as indicated below and to manage the flow and sharing of data without unduly burdening the customer's internal intranet network.
 - a. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
 - b. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.3 NETWORKS

- A. The Local Area Network (LAN) shall be a 100 megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and SOAP. Provide support for multiple Network Area Controllers (NACs), user workstations and, if specified, a local server.
- B. Local area network minimum physical and media access requirements:
 - 1. Ethernet; IEEE Standard 802.3.
 - 2. Cable; 100 Base-T, UTP-8 wire, Category 6.
 - 3. Minimum throughput; 100 Mbps.
- C. Communication conduits shall not be installed closer than six feet from 110VAC or higher transformers or run parallel within six feet of electrical high-power cables. Route the cable as far from interference generating devices as possible. Where communication wire must cross 110VAC or higher wire, it must do so at right angles.
- D. Ground all shields (earth ground) at one point only to eliminate ground loops. Provide all shield grounding at the controller location, with the shield at the sensor/device end of the applicable wire being left long and "safed" off in an appropriate manner.
- E. There shall be no power wiring more than 30 VAC rms run in conduit with communications wiring. In cases where signal wiring is run in conduit with communication wiring, run all communication wiring and signal wiring using separate twisted pairs (24awg) in accordance with the manufacturer's wiring practices.

2.4 REMOTE NETWORK ACCESS

- A. For Local Area Network installations, provide access to the LAN from a remote location via the Internet. The Owner shall provide a connection to the Internet to enable this access via high speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line, T1 Line or via the customer's intranet to a corporate server providing access to an Internet Service Provider (ISP). Customer agrees to pay monthly access charges for connection and ISP.

2.5 NETWORK AREA CONTROLLER (NAC)

- A. The TCC shall supply one or more Network Area Controllers (NAC) as part of this contract. Number of NACs required depends on the type and quantity of devices provided under Divisions 23 and 26. The TCC shall determine the quantity and type of devices.
- B. NAC shall be provided with open connectivity to any manufacturer's BACnet programmable or application specific direct digital controllers. These controllers shall be JACE 8000 Series models or the identical hardware private label equivalent. The programmable controllers and application specific controllers provided under this section shall be able to be programmed by their respective engineering software application tools through the Niagara-based supervisory controllers from the Ethernet level network. The engineering software application tools shall be able to be loaded on a personal computer with Ethernet connectivity, and no additional hardware shall be required to connect to and download any programmable or application specific controller.

- C. Each NAC shall provide the interface between the LAN or WAN and the field control devices and shall provide global supervisory control functions over the control devices connected to the NAC. It shall execute application control programs to provide:
 - 1. Calendar functions.
 - 2. Scheduling.
 - 3. Trending.
 - 4. Alarm monitoring and routing.
 - 5. Time synchronization.
 - 6. Integration of all controller data.
 - 7. Network Management functions.

- D. The Network Area Controller shall provide the following hardware features as a minimum:
 - 1. One Ethernet Port - 10/100 Mbps.
 - 2. One RS-232 port.
 - 3. One RS-485 port.
 - 4. Battery backup.
 - 5. Flash memory for long-term data backup. (If battery backup or flash memory is not supplied, the controller shall contain a hard disk with at least 1 gigabyte storage capacity.)
 - 6. The NAC must be capable of operation over a temperature range of 32°F to 122°F.
 - 7. The NAC must be capable of withstanding storage temperatures of between 0°F and 158°F.
 - 8. The NAC must be capable of operation over a humidity range of 5% RH to 95% RH, non-condensing.

- E. The NAC shall provide multiple user access to the system and support for ODBC or SQL. Databases resident on the NAC shall be ODBC-compliant or must provide an ODBC data access mechanism to read and write data stored within it.

- F. The NAC shall support standard Web browser access via the Internet or an intranet and a minimum of five (5) simultaneous users.

- G. Event Alarm Notification and Actions:
 - 1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
 - 2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a LAN, remote via dial-up telephone connection, or WAN.
 - 3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including, but not limited to:
 - a. Alarm
 - b. Normal
 - 4. Provide for the creation of a minimum of eight alarm classes with different routing and acknowledgement properties, e.g. security, HVAC, Fire, etc.
 - 5. Provide timed (scheduled) routing of alarms by class, object, group, or node.
 - 6. Provide alarm generation from binary object "runtime" and/or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.

- H. Treat control equipment and network failures as alarms and annunciated.

- I. Annunciate alarms in any of the following manners as defined by the user:
 - 1. Screen message text.
 - 2. E-mail of the complete alarm message to multiple recipients. Provide the ability to route and e-mail alarms based on:
 - a. Day of week.
 - b. Time of day.
 - c. Recipient.
 - 3. Pagers via paging services that initiate a page on receipt of e-mail message.
 - 4. Graphic with flashing alarm object(s).
 - 5. Printed message, routed directly to a dedicated alarm printer.
- J. The FMCS shall record the following for each alarm:
 - 1. Time and date.
 - 2. Location (building, floor, zone, office number, etc.).
 - 3. Equipment tag.
 - 4. Acknowledge time, date, and user who issued acknowledgement.
 - 5. Number of occurrences since last acknowledgement.
- K. Give defined users proper access to acknowledge any alarm.
- L. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.
- M. Provide a "query" feature to allow review of specific alarms by user-defined parameters.
- N. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
- O. An error log to record invalid property changes or commands shall be provided and available for review by the user.

2.6 BACNET FMCS

- A. The intent of this specification is to provide a peer-to-peer networked, standalone, distributed control system with the capability to integrate ANSI/ASHRAE Standard 135-2001 BACnet, MODBUS, OPC, and other open and proprietary communication protocols in one open, interoperable system.
- B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices in the system. Adherence to industry standards including the latest ANSI/ASHRAE Standard 135 (BACnet) to assure interoperability between all system components is required. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet (BACnet Ethernet/IP) and/or RS-485 (BACnet MSTP).

C. Interoperable BACnet Controller (IBC):

1. Controls shall be microprocessor based Interoperable BACnet Controllers (IBC) in accordance with the latest ANSI/ASHRAE Standard 135. Provide IBCs for unit ventilators, fan coils, heat pumps, terminal air boxes (TAB) and other applications. The application control program shall reside in the same enclosure as the input/output circuitry that translates the sensor signals. Provide a PICS document showing the installed system's compliance level to ANSI/ASHRAE Standard 135. Minimum compliance is Level 3.
2. The IBCs shall be listed by the BACnet Testing Laboratory (BTL) as follows:
 - a. BACnet Building Controller(s) (B-BC).
 - b. BACnet Advanced Application Controller(s) (B-AAC).
 - c. BACnet Application Specific Controller(s) (B-ASC).
3. The IBCs shall communicate with the NAC.
4. Each IBC sensor shall connect directly to the IBC and shall not use any of the I/O points of the controller. The IBC Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive. The IBC sensor shall provide a communications jack for connection to the BACnet communication trunk to which the IBC controller is connected. The IBC sensor, the connected controller, and all other devices on the BACnet bus shall be accessible by the POT.
5. All IBCs shall be fully application programmable and shall at all times maintain their BACnet Level 3 compliance. Controllers offering application selection only (non-programmable) require a 10% spare point capacity to be provided for all applications. Store all control sequences within or programmed into the IBC in non-volatile memory that does not depend on a battery to be retained.
6. The Contractor supplying the IBCs shall provide documentation for each device, with the following information at a minimum:
 - a. BACnet Device; MAC address, name, type and instance number.
 - b. BACnet Objects; name, type and instance number.
7. It is the responsibility of the Contractor to ensure that the proper BACnet objects are provided in each IBC.

D. Object Libraries:

1. A standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.
2. The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.
3. In addition to the standard libraries specified here, the system supplier shall maintain an on-line accessible (over the Internet) library, available to all registered users, to provide new or updated objects and applications as they are developed.
4. All control objects shall conform to the control objects specified in the BACnet specification.
5. The library shall include applications or objects for the following functions, at a minimum:
 - a. Scheduling Object: The schedule must conform to the schedule object as defined in the BACnet specification, providing seven-day plus holiday and temporary

- scheduling features and a minimum of 10 on/off events per day. Data entry to be by graphic sliders to speed creation and selection of on-off events.
- b. Calendar Object: The calendar must conform to the calendar object as defined in the BACnet specification, providing 12-month calendar features to allow for holiday or special event data entry. Data entry to be by graphic "point-and-click" selection. This object must be "linkable" to any or all scheduling objects for effective event control.
 - c. Override Object: Provide override object that is capable of restarting equipment turned off by other energy saving programs to maintain occupant comfort or for equipment protection.
 - d. Start-Stop Time Optimization Object: Provide a start-stop time optimization object to start equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled unoccupied time just far enough ahead to take advantage of the building's "flywheel" effect for energy savings. Provide automatic tuning of all start-stop time object properties based on historical performance.
 - e. Demand Limiting Object: Provide a demand-limiting object that is capable of controlling demand for any selected energy utility (electric, oil, gas, etc.). The object shall be able to monitor a demand value and predict (using a sliding window prediction algorithm) the demand at the end of the user-defined interval period (1 to 60 minutes). This object shall also accommodate a utility meter time sync pulse for fixed interval demand control. Upon a prediction that will exceed the user-defined demand limit (supply a minimum of 6 per day), the demand limiting object shall issue shed commands to either turn off user specified loads or modify equipment setpoints to provide the desired energy reduction. If the list of sheddable equipment is not enough to reduce the demand to below the setpoint, display a message on the user's screen (as an alarm) instructing the user to take manual actions to maintain the desired demand. The shed lists are specified by the user and shall be selectable to be shed in either a fixed or rotating order to control which equipment is shed the most often. Upon suitable reductions in demand, the demand-limiting object shall restore the equipment that was shed in the reverse order in which it was shed. Each sheddable object shall have a minimum and maximum shed time property to provide both equipment protection and occupant comfort.
6. The library shall include control objects for the following functions:
- a. Analog Input Object: Minimum requirement is to comply with the BACnet standard for data sharing. Allow high, low and failure limits to be assigned for alarming. Also, provide a time delay filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.
 - b. Analog Output Object: Minimum requirement is to comply with the BACnet standard for data sharing.
 - c. Binary Input Object: Minimum requirement is to comply with the BACnet standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment runtime by counting the amount of time the hardware input is in an "on" condition. The user must be able to specify either input condition as the "on" condition.
 - d. Binary Output Object: Minimum requirement is to comply with the BACnet standard for data sharing. Properties to enable minimum on and off times for equipment protection as well as start-to-start delay must be provided. Incorporate the BACnet Command Prioritization priority scheme to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide 16 levels of priority as a minimum. Systems not employing the BACnet method of contention resolution are not acceptable.

- e. PID Control Loop Object: Minimum requirement is to comply with the BACnet standard for data sharing. Each individual property must be adjustable to allow proportional control only, or proportional with integral control, or proportional, integral and derivative control.
 - f. Comparison Object: Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.
 - g. Math Object: Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.
 - h. Custom Programming Objects: Provide a blank object template for the creation of new custom objects to meet specific user application requirements. This object must provide a simple BASIC-like programming language that is used to define object behavior. Provide a library of functions including, but not limited to, math and logic functions and string manipulation. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for reuse.
 - i. Interlock Object: Provide an interlock object that provides a means of coordination of objects within a piece of equipment, such as an air handler or other similar types of equipment. An example is to link the return fan to the supply fan such that, when the supply fan is started, the return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming, thereby eliminating nuisance alarms during the off period.
 - j. Temperature Override Object: Provide an object whose purpose is to override a binary output to an "on" state in the event a user-specified high or low limit value is exceeded. Link this object to the desired binary output object as well as to an analog object for temperature monitoring to cause the override to be enabled. This object will execute a start command at the Temperature Override level of start/stop command priority, unless changed by the user.
 - k. Composite Object: Provide a container object that allows a collection of objects representing an application to be encapsulated to protect the application from tampering or to more easily represent large applications. This object must have the ability to allow the user to select the appropriate parameters of the "contained" application that are represented on the graphic shell of this container.
7. The object library shall include objects to support the integration of devices connected to the Network Area Controller (NAC). Provide the following as part of the standard library included with the programming software:
- a. LonMark/LonWorks Devices: These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering. Provide LonMark manufacturer-specific objects to facilitate simple integration of these devices. Support all network variables defined in the LonMark profile. The device manufacturer shall provide information (type and function) regarding network variables not defined in the LonMark profile.
 - b. For devices not conforming to the LonMark standard, provide a dynamic object that can be assigned to the device based on network variable information provided by the device manufacturer. Device manufacturer shall provide an XIF file, resource file, and documentation for the device to facilitate device integration.

- c. For BACnet devices, provide the following objects:
 - 1) Analog In.
 - 2) Analog Out.
 - 3) Analog Value.
 - 4) Binary.
 - 5) Binary In.
 - 6) Binary Out.
 - 7) Binary Value.
 - 8) Multi-State In.
 - 9) Multi-State Out.
 - 10) Multi-State Value.
 - 11) Schedule Export.
 - 12) Calendar Export.
 - 13) Trend Export.
 - 14) Device.
- d. For each BACnet object, provide the ability to assign the object a BACnet device and object instance number.
- e. For BACnet devices, provide the following support at a minimum:
 - 1) Segmentation.
 - 2) Segmented Request.
 - 3) Segmented Response.
 - 4) Application Services.
 - 5) Read Property.
 - 6) Read Property Multiple.
 - 7) Write Property.
 - 8) Write Property Multiple.
 - 9) Confirmed Event Notification.
 - 10) Unconfirmed Event Notification.
 - 11) Acknowledge Alarm.
 - 12) Get Alarm Summary.
 - 13) Who-has.
 - 14) I-have.
 - 15) Who-is.
 - 16) I-am.
 - 17) Subscribe COV.
 - 18) Confirmed COV notification.
 - 19) Unconfirmed COV notification.
 - 20) Media Types.
 - 21) Ethernet.
 - 22) BACnet IP Annex J.
 - 23) MSTP.
 - 24) BACnet Broadcast Management Device (BBMD) function.
 - 25) Routing.

2.7 DATA COLLECTION AND STORAGE (TRENDING REQUIREMENTS)

- A. The NAC shall be able to collect data for any property of any object and store resident in the NAC that shall have, at a minimum, the following configurable properties:
 - 1. Designating the log as interval or deviation.

2. For interval logs, configure the object for time of day, day of week and the sample collection interval.
 3. For deviation logs, configure the object for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
 4. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full or rollover the data on a first-in, first-out basis.
 5. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.
- B. Store all log data in a relational database in the NAC that is accessible from a server (if the system is so configured) or a standard Web browser.
- C. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.
- D. All log data shall be available to the user in ALL the following data formats:
1. HTML.
 2. XML.
 3. Plain text.
 4. Comma or tab separated values.
- E. The NAC shall archive its log data either locally (to itself) or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties:
1. Archive on time of day.
 2. Archive on user-defined number of data stores in the log (buffer size).
 3. Archive when log has reached its user-defined capacity of data stores.
 4. Provide ability to clear logs once archived.

2.8 AUDIT LOG

- A. Provide and maintain an audit log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:
1. Time and date.
 2. User ID.
 3. Change or activity: i.e., change setpoint, add or delete objects, commands, etc.

2.9 DATABASE BACKUP AND STORAGE

- A. The NAC shall automatically backup its database on a user-defined time interval.
- B. Store copies of the current database and, at the most, the recently saved database in the NAC. The age of the most recently saved database shall depend on the user-defined database save interval.

- C. Store the NAC database in XML format to allow viewing and editing. Other formats are acceptable as long as XML format is supported.

2.10 GRAPHIC USER INTERFACE SOFTWARE

- A. Operating System:
 - 1. Provide computer with the most current Microsoft-based operating system with which the GUI has proven compatibility.
- B. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu pulldowns and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line) that displays the location and the selected object identification.
- C. Point Organization: Organize points by equipment categories, location, or other means acceptable to Owner.
- D. Real-Time Displays: The GUI shall support the following graphic features and functions:
 - 1. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file. Use of proprietary graphic file formats is not acceptable. In addition to, or in lieu of, a graphic background, the GUI shall support the use of scanned pictures.
 - 2. Graphic screens shall be able to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URLs, and links to other graphic screens.
 - 3. Graphics shall support layering, and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.
 - 4. Modifying common application objects, such as schedules, calendars, and setpoints, shall be accomplished graphically.
 - a. Schedule times shall be adjusted using a graphic slider without requiring any keyboard entry from the operator.
 - b. Holidays shall be set by using a graphic calendar without requiring any keyboard entry from the operator.
 - 5. Commands to start and stop binary objects shall be made by selecting the object and the appropriate command from a pop-up menu. No text entry shall be required.
 - 6. Adjustments to analog objects, such as setpoints, shall be made by selecting the object and using a graphic slider to adjust the value. No text entry shall be required.
- E. System Configuration: At a minimum, the GUI shall include the necessary software and components to enable the operator to perform the following tasks with proper password access:
 - 1. Create, delete or modify control strategies.
 - 2. Add/delete objects.
 - 3. Tune control loops by adjusting control loop parameters.
 - 4. Enable or disable control strategies.
 - 5. Generate hard copy records or control strategies on a printer.

6. Select alarm points and define the alarm state.
 7. Select points to be trended and initiate the recording of values automatically.
 8. View any trend as a graph.
- F. On-Line Help: Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available using hypertext. All system documentation and help files shall be in HTML format.
- G. Security: Each operator shall be required to log on to that system with a user name and password to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall be able to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operator's access for viewing and/or changing each system application, full screen editor, and object. Each operator shall be automatically logged off the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. Store all system security data in an encrypted format.
- H. System Diagnostics: The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. Annunciate the failure of any device to the operator.
- I. Alarm Console:
1. The system shall have a dedicated alarm window or console. This window will notify the operator of an alarm condition, and allow the operator to view details of the alarm and to acknowledge the alarm.
 2. When the alarm console is enabled, a separate alarm notification window will supersede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator are not acceptable. The use of the alarm console can be enabled or disabled by the system administrator.

2.11 WEB BROWSER CLIENTS

- A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™, Firefox™, or Chrome. Systems requiring additional software to enable a standard Web browser to reside on the client machine, or manufacturer-specific browsers, are not acceptable.
- B. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphic User Interface. Systems that require different views or that require different means of interacting with objects, such as schedules or logs, are not permitted.
- C. The Web browser client shall provide:
1. User log-on identification and password shall be required. If an unauthorized user attempts access, display a blank web page. Implement security using Java authentication and encryption techniques to prevent unauthorized access.

2. Graphic screens developed for the GUI shall be the same screens used for the Web browser client. The web browser interface shall support all animated graphic objects supported by the GUI.
3. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
4. Store all graphic screens in the Network Area Controller (NAC) without requiring any graphics storage on the client machine.
5. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.
6. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
 - a. Modify common application objects, such as schedules, calendars, and setpoints, graphically.
 - 1) Schedule times shall be adjustable using a graphic slider, without requiring any keyboard entry from the operator.
 - 2) Holidays shall be set using a graphic calendar, without requiring any keyboard entry from the operator.
 - b. Commands to start and stop binary objects shall be made by right-clicking the selected object and selecting the appropriate command from a pop-up menu. No text entry shall be required.
 - c. View logs and charts.
 - d. View and acknowledge alarms.
 - e. Setup and execute SQL queries on log and archive information
7. The system shall be able to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just his/her defined home page. From the home page, links to other views or pages in the system shall be possible, if allowed by the system administrator.
8. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on intranet sites by specifying the Uniform Resource Locator (URL) for the desired link.

2.12 SYSTEM PROGRAMMING

- A. The GUI software shall perform system programming and graphic display engineering. Access to the GUI software shall be through password access as assigned by the system administrator.
- B. Provide a library of control, application, and graphic objects to enable creation of all applications and user interface screens. Applications shall be created by selecting the control objects from the library, dragging or pasting them on the screen, and linking them together using a built-in graphic connection tool. Completed applications may be stored in the library for future use. GUI screens shall be created in the same fashion. Data for the user displays shall be obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display. Provide all software tools or processes to create applications and user interface displays.

C. Programming Methods:

1. Provide the capability to copy objects from the supplied libraries or from a user-defined library to the user's application. Link objects with a graphic linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; e.g., internal, external, hardware, etc.
2. Configuration of each object shall be done through the object's property sheet using fill-in-the-blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration is not acceptable.
3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
4. All programming shall be done in real time. Systems requiring the uploading, editing, and downloading of database objects are not allowed.
5. The system shall support object duplication in a customer's database. An application, once configured, can be copied and pasted for easy reuse and duplication. All links, other than to the hardware, shall be maintained during duplication.

2.13 DDE DEVICE INTEGRATION

- A. The NAC shall support the integration of device data via Dynamic Data Exchange (DDE) over the Ethernet network. The NAC shall act as a DDE client to another software application that functions as a DDE server.
- B. Provide the required objects in the library included with the Graphic User Interface programming software to support the integration of these devices into the FMCS. Objects provided shall include, at a minimum:
 1. DDE Generic AI Object.
 2. DDE Generic AO Object.
 3. DDE Generic BO Object.
 4. DDE Generic BI Object.

2.14 MODBUS SYSTEM INTEGRATION

- A. The NAC shall support integration of device data from Modbus RTU, ASCII, and TCP control system devices. Connect to the Modbus system via an RS-232, RS485, or Ethernet IP as required by the device.
- B. Provide the required objects in the library included with the GUI programming software to support the integration of the Modbus system data into the FMCS. Objects provided shall include, at a minimum:
 1. Read/Write Modbus AI Registers.
 2. Read/Write Modbus AO Registers.

3. Read/Write Modbus BI Registers.
 4. Read/Write Modbus BO Registers.
- C. The NAC shall perform all scheduling, alarming, logging and global supervisory control functions of the Modbus system devices.
- D. The FMCS supplier shall provide a Modbus system communications driver. The equipment system vendor that provided the equipment using Modbus shall provide documentation of the system's Modbus interface and shall provide factory support at no charge during system commissioning.

2.15 OPC SYSTEM INTEGRATION

- A. The Network Area Controller shall act as an OPC client and shall support the integration of device data from OPC servers. The connection to the OPC server shall be Ethernet IP. The OPC client shall support third-party OPC servers compatible with the Data Access 1.0 and 2.0 specifications.
- B. Provide the required objects in the library included with the GUI programming software to support the integration of the OPC system data into the FMCS. Objects provided shall include:
1. Read/Write OPC AI Object.
 2. Read/Write OPC AO Object.
 3. Read/Write OPC BI Object.
 4. Read/Write OPC BO Object.
 5. Read/Write OPC Date/Time Input Object.
 6. Read/Write OPC Date/Time Output Object.
 7. Read/Write OPC String Input Object.
 8. Read/Write OPC String Output Object.
- C. The NAC shall perform all scheduling, alarming, logging and global supervisory control functions of the OPC system devices.
- D. The FMCS supplier shall provide an OPC client communications driver. The vendor that provided the equipment using OPC shall provide documentation of the system's OPC server interface and shall provide free factory support during system commissioning.

2.16 SOFTWARE

- A. IDC/IBCs shall operate totally standalone and independent of a central computer for all specified control applications.
- B. Software shall include a complete operating system (OS), communications handler, point processing, energy management application packages as specified herein, standard control algorithms and specific control sequences (IDC/IBC) and an Owner/user custom control calculation package complete with interpreter.
- C. OS software shall be PROM resident, operate in real time, provide prioritized task scheduling, control time programs, monitor and manage communications, and scan inputs and outputs.

- D. Each IDC/IBC panel shall include the following energy management routines:
1. Time of day scheduling.
 2. Optimum start/stop.
 3. Peak demand limiting.
 4. Economizer control.
 5. PID control.
 6. Supply air reset.
 7. Outdoor air reset.
- E. Input/output point processing software shall include:
1. Update of all connected input and output points at least once per second.
 2. Analog to digital conversion, scaling and offset, correction of sensor non-linearity, sensing no response or failed sensors, and conversion of values to 32-bit floating point format. Retain both the maximum and minimum values sensed for each analog input in memory. It shall be possible to input subsets of standard sensor ranges to the A/D converter and assign gains to match the full-scale 32-bit conversion to achieve high accuracy readout.
 3. A reasonability check on all analog inputs against previous values and discarding of values falling outside preprogrammed reasonability limits.
 4. Assignment of proper engineering units and status conditions to all inputs and outputs.
 5. Analog input alarm comparison with the ability to assign two individual sets of high and low limits (warning and alarm) to an input or to assign a set of floating limits (alarm a reset schedule or FMCS control point) to the input. Assign each alarm a unique differential to prevent a point from oscillating in and out of alarm. Make alarm comparisons of each scan cycle.
 6. Adjustment of timing from two seconds to two minutes in one-second increments to eliminate nuisance alarms on startup.
- F. Command Control software shall manage the receipt of commands from the server and from control programs.
1. Provide command delay to prevent simultaneous energizing of loads. Delay must be programmable from 0 to 30 seconds.
 2. Assign each command a command and residual priority to manage conflicts created by multiple programs having access to the same command point. Allow only outputs with a higher command priority to execute. Whenever a command is allowed to execute, its assigned residual priority shall replace the existing residual priority.
 3. A "fixed mode" option (override) shall allow inputs to and outputs from control programs to set to a fixed state or value. When in the "fixed mode", assign inputs and outputs high residual command priority to prevent override by application programs.
- G. Alarm lockout software shall prevent nuisance alarms. On initial start-up of mechanical equipment, assign a "timed lockout" period to analog points to allow them to reach a stable condition before activating alarm comparison logic. Lockout period shall be programmable for each point from 0 to 90 minutes in one-minute increments.
- H. A "hard lockout" shall also be provided to positively lock out alarms when equipment is turned off or when a true alarm depends on the condition of an associated point. Hard lockout points and lockout initiators shall be operator programmable.

- I. Runtime shall be accumulated based on the status of a digital input point. It shall be possible to totalize either on time or off time up to 10,000 hours with one-minute resolution. Runtime counts shall reside in non-volatile memory and have DCP resident runtime limits assignable through the operator's terminal.
- J. A transition counter shall count the number of times a device is cycled on or off. Counter shall be non-volatile and capable of counting 600,000 cycles. Limits shall be assignable to counts to provide maintenance alarm printouts.
- K. Custom IDC/IBC programs shall meet the control strategies called for in the sequence of operation of these specifications. Each IDC/IBC shall have resident in its memory and available to the programs a full library of IDC/IBC algorithms, intrinsic control operators, arithmetic, logic, and relational operators. Provide the following features:
 - 1. Proportional Control, Proportional plus Integral (PI), Proportional plus Integral plus Derivative (PID), and Adaptive Control (self-learning). Use Adaptive Control where the controlled flow rate is variable (such as TAB units and variable flow pumping loops). The adaptive control algorithm shall monitor the loop response to output corrections and adjust the loop response characteristics in accordance with the time constant changes imposed by variable flow rates. The algorithm shall operate in a continuous self-learning manner and shall retain in memory a stored record of the system dynamics so that, on system shutdown and restart, the learning process starts from where it left off. Standard PID algorithms are not acceptable substitutes for variable flow applications since they will provide satisfactory control at only one flow rate and will require continued manual fine tuning.
 - 2. All IDC/IBC setpoints, gains and time constants associated with IDC/IBC programs shall be available to the operator for display and modification via the operator workstation.
 - 3. The execution interval of each IDC/IBC loop shall be adjustable from 2 to 120 seconds in one-second increments.
 - 4. IDC/IBC control programs shall assign initialization values to all outputs so controlled devices assume a failsafe position on start-up.
- L. Provide time and event programming (TEP) capability to initiate a controlled sequence of events for execution at a specific time or upon the occurrence of an event. Minimum program features required are:
 - 1. Analog points commandable to a specific value.
 - 2. Digital points commandable to a specific state; e.g. on or off; fast, slow or off.
 - 3. Initiator to be a specific day and time or a specific event; e.g. an alarm.
 - 4. Manual initiation via operator's command.
 - 5. Commands must honor command delays (to prevent current surges), and assigned minimum ON and OFF times.
 - 6. Commands must honor command and residual priority structures allowing higher priority commands (like smoke control) to override lower priority commands (like time of day scheduling) and residual priority.
 - 7. Ability to chain TEPs.
 - 8. Ability to enable and disable TEPs individually.
 - 9. Ability to enable/disable TEP initiators.

- M. Store Energy Management application programs and associated data files in non-volatile or 72-hour battery backed RAM memory. Individual programs shall be accessible from the operator workstation for enabling/disabling and program parameter modification and shall include:
1. Time Programs:
 - a. Provide an independent start and stop program time for each system identified in the points list.
 - b. It shall be possible to assign two independent start and stop times/days to any equipment connected to a controller.
 2. Exception Day Scheduling:
 - a. Provide an Exception Day program for holiday and other planned exceptions to time programs. Exception schedules shall be DSC resident and operator programmable up to one year in advance.
 - b. The program shall allow definition of up to 32 exception time spans. Define each span by calendar start day and calendar stop day.
 3. An IDC/IBC resident temporary scheduler shall allow operators to modify present time program control of equipment. Minimum feature set required is:
 - a. Ability to alter time schedules as much as six days in advance.
 - b. Ability to alter either start time, stop time or both for each day.
 - c. Temporary schedule shall be in effect for all days specified.
 - d. Automatically delete the temporary schedule and restore program to normal schedule after execution.
 - e. Ability to assign schedule changes as permanent as well as temporary.
- N. The IDC/IBC shall have built-in, non-descriptive, self-test procedure for checking the indication lights, digital display, and memory. It shall display advisories for maintenance, performance, and/or software problems.
- O. All electronics shall be:
1. Standard locally stocked modular boards.
 2. Plug-in type.
 3. Furnish all ROM programs unlocked.

2.17 CONTROL DAMPERS

- A. Rectangular Control Dampers - Standard Construction:
1. Shall be licensed to bear the AMCA Certified Rating Seal.
 2. Test leakage and pressure drop per AMCA 500.
 3. Frame: Hat-shaped channel, minimum 12 gauge extruded aluminum, and minimum 4" deep. Caulk or weld seams to prevent leakage.
 4. Blades: Minimum 12 gauge extruded aluminum airfoil design, minimum 6" wide, and overlapping blades and blade seals (overlapping blade seals only is unacceptable).
 5. Shaft: Non-cylindrical, solid aluminum or zinc plated steel with opening in blade to match profile of shaft. Shaft shall be securely fastened to the blade and of sufficient length to mount direct-coupled actuator. Damper manufacturer shall provide drive pin extensions and outboard bearing support brackets as required.

6. Bearings: Acetal (Delrin/Celcon) inner bearing fixed to an aluminum shaft, rotating within a polycarbonate outer bearing inserted in the frame. Provide thrust bearings for vertical damper applications.
7. Blade Seals: Extruded silicone gaskets secured in an integral slot within the blade.
8. Side Seals: Stainless steel compression type or extruded silicone gasket secured in an integral slot within the frame.
9. Linkage: Shall be concealed in the frame, constructed of aluminum or corrosion-resistant zinc plated steel, and securely fastened to shaft. Blades linked for opposed operation, unless noted otherwise on the drawings. Blades shall close evenly. Use one direct-coupled actuator per damper section. Jack-shafting is not acceptable.
10. Size Limits: 48" maximum horizontal blade length, 24 square foot maximum area per damper. Total cross-sectional area of dampers in ducts shall be at least as large as the duct without the use of blank-off sections.
11. Maximum Leakage: Class 1A at 1" w.c. pressure differential for a 24" x 24" damper.
12. Maximum Pressure Drop for Opposed Blade Damper: 0.15" for 8,000 CFM through a 24" x 24" damper (2000 fpm).
13. Maximum Pressure Drop for Parallel Blade Damper: 0.08" for 8,000 CFM through a 24" x 24" damper (2000 fpm).

B. Thermally Insulated Control Damper:

1. Shall be licensed to bear the AMCA Certified Rating Seal.
2. Test leakage and pressure drop per AMCA 500.
3. Frame: Extruded aluminum, minimum 4" deep, 0.080" minimum thickness.
4. Thermally Broken Frame: Extruded aluminum, minimum 4" deep, 0.080" minimum thickness, flanged to duct. Entire frame shall be thermally broken using polyurethane resin pockets, complete with thermal cuts.
5. Blades: Minimum 12 gauge extruded aluminum airfoil design, minimum 6" wide, internally insulated with expanded polyurethane foam and thermally broken, with overlapping blades and blade seals (overlapping blade seals only is unacceptable).
6. Shaft: Non-cylindrical, solid aluminum or zinc plated steel shaft with opening in blade to match profile of shaft. Shaft shall be securely fastened to the blade and of sufficient length to mount direct-coupled actuator. Damper manufacturer shall provide drive pin extensions and outboard bearing support brackets as required.
7. Bearings: Acetal (Delrin/Celcon) inner bearing fixed to an aluminum shaft, rotating within a polycarbonate outer bearing inserted in the frame. Provide thrust bearings for vertical damper applications.
8. Side Seals: Stainless steel compression type or extruded silicone gasket secured in an integral slot within the frame.
9. Linkage: Shall be concealed in the frame, constructed of aluminum or corrosion-resistant zinc plated steel, and securely fastened to shaft. Blades linked for opposed operation, unless noted otherwise on the drawings. Blades shall close evenly. Use one direct-coupled actuator per damper section. Jack-shafting is not acceptable.
10. Size Limits: 48" maximum horizontal blade length, 24 square foot maximum area per damper. Total cross-sectional area of dampers in ducts shall be at least as large as the duct without the use of blank-off sections.
11. Maximum Leakage: Class 1A at 1" w.c. pressure differential for a 24" x 24" damper.
12. Maximum Pressure Drop: 0.21" for 8,000 CFM through a 24" x 24" damper (2000 fpm).

2.18 DAMPER ACTUATORS

A. Damper Actuators - Electronic:

1. Actuator shall be UL 873 or 60730 listed and provided with NEMA housing for applicable environment, electronic overload protection to prevent actuator damage due to over-rotation. Mount actuator by means of a V-bolt dual nut clamp with a V-shaped toothed cradle, directly couple and mount to the valve bonnet stem, or ISO-style direct-coupled mounting pad. Actuators shall be capable of being mechanically and electrically paralleled to increase torque, if required.
2. Actuators shall be warranted for a period of five (5) years from the date of production, with the first two (2) years unconditional.
3. Proportional actuator position shall be proportional to analog or pulse width modulating signal from electronic control system.
4. Fail-Safe Dampers: Where shown on the drawings or sequences, fail-safe mechanism shall operate the damper to the fail position following power interruption.
 - a. Mechanical/Spring: Mechanical spring return mechanism to drive controlled drive to an end position (open or close) on loss of power.
 - b. Electronic: Electronic fail-safe shall incorporate an active balancing circuit to maintain equal charging rates among the capacitors. The power fail position shall be proportionally adjustable between 0 to 100% in 10 percent increments with a 2 second operational delay.
5. Feedback: Where shown on drawings or sequences, provide analog feedback signal for positive position indication.
6. Damper End Switches: Where shown on the drawings or sequences, provide end switches to prove damper reaches open/closed position.

2.19 CONTROL INSTRUMENTATION

A. Temperature Measuring Devices:

1. Electric Thermostats:
 - a. Single Temperature - Low Voltage Electric: Integral manual ON/OFF/AUTO selector switch, minimum dead band of 5°F, anticipator circuits, concealed temperature adjustment, locking cover, 24 V control transformer (if not included with unit under control), single or double pole as required.
2. Low Limit Switch:
 - a. Provide one foot of sensing element for each one square foot of coil area, maximum element length 25 feet, of the vapor tension type, so that any point along the entire length of measuring element can trigger the switch.
 - b. Provide 3" minimum radius capillary support clips at each turn.
 - c. Furnish each thermostat with one single pole, single throw normally-opened switch and one single pole, single throw normally-closed auxiliary switch.
 - d. Setpoint range shall be 15°F to 55°F with a permanent stop at 35°F.
 - e. Differential shall be fixed at approximately 5°F and supplied with manual reset.

B. Temperature Sensors:

1. Duct Temperature Sensor:

- a. RTD type averaging sensor. 1000 ohm platinum RTD; accuracy: minimum +/- 1.2°F; range -40°F-220°F.
- b. Sensing element shall have a minimum of 1 foot of sensor length for each 2 square feet of duct or coil area. Sensor shall be arranged evenly across the duct or coil such that no point in the duct or coil is more than 1 foot away from the sensor.
- c. Probe type thermistors are acceptable in VAV box duct applications downstream of reheat coils.

C. Humidity Measuring Devices:

1. Humidity Sensors:

- a. Room Humidity Sensors: Fully electronic with no moving parts or parts requiring periodic service. Accuracy shall be minimum of 2.0 %RH accuracy from 0-90 %RH and 2.5 %RH accuracy from 90-100 %RH humidity at temperatures from 50°F to 104°F.
- b. Duct Humidity Sensors: Fully electronic with no moving parts or parts requiring periodic service. Accuracy shall be \pm 2% of reading.

2. Humidistats:

- a. Room Humidistats: Wall-mounted, proportioning type, with adjustable 2% RH throttling range, operating range from 30% to 80% at temperatures up to 110°F, cover with concealed setpoint. Accuracy shall be minimum of 1.5 %RH accuracy from 0-90 %RH and 2.5 %RH accuracy from 90-100 %RH at temperatures from 50°F to 104°F.

D. This device will measure the RH and will throttle the Humidifier Output signal to the valve or humidifier to keep the duct humidity from exceeding a preset limit Combination Duct Temperature/Humidity Throttle Sensors.

1. Duct mounted: Multi-function humidity device. Duct humidity limiter with integral temperature sensor. Proportionately reduce its output signal to the humidification equipment as duct relative humidity (RH) approaches user-defined setpoint. Initial setpoint shall be 85%RH (ADJ.) Single-pole, single-throw normally open relay contact for on/off and alarm indication. 0-10VDC or 0-20mA AC
2. Temperature Component: Thermistor sensing element or resistance temperature device (RTD), 1,000 ohm at 0°F (21°F); 32°F to 120°F operating range, \pm 0.50°F accuracy.
3. Humidity Component: Polymer element, Proportioning type, with adjustable 2% RH throttling range, setpoint 60% to 95% at temperatures up to 150°F. Accuracy shall be minimum of 2.0 %RH accuracy from 0-90 %RH.

E. Pressure Measuring Devices

1. Differential Pressure Switches:

a. Standard Pressure Switches:

- 1) Diaphragm-activated gauge with 4-3/4" dial, cast aluminum case, sealed interior, designed to resist shock and vibration, and rated for 15 psig.

- 2) Accuracy shall be $\pm 3\%$ of full scale maximum throughout entire range at 70°F.
- 3) Provide mounting brackets, probes, and shutoff valves required for proper installation.
- 4) The range and service shall be as required for application or as noted on the drawings.
- 5) Provide two (2) photo-transistor-activated circuits and two (2) DPDT relays for both high or low limit alarms or controls.
- 6) Provide latching relays that require manual reset once activated.
- 7) Acceptable Manufacturer: Dwyer Photohelic Series 3000.

2. Pressure Transmitters/Transducer:

a. Air-to-Air:

- 1) Provide transducer having the following minimum performance for measuring duct static pressure for VFD control or measuring differential pressure across filter banks:
 - a) Accuracy: $\pm 1.0\%$ FS
 - b) Non-Linearity, BFS: $\pm 0.96\%$ FS
 - c) Hysteresis: 0.10% full scale
 - d) Non-Repeatability: 0.05% full scale
 - e) Thermal Effects (compensated range): 0°F to +150°F
 - f) Maximum Line Pressure: 10 PSI
 - g) Zero/Span Shift: 0.033%FS/°F
 - h) Long Term Stability: 0.5%FS/1year
- 2) Provide transducer with the following minimum performance for measuring differential pressure across piezometer fan inlet airflow measuring stations:
 - a) Unit shall come factory equipped with static tube attached.
 - b) Unit shall include: (1) LCD shall display differential pressure on face of sensor enclosure over the entire operational range, and (2) IPCC-rated polycarbonate enclosure with short circuit proof outputs and reverse polarity protected inputs.
 - c) Accuracy at 72°F: $\pm 0.25\%$ FS
 - d) Stability: $\pm 0.25\%$ full scale per year
 - e) Temperature Error: (1) Zero: $\pm 0.025\%$ full scale per °C, (2) Span: Maximum $\pm 0.03\%$ full scale per °C
 - f) Environmental Operating Range: 32°F to 140°F.
 - g) Overpressure: Proof: (1) 2 psi, (2) Burst: 3 psi
 - h) Humidity: 0% to 95% RH non-condensing.

F. Flow Measuring Devices:

1. Airflow Measuring Stations:

a. Duct Mounted Airflow Measuring Stations (AFMS) - Thermal Dispersion:

- 1) Provide airflow/temperature measurement devices where indicated on the plans.

- 2) Each AFMS shall consist of one or more sensor probes and a single, remotely mounted, microprocessor-based transmitter capable of independently processing up to 16 independently wired sensor assemblies.
 - a) Each sensor assembly shall contain two individually wired, hermetically sealed bead-in-glass thermistors.
 - b) Thermistors shall be mounted in the sensor assembly using a marine-grade, waterproof epoxy. Thermistor leads shall be protected and not exposed to the environment.
 - c) Devices using chip-in-glass or diode-case chip thermistors are not acceptable.
 - d) Devices using less than two thermistors in each sensor assembly are not acceptable.
 - e) Devices using platinum wire RTDs are not acceptable.
 - f) Devices having electronic circuitry mounted in or at the sensor probe are not acceptable.
 - g) Pitot tubes and arrays are not acceptable.
 - h) Vortex shedding devices are not acceptable.

- 3) All Sensor Probes:
 - a) Each sensor assembly shall independently determine the velocity and temperature at its measurement point.
 - b) Each sensor assembly shall be calibrated at a minimum of 16 airflow rates and 3 temperatures to standards that are traceable to the National Institute of Standards and Technology (NIST).
 - c) Airflow measuring station assembly accuracy shall be $\pm 2\%$ of Reading over the entire operating airflow range. Temperature accuracy shall be $\pm 0.15^\circ$ F between -20° F and 160° F.
 - d) The operating humidity range for each sensor probe shall be 0-99% RH (non-condensing).
 - e) Each sensor probe shall have an integral, UL listed, plenum rated cable and terminal plug for connection to the remotely mounted transmitter. A single manufacturer shall provide both the airflow/temperature measuring probe(s) and transmitter for each measurement location.
 - f) The number of probes shall be as recommended by the manufacturer to achieve the specified accuracy.

- 4) Duct and Plenum Probes:
 - a) Probes shall be constructed of extruded, gold anodized, 6063 aluminum tube. All wires within the aluminum tube shall be Kynar coated.
 - b) Probe assembly mounting brackets shall be constructed of 304 stainless steel.
 - c) The operating airflow range shall be 0 to 5,000 FPM unless otherwise indicated on the plans.

5) Sensor Density:

Area (sq. ft.)	Total # of Sensors Required
Less than 2	4
2 to less than 4	6
4 to less than 8	8
8 to less than 16	12
≥ 16	16

6) Transmitters:

- a) The transmitter shall have an integral 16-character alphanumeric LCD display capable of simultaneously displaying individual airflow and temperature.
- b) The transmitter shall be capable of field configuration and diagnostics using an on-board interface and LCD display.
- c) The operating temperature range for the transmitter shall be -20° F to 120° F.
- d) The transmitter shall be capable of communicating with other devices using one of the following interface options:
- e) Option 1: Linear analog output signals for airflow and temperature: Field selectable, fuse protected and isolated, 0-10VDC/4-20mA (4-wire)
- f) Option 2: RS-485: Field selectable BACnet-ARCNET, BACnet-MS/TP, Modbus-RTU or Johnson Controls N2-Bus. BACnet devices shall provide analog variables for airflow and temperature containing individual sensor airflow rate and temperature data.
- g) Option 3: 10 Base-T Ethernet: Field selectable BACnet Ethernet, BACnet-IP, Modbus-TCP and TCP/IP. Provide dynamic link libraries and VBA functions to interface Ethernet devices to Microsoft Excel for remote monitoring of airflow and temperature using a Windows 2000 or Windows XP based PC.
- h) Option 4: LonWorks Free Topology

b. Fan Inlet Airflow Measuring Stations (AFMS) - Thermal Dispersion:

- 1) Sensor assemblies shall be mounted on 304 stainless steel housings.
- 2) Mounting rods shall be field adjustable to fit the fan inlet and constructed of nickel plated steel.
- 3) Mounting feet shall be constructed of 304 stainless steel and securely riveted in place to prevent loosening over time due to vibration.
- 4) The operating airflow range shall be 0 to 10,000 FPM unless otherwise indicated on the plans.
- 5) Transmitters
 - a) The transmitter shall have an integral 16-character alphanumeric LCD display capable of simultaneously displaying individual airflow and temperature.
 - b) The transmitter shall be capable of field configuration and diagnostics using an on-board interface and LCD display.
 - c) The operating temperature range for the transmitter shall be -20° F to 120° F.

- d) The transmitter shall be capable of communicating with other devices using one of the following interface options:
 - e) Option 1: Linear analog output signals for airflow and temperature: Field selectable, fuse protected and isolated, 0-10VDC/4-20mA (4-wire)
 - f) Option 2: RS-485: Field selectable BACnet-ARCNET, BACnet-MS/TP, Modbus-RTU or Johnson Controls N2-Bus. BACnet devices shall provide analog variables for airflow and temperature containing individual sensor airflow rate and temperature data.
 - g) Option 3: 10 Base-T Ethernet: Field selectable BACnet Ethernet, BACnet-IP, Modbus-TCP and TCP/IP. Provide dynamic link libraries and VBA functions to interface Ethernet devices to Microsoft Excel for remote monitoring of airflow and temperature using a Windows 2000 or Windows XP based PC.
 - h) Option 4: LonWorks Free Topology
- 6) The AFMS shall be UL listed as an entire assembly.
- c. Fan Inlet Airflow Measuring Stations - Differential Pressure:
- 1) Fan Inlet Measuring Station Pressure Sensors, Transmitters and Transducers:
 - a) Select for appropriate pressure range, fan type, inlet velocity, and airflow volume.
 - b) Transmitter features and minimum performance requirements shall be as follows: (1) Combined Accuracy: $\pm 0.50\%$, (2) Terminal Point Nonlinearity: $\pm 0.40\%$, (3) Hysteresis: $\pm 0.02\%$, (4) Non-repeatability: $\pm 0.05\%$, (5) Compensation Range - Zero Shift: $\pm 0.025\%$ FS/ $^{\circ}$ F, Span Shift: 0.025% FS/ $^{\circ}$ F, (6) Differential Overpressure: 5 psi proof and 25 psi burst pressure, (7) Output signal: 0 to 10 VDC.
 - c) Each transducer shall be provided with an integral manual zeroing valve to allow for field calibration of the zero-reference value without the need for shutting the operating system down.
 - d) System airflow (measured in CFM) shall be continuously displayed on an LCD display meter (0.5 inches high by 3.5 digits) located on the face of the air volume/velocity transducer control enclosure.
 - d. Mounting of fan inlet static pressure sensing elements shall be in accordance with manufacturer's published installation instructions to ensure accuracy of readings.
- G. Current Measuring Devices:
- 1. Current Switches for Constant Speed Motors:
 - a. Digital device rated for amperage load of motor or device with split core design, adjustable high and low trip points, 600 VAC rms isolation, induced power from the monitored load, LED indicator lamps for output status and sensor power. The device shall sense overloading, belt-loss, and power failure with a single signal.
 - 2. Current Switches for Motors Controlled by VFD:
 - a. Digital device rated for amperage load of motor or device with split core design, factory programmed to detect motor undercurrent conditions on variable or

constant volume loads, self-calibrating, positive status indication, LED indicator lamps, 600 VAC rms isolation, induced power from the monitored load with NO output. The current sensor shall store the motor current operating parameters in non-volatile memory and have a pushbutton reset to clear the memory if the operating parameters change or the sensor is moved to another load. The device shall sense overloading, belt-loss, and power failure with a single signal. The sensor shall be mounted on the load side of variable frequency drives.

H. Carbon Monoxide Sensors:

1. Solid-state gas sensor/transmitter, NEMA 1 gasketed enclosure, normal operating temperature 0-120°F, normal relative humidity operation 5-95%, $\pm 5\%$ accuracy, and detection range of 0-200 ppm.
2. Provide 4-20 mA output from the sensor to the FMCS system.
3. Provide local alarm whenever carbon monoxide level exceeds 100 ppm.
4. It shall be compatible with BACnet network interface and shall input these values to the network area controller.
5. Install in accordance with OSHA requirements.
6. Unit shall be factory calibrated and shall be re-calibrated after installation per manufacturer's recommendations.

I. Combination Carbon Monoxide/Nitrogen Dioxide Sensors:

1. Solid-state gas sensor/transmitter for each gas, NEMA 1 gasketed enclosure, normal operating temperature 0-120°F, normal relative humidity operation 5-95%, $\pm 5\%$ accuracy, and detection range of 0-200 ppm.
2. Provide separate 4-20 mA output from the sensor to the FMCS system for each gas.
3. Provide local alarm whenever carbon monoxide level exceeds 100 ppm or nitrogen dioxide level exceeds 5 ppm.
4. It shall be compatible with BACnet network interface and shall input these values to the network area controller.
5. Install in accordance with OSHA requirements.
6. Unit shall be factory calibrated and shall be re-calibrated after installation per manufacturer's recommendations.

J. Carbon Dioxide Sensors:

1. Microprocessor based non-dispersive infrared sensor with range of 0 to 2,000 ppm CO₂ with ± 100 ppm accuracy, maximum drift (compensated) of $\pm 5\%$ full scale in five years, VOC software and hardware sensing, duct mounting where applicable, 0-10V dc or 4-20 mA output directly proportional to ppm, adjustable alarm limit, membrane filter, and terminal block. The diffusion gas chamber in the sensor shall incorporate a reflective light pipe or wave guide surrounded by a gas permeable membrane that prevents particulate contamination of the sensor. Unit shall have selectable IAQ mode with output signal and sum of CO₂ and VOC levels.

K. Miscellaneous Devices:

1. Thermostat and Sensor Enclosures:
 - a. Clear plastic guard with lock. Wire guard with tamperproof screws. Setpoint shall be adjustable with cover in place. Fasten to wall separately from thermostat. Provide guards in all corridors, gymnasiums, locker rooms, toilet rooms, assembly halls and as noted on the drawings.

- b. Heavy Duty Enclosure:
 - 1) Perforated steel, tamperproof locking thermostat and control device enclosure.
 - 2) Box shall be nominally 8"x6"x2" deep or sized as required to fit devices to be enclosed.
 - 3) Perforated cover shall be 16 gauge steel with maximum 3/16" perforations on maximum 1/4" staggered centers for a 55% free area.
 - 4) Secure to wall from inside of box. Cover shall be secured by tamperproof screws to frame.
 - 5) Color shall match electrical devices. Verify color with the Electrical Contractor.

2. Twist Timers:

- a. Wall-mounted heavy duty, with rotary dial and face graduated in minutes or hours as noted. Unit shall fit behind standard "decorator" wall plate. Color of timer and face plate shall match remainder of project. Verify with Electrical Contractor. Provide wall plate and engraved plastic label indicating service.
- b. Switch shall be rated for 20 amps at 125 volts (10 amps at 277 volts) and fit standard 2-1/2" deep electrical box.
- c. Provide time cycle noted on the drawings or in the specifications; up to 12 hours.
- d. Manufacturers:
 - 1) Paragon SWD Series
 - 2) Tork A500 Series
 - 3) Intermatic FD Series
 - 4) Marktime Series 93

2.20 CONDUIT AND BOXES

- A. Conduit and Boxes: Refer to Electrical Section 260533 for materials, sizing, and other requirements
- B. Conduit and Box Identification (Color and Labeling):
 - 1. Refer to the Temperature Control Contractor notes located on the mechanical cover sheet for raceway and box color requirements.
 - 2. Refer to Electrical Section 260553 for raceway and box labeling requirements.

2.21 WIRE AND CABLE

- A. Wire and Cable: Refer to Electrical Section 260513 for wire and cable materials.
 - 1. Wire and Cable Color: Refer to the Temperature Control Contractor notes located on the mechanical cover sheet for wire and cable color requirements.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- A. Verify that systems are ready to receive work. Beginning of installation means installer accepts existing conditions.
- B. Install system and materials in accordance with manufacturer's instructions.
- C. Drawings of the TCS and FMCS network are diagrammatic only. Any apparatus not shown but required to meet the intent of the project documents shall be furnished and installed without additional cost.
- D. Install all operators, sensors, and control devices where accessible for service, adjustment, calibration, and repair. Do not install devices where blocked by piping or ductwork. Devices with manual reset or limit adjustments shall be installed below 6'-0" if practical to allow inspection without using a ladder.
- E. Verify locations of wall-mounted devices (such as thermostats, temperature and humidity sensors, and other exposed sensors) with drawings and room details before installation. Coordinate mounting heights to be consistent with other wall-mounted devices. Maximum height above finished floor shall not exceed ADA mounting requirements.
- F. Provide valves over 3/4" size with position indicators and pilot positioners where sequenced with other controls.
- G. Mount control panels adjacent to associated equipment on vibration-free walls or freestanding angle iron supports. One cabinet may accommodate more than one system in same equipment room.
- H. After completion of installation, test and adjust control equipment.
- I. Check calibration of instruments. Recalibrate or replace.
- J. Furnish and install conduit, wire, and cable per the National Electric Code, unless noted otherwise in this section.
- K. All hardware, software, equipment, accessories, wiring (power and sensor), piping, relays, sensors, power supplies, transformers, and instrumentation required for a complete and operational FMCS system, but not shown on the electrical drawings, are the responsibility of the TCC.
- L. Labels For Control Devices:
 - 1. Provide labels indicating service of all control devices in panels and other locations.
 - 2. Labels may be made with permanent marking pen in the control panels if clearly legible.
 - 3. Use engraved labels for items outside panel such as outside air thermostats.
 - 4. Labels are not required for room thermostats, damper actuators and other items where their function is obvious.

M. VFDs:

1. This project includes several variable frequency drives to control the flow of fans and/or pumps based on a control variable.
2. Verify output signal required, 4-20 mA or 0-10V dc, with the EC.
3. If VFD has a bypass feature, auxiliary contacts on the drive may not be used for motor status. A separate relay must be used to indicate motor rotation in either hand or auto positions.
4. If a separate current transmitter or switch is indicated for status, install this device between the VFD and the motor. In this case, the drive status may be connected to the auxiliary contacts in the VFD.
5. Some devices, such as low limits and fire alarm shutdown relays, must be hardwired to the fan motor. Make connections such that fan will shut down whether in hand or auto position if the unit has a bypass feature.

N. Airflow Stations:

1. The transmitter shall be installed at a location that is protected from weather, water, and vibration.
2. Mount transmitter where they can easily be read (36" to 66" above floor). Do not fasten transmitters directly to ductwork or compromise duct insulation.
3. The manufacturer's authorized representative shall visit the project site during construction prior to station installations to confirm all submitted sizes, mounting requirements and locations. Size adjustments shall be made at no additional cost. The representative shall meet on site with the TCC to support and train them on proper installation procedures and calibration.
4. Install labels at each sensor and transmitter identifying its service.

3.2 CONDUIT AND BOXES INSTALLATION

- A. Conduit and Box Installation: Refer to Electrical Section 260533 for execution and installation.
- B. Conduit and Box Identification (color and labeling) installation. Refer to Electrical Section 260553 for raceway and box identification installation.
- C. Outlet Box Schedule: Thermostat/temperature sensor:
 1. Dry Interior Locations: Provide 4" square galvanized steel with raised cover to fit flush with finished wall line. When located in concrete block walls, provide square edge title cover of sufficient depth to extend out to face of block or masonry boxes.
 2. Other Conditions: Refer to Electrical Section 260533 for requirements.

3.3 WIRE AND CABLE INSTALLATION

- A. Wire and Cable Installation: Refer to Electrical Section 260513 for execution and installation.
- B. Field Quality Control:
 1. Inspect wire and cable for physical damage and proper connection.
 2. Torque test conductor connections and terminations to manufacturer's recommended values.
 3. Perform continuity test on all conductors.

4. Protection of cable from foreign materials:
 - a. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited, to overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.
 - b. Overspray of paint on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.

C. Installation Schedule:

1. Conduit terminations to all devices installed in applications with rotating equipment, expansion/contraction or vibration shall be made with flexible metallic conduit, unless noted otherwise. Final terminations to exterior devices installed in damp or wet locations shall be made with liquidtight flexible metallic conduit. Terminations in hazardous areas, as defined in the National Electrical Code, shall be made with flexible conduit rated for the environment.

3.4 COMMISSIONING

- A. Upon completion of the installation, this Contractor shall load all system software and start up the system. This Contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to ensure that the system is functioning in full accordance with these specifications.
- B. This Contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the FMCS system operation.
- C. This Contractor shall prove that the controls network is functioning correctly and within acceptable bandwidth criteria and shall test the system with an approved protocol analysis tool. Provide a log and statistics summary showing that each channel is within acceptable parameters. Each channel shall be shown to have at least 25% spare capacity for future expansion.

- D. Upon completion of the performance tests described above, repeat these tests, point by point, as described in the validation log above in the presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.
- E. System Acceptance: Satisfactory completion is when this Contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.5 PREPARATION FOR BALANCING

- A. Verify that all dampers are in the position indicated by the controller (e.g., open, closed or modulating).
- B. Check the calibration and setpoints of all controllers.
- C. Check the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts, or cold walls.
- D. Check that all sequences operate as specified. Verify that no simultaneous heating and cooling occurs, unless specified. Observe that heating cannot begin at TAB reheat terminals until the unit is at the minimum CFM.
- E. Verify the operation of all interlock systems.

3.6 TEST AND BALANCE COORDINATION

- A. The Contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
- B. The Contractor shall provide a minimum of four (4) hours training for the Balancing Contractor in the use of these tools.
- C. In addition, the Contractor shall provide a qualified technician to assist in the test and balance process until the first 20 terminal units are balanced.
- D. The tools used during the test and balance process shall be returned at the completion of the testing and balancing.

3.7 DEMONSTRATION AND ACCEPTANCE

- A. At completion of installation, provide two days minimum instruction for operators. Demonstrate operation of all controls and systems. Describe the normal operation of all equipment.

3.8 TRAINING

A. On-Site:

1. After completion of commissioning, the manufacturer shall provide eight (8) hours of training on consecutive days for four (4) Owner's representatives. The training course shall enable the Owner's representatives to perform Day-to-Day Operations as defined herein. A factory-trained instructor with experience in presenting the training material and the system programmer for this project shall perform the training.

B. Day-to-Day Operations - Training Description:

1. Proficiently operate the system.
2. Understand control system architecture and configuration.
3. Understand FMCS systems components.
4. Understand system operation, including FMCS system control and optimizing routines (algorithms).
5. Operate the workstation and peripherals.
6. Log-on and off the system.
7. Access graphics, point reports, and logs.
8. Adjust and change system setpoints, time schedules, and holiday schedules.
9. Recognize malfunctions of the system by observation of the printed copy and graphic visual signals.
10. Understand system drawings and Operation and Maintenance manual.
11. Understand the job layout and location of control components.
12. Access data from FMCS controllers and ASCs.
13. Operate portable operator's terminals.

C. System Management - Training Description:

1. Maintain software and prepare backups.
2. Interface with job-specific, third-party operator software.
3. Add new users and understand password security procedures.

D. Provide course outline and materials in accordance with the "SUBMITTALS" article in Part 1 of this section. The instructor(s) shall provide one copy of training material per student.

3.9 INSTALLATION OF SENSORS

A. Install sensors in accordance with the manufacturer's recommendations.

B. Mount sensors rigidly and adequately for the environment within which the sensor operates.

C. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.

D. Averaging sensors and low limits shall be installed at the top of the assembly with the element on a slight downward incline away from the sensor making a serpentine pattern over the cross-sectional area with elements spaced not over 12" apart and within 6" of the top and bottom of the area.

E. All pipe-mounted temperature sensors shall be installed in immersion wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.

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- F. Install outdoor air temperature sensors on exterior of north wall, complete with sun shield at designated location approved by Architect/Engineer. TCC shall prime and paint the device enclosure. Color selection by Architect.
- G. Install all wall-mounted CO2 sensors between 3 feet and 6 feet above the floor.

END OF SECTION

SECTION 232300
REFRIGERATION PIPING AND SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Piping and Pipe Fittings
- B. Moisture and Liquid Indicators
- C. Check Valves
- D. Pressure Relief Valves
- E. Filter-Driers
- F. Suction Filters
- G. Solenoid Valves
- H. Expansion Valves
- I. Receivers
- J. Suction Accumulators

1.2 QUALITY ASSURANCE

- A. Remanufactured specialties are not acceptable.

1.3 REFERENCES

- A. ANSI/ASME SEC 8D - Boilers and Pressure Vessels Code, Rules for Construction of Pressure Vessels.
- B. ANSI/ASME SEC 9 - Boilers and Pressure Vessels Code, Welding and Brazing Qualifications.
- C. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- D. ANSI/ASME B31.5 - Refrigeration Piping.
- E. ANSI/ASTM B32 - Solder Metal.
- F. ANSI/ASTM B88 - Seamless Copper Water Tube.

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- G. ANSI/AWS A5.8 - Brazing Filler Metal.
- H. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

1.4 SUBMITTALS

- A. Submit shop drawings under provisions of Section 230500.
- B. Submit layout of entire piping system including equipment, critical dimensions, and all pipe sizes, traps, valves, and accessories. Layout shall be a custom drawing for this job, not a standard detail. The refrigeration equipment supplier shall stamp the approval on layout drawings.
- C. Submit product data for specialties, including manufacturers catalog information.
- D. Submit manufacturer's installation instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store piping and specialties in shipping containers with labels in place.
- B. Protect piping and specialties from entry of foreign material by leaving caps and plugs in place until installation.

PART 2 - PRODUCTS

2.1 PIPING

- A. Design Pressure: 450 psig.
 - 1. Maximum Design Temperature: 250°F.
- B. Piping - 4" and under; Brazed Joint:
 - 1. Tubing: Type ACR hard drawn seamless copper tube, ASTM B280. Sizes indicated are nominal designation.
 - 2. Joints: Brazed with silver solder.
 - 3. Fittings: Wrought copper solder joint, ANSI B16.22.
 - 4. Special Requirements: All tubing shall be cleaned, dehydrated, pressurized with dry nitrogen, plugged and tagged by manufacturer "for refrigeration service". During brazing operations, continuously purge the interior of the pipe with nitrogen to prevent oxide formation.
- C. Piping - 1-3/8" and Under; Dual Concentric Crimp Mechanical Press Connection (Contractor's Option):
 - 1. Tubing: Type ACR hard drawn seamless copper tube, ASTM B280. Sizes indicated are nominal designation.
 - 2. Joints: Dual concentric crimp band mechanical press connection.

3. Fittings: Refrigerant Grade Copper in accordance with ASTM B75 or ASTM B743 with embedded HNBR O-ring.
4. Manufacturers:
 - a. Rapid Locking System (RLS)
 - b. Conex Banninger
 - c. Parker Hannifin
 - d. MaxiPro ACR
 - e. Nibco ACR Press

2.2 MOISTURE AND LIQUID INDICATORS

- A. UL listed, with copper, brass, or copper-plated steel body, flared or solder ends, extended fittings in units up to at least 1-1/8" to allow brazing without removing the cartridge, sight glass, color coded paper moisture indicator that is replaceable without breaking piping connections for units up to 1-1/8" size, and plastic cap; maximum working pressure of 500 psi, and maximum temperature of 200°F.
 1. Manufacturers:
 - a. Sporlan
 - b. Henry Valve Company
 - c. Alco Valve

2.3 VALVES

- A. BA-14: Refrigerant Ball Valve: 3/8" thru 3-1/8", 500 psi, -40°F to +300°F, full-port up to 2-1/8" size, blow-out proof, PTFE seals, brass ball with equalizing orifice, visible position indication, seal cap, extended copper connections, replaceable stem seals, compatible with all CFC, HCFC, and HFC refrigerants.
 1. Manufacturers:
 - a. Henry Valve Company
 - b. Superior Valve
 - c. Alco Valve

2.4 CHECK VALVES

- A. CK-10: 1/4" thru 3-5/8", 500 psi, globe or angle pattern, brazed, brass body, cleaned-dried-plugged and tagged at factory for refrigerant service.
 1. Manufacturers:
 - a. Henry Valve Company
 - b. Mueller
 - c. Wolf-Linde

2.5 PRESSURE RELIEF VALVES

- A. RV-5: Straight Thru or Angle Type: Brass body and disc, Teflon seat, factory sealed and stamped with ASME UV and National Board Certification NB; selected to ANSI/ASHRAE 15.

2.6 FILTER-DRIERS

- A. Replaceable Cartridge Angle Type: ANSI/AHRI 710, UL listed, brass or epoxy-coated steel shell, molded desiccant high-water capacity filter core(s); maximum working pressure of 500 psi; maximum temperature of 275°F; maximum pressure drop of 3 psi with R410a or 1.5 psi with R134a at system flow rate.
- B. Permanent Straight Thru Type: ANSI/AHRI 710, UL listed, steel shell with molded desiccant filter core, maximum working pressure of 500 psi, maximum pressure drop of 3 psi with R410a or 1.5 psi with R134a at system flow rate.

2.7 SUCTION FILTERS

- A. Replaceable Cartridge Angle Type: UL listed for 500 psi up to 2-18" size, and 400 psi for larger sizes, steel shell that passes 1000-hour salt spray test with copper fittings, replaceable pleated filter element(s); maximum pressure drops of 3 psi with R410a or 2 psi with R134a at system flow rate, capable of accepting molded desiccant core for cleanup after compressor burnout, access valve in the removable end plate. Install with side refrigerant inlet.

2.8 SOLENOID VALVES

- A. Valve: AHRI 760; pilot operated; copper or brass body and internal parts; synthetic seat; stainless steel stem and plunger assembly; extended solder ends to permit installation without disassembly; maximum working pressure of 500 psi; normally closed. Maximum pressure drop at system flow of 5 psi for R410a and 3 psi for R134a.
- B. Coil Assembly: UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, surge protector and color-coded lead wires, integral junction box, Class F temperature rated, ANSI/UL 429.

2.9 EXPANSION VALVES

- A. Angle or Straight Thru Type: ANSI/AHRI 750; materials suitable for system refrigerant, external equalizer, adjustable super heat setting, balanced port design, suitable for horizontal or vertical installation, with replaceable capillary tube and remote sensing bulb.
- B. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10°F super heat. Select to avoid being undersized at full load or excessively oversized at part load.

2.10 RECEIVERS

- A. All receivers shall have capacity to hold the entire refrigerant charge when 90% full at 90°F per ASHRAE 15-78.
- B. 6" and Smaller Internal Diameter: ANSI/AHRI 495, UL listed, steel or copper, brazed; 450 psi working pressure, with tappings for inlet, outlet, and relief valve or fusible plug.

2.11 SUCTION ACCUMULATORS

- A. All accumulators shall have capacity to hold 50% of the refrigerant charge when 90% full at 90°F per ASHRAE 15-78, pressure drop equivalent to under 0.5°F at peak capacity, a finish that survives a 500-hour salt spray test, vertical design with dip tube and screened oil inlet orifice, and a hot gas boil-out coil to evaporate liquid refrigerant.
- B. 6" and Smaller Internal Diameter: ANSI/AHRI 495, UL listed, steel or copper, brazed; 400 psi pressure rating, with tappings for inlet, outlet, and pressure relief valve or fusible plug.

2.12 EXPANSION COMPENSATION

- A. Assembly consisting of two flexible connectors, two copper flexible connectors, two 90° elbows, and a 180° return pipe. Unit shall be in the form of a pipe loop.
- B. Connectors shall have corrugated copper hose bodies with copper braided casings.
- C. Connectors shall be rated for 150 psi working pressure at 70°F.
- D. Sizes 2" and smaller shall have copper sweat ends.
- E. Connectors shall be suitable for 1/2" permanent misalignment.
- F. Manufacturer:
 - 1. Metraflex Type MLS

PART 3 - EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories in preparation to be painted.

3.2 INSTALLATION

- A. Install specialties in accordance with manufacturer's instructions.
- B. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
- C. Route piping in orderly manner, parallel to building structure, and maintain gradient.
- D. Install piping to conserve building space and not interfere with use of space.
- E. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.
- F. Group piping whenever practical at common elevations and locations. Slope piping 1% in direction of oil return.
- G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- H. Provide clearance for installation of insulation and access to valves and fittings.
- I. Provide access doors for concealed valves and specialties.
- J. Where pipe support members are welded to structural building frame, brush clean, and apply zinc rich primer to welding.
- K. Insulate piping and equipment; per Section 230719 and Section 230716.
- L. Provide external equalizer piping on expansion valves, and locate expansion valve sensing bulb immediately downstream of evaporator on suction line. Connect distributor to expansion valve outlet.
- M. Install flexible connectors parallel to the shafts of compressors.
- N. Fully charge system with refrigerant after testing.

3.3 PIPE ERECTION AND LAYING

- A. Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be rejected and removed from the job immediately.
- B. All pipe, fittings, valves, equipment and accessories shall have factory applied identification sufficient to determine their conformance with specified requirements.
- C. Exercise care at all times to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not erect or install any item that is not clean.
- D. During construction, until system is fully operational, keep all openings in piping and equipment closed except when actual work is being performed on that item or system. Closures shall be plugs, caps, blind flanges or other items designed for this purpose.

- E. Change direction of pipes only with fittings or pipe bends. Change size only with fittings.
- F. Cut all pipe to exact measurement and install without springing or forcing.

3.4 APPLICATION

- A. Provide solenoid valves in liquid lines of systems, in oil bleeder lines to stop flow of oil and refrigerant into the suction line when system shuts down, and in hot gas bypass lines, as applicable.
- B. Provide refrigerant charging valve connections.
- C. Provide replaceable cartridge filter-driers, with three-valve bypass assembly and suction filters without bypass assembly.

3.5 JOINING OF PIPE

- A. Brazed Joints:
 - 1. Make up joints with brazing filler metal conforming to ANSI/AWS A5.8. Cut copper tubing ends perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt, and grease just prior to brazing. Apply flux evenly, but sparingly, to all surfaces to be joined. Brazing filler metal with a flux coating may also be used. Heat joints uniformly to proper brazing temperature so braze filler metal flows to all mated surfaces. Wipe excess braze filler metal, leaving a uniform fillet around cup of fitting.
 - 2. Flux shall conform to ANSI/AWS A5.31.
 - 3. Remove composition discs and all seals during brazing if not suitable for a minimum of 840°F or greater than the melting temperature of the brazing filler metal, whichever is greater.
- B. Mechanical Press Connection:
 - 1. Copper press fitting shall be made in accordance with the manufacturer's installation instructions.
 - 2. Examination: Upon delivery to the jobsite, examine copper tubing and fittings for debris, defects, incise marks (manufacturer's engraving on tube), holes, or cracks.
 - 3. Fully insert tubing into the fitting and mark tubing.
 - 4. Prior to making connection, the fitting alignment shall be checked against the mark made on the tube to ensure the tubing is fully engaged in the fitting.
 - 5. Joint shall be pressed with a tool approved by the manufacturer.
 - 6. Installers shall be trained by manufacturer personnel or representative. Provide documentation upon request.
- C. Axially Swaged Connection:
 - 1. Brass axially swaged connectors shall be installed in accordance with the manufacturer's installation instructions.
 - 2. Installers shall be trained by a certified Vulkan LOKRING trainer. Provide proof of certification upon request.

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3.6 FIELD QUALITY CONTROL

- A. Test piping system with nitrogen at 300 psig for at least 8 hours without loss of pressure.
- B. Comply with ASHRAE Standard 147 for refrigerant system integrity testing.
- C. After pressure testing, evacuate all refrigerant piping to at least 28" of mercury for 24 hours without loss of vacuum. Ensure moisture does not enter the piping prior to and during the tests.

END OF SECTION

SECTION 233100

DUCTWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Galvanized Ductwork
- B. Ductwork Reinforcement
- C. Ductwork Sealants
- D. Rectangular Ductwork
- E. Round Ductwork
- F. Exposed Ductwork (Rectangular, Round)
- G. Flexible Duct
- H. Leakage Testing
- I. Ductwork Penetrations

1.2 REFERENCES: Conform to all applicable requirements of the following publications:

- A. ADC Flexible Duct Performance and Installation Standards, 3rd Edition 1996.
- B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. ASHRAE - Handbook 2020 Systems and Equipment; Chapter 19 - Duct Construction.
- D. ASHRAE - Handbook 2021 Fundamentals; Chapter 21 - Duct Design.
- E. ASTM A90 - Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
- F. ASTM A167- Stainless & Heat-Resisting Chromium-Nickel Steel Plate, Sheet, & Strip.
- G. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- H. ASTM A924 - Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

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- I. ASTM E90-02 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
- J. ASTM E413-87 - Classification for Rating Sound Insulation.
- K. AWS D9.1M/D9.1 - Sheet Metal Welding Code.
- L. IECC - International Energy Conservation Code (latest published edition)
- M. NFPA 90A - Installation of Air-Conditioning and Ventilating Systems.
- N. NFPA 90B - Installation of Warm Air Heating and Air- Conditioning Systems.
- O. SMACNA - Air Duct Leakage Test Manual.
- P. SMACNA - HVAC Duct Construction Standards.
- Q. SMACNA - Round Industrial Duct Construction Standards - 1999 Edition.
- R. UL 181 - Factory-Made Air Ducts and Air Connectors.
- S. UL 181A - Closure Systems for Use with Rigid Air Ducts and Air Connectors
- T. UL 181B - Closure Systems for Use with Flexible Air Ducts and Air Connectors.

1.3 SUBMITTALS

- A. Submit shop drawings per Section 230500.
- B. Submit duct fabrication standards in compliance with SMACNA and these specifications. Clearly indicate metal gauges, reinforcement, and joining methods intended for use for each pressure classification. Furnish details of all common duct fittings and joint connections to be used on this project.
- C. The Architect/Engineer may require field verification of sheet metal gauges and reinforcing to verify compliance with these specifications. At the request of the Architect/Engineer, the contractor shall remove a sample of the duct for verification. The contractor shall repair as needed.
- D. Duct Layout Drawings: Submit detailed duct layout drawings at 1/4" minimum scale complete with the following information:
 - 1. Actual duct routing, ductwork fittings, actual sheet metal dimensions including insulation liner and wrap, duct hanger and support types, ductwork accessories, etc. with lengths and weights noted.
 - 2. Differentiate ducts that are wrapped. Include insulation thickness, type of insulation, and acoustical lagging.
 - 3. Room names and numbers, ceiling types, and ceiling heights.
 - 4. Indicate location of all beams, bar joists, etc. along with bottom of steel elevations for each member.

5. Verify clearances and interferences with other trades prior to preparing drawings. IMEG will provide electronic copies of ventilation drawings for contractor's use if the contractor signs and returns the "Electronic File Transfer" waiver. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for this submittal. Refer also to Section 230500.

- E. Duct Leakage Test Summary Report: Upon completion of the pressure test described in Part 3, the Contractor shall submit an air duct leakage test summary report as outlined in the SMACNA HVAC Duct Leakage Test Manual.

1.4 DEFINITIONS

- A. Duct Sizes shown on drawings are inside clear dimensions. Maintain clear dimensions inside any lining.
- B. Transitions are generally not shown in single-line ductwork. Where sizes change at a divided flow fitting, the larger size shall continue through the fitting.
- C. Exterior Duct: Ductwork located outside the conditioned envelope including exposed ductwork above the roof, outside exterior walls, in attics above insulated ceilings, inside parking garages, and crawl spaces.
- D. Interior Duct: Ductwork located within the conditioned envelope including return air plenums and indirectly conditioned spaces.

1.5 COORDINATION DRAWINGS

- A. Reference Coordination Drawings article in Section 230500 for required duct systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.
- B. Duct drawings shall be at 1/4" minimum scale complete with the following information:
 1. Actual duct routing, ductwork fittings, actual sheet metal dimensions including insulation liner and wrap, duct hanger and support types, ductwork accessories, etc. with lengths and weights noted.
 2. Differentiate ducts that are lined or wrapped. Include insulation thickness, type of insulation, and acoustical lagging.
 3. Location and size of all duct access doors.
 4. Room names and numbers, ceiling types, and ceiling heights.
 5. Indicate location of all beams, bar joists, etc. along with bottom of steel elevations for each member.
 6. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings. Architectural plans will need to be obtained from the Architect.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS AND SUPPORTS

A. Rectangular Duct - Single Wall:

1. General Requirements:

- a. All ductwork gauges and reinforcements shall be as listed in SMACNA Duct Construction Standards Chapter 2. Where necessary to fit in confined spaces, furnish heaviest duct gauge and least space consuming reinforcement.
- b. Transitions shall not exceed the angles in Figure 4-7.

2. Exceptions and modifications to the 2005 HVAC Duct Construction Standards are:

- a. All ducts shall be cross-broken or beaded.
- b. Snap lock seams are not permitted.
- c. Turning vanes shall be used in all 90° mitered elbows, unless clearly noted otherwise on the drawings. Vanes shall be as follows:
 - 1) Type 1:
 - a) Description: Single wall type with 22-gauge (0.029") or heavier vanes, 3-1/4" blade spacing, and 4" to 4-1/2" radius. Vanes hemmed if recommended by runner manufacturer. Runners shall have extra-long locking tabs. C-value independently tested at below 0.26. EZ Rail II by Sheet Metal Connectors or equal.
 - b) Usage: Limited to 3,000 fpm and vane lengths 36" and under.
 - 2) Type 2:
 - a) Description: Double wall type with 3-1/4" blade spacing, 4-1/2" radius, 24-gauge minimum, and SMACNA Type 1 runners. C-value below 0.27.
 - b) Usage: No limits other than imposed by the manufacturer. Provide intermediate support for vanes over 48" long.
 - 3) Turning vanes shall operate quietly. Repair or replace vanes that rattle or flutter.
 - 4) Runners must be installed at a 45° angle. Elbows with different size inlet and outlet must be radius type.
 - 5) Omitting every other vane is prohibited.
- d. Where smooth radius rectangular elbows are shown, they shall be constructed per SMACNA Figure 4-2. Type RE1 shall be constructed with a centerline duct radius R/W of 1.0. Where shown on drawings, Type RE3 elbows with 3 vanes shall be used with centerline duct radius R/W of 0.6 (SMACNA $r/W=0.1$). RE1 or RE3 elbows may be used where mitered elbows are shown if space permits. Mitered elbows (with or without turning vanes) may not be substituted for radius elbows. Do not make branch takeoffs within 4 duct diameters on the side of the duct downstream from the inside radius of radius elbows.

- e. Rectangular branch and tee connections in ducts over 1" pressure class shall be 45° entry type per Figs. 4-5 and 4-6. Rectangular straight taps are not acceptable above 1" pressure class.
- f. Bellmouth fittings shown on return duct inlets shall expand at a 60-degree total angle horizontally and vertically (space permitting) and have length of at least 25% of the smallest duct dimension.
- g. Round taps off rectangular unlined ducts shall be flanged conical or bellmouth type (equal to Buckley Bellmouth or Sheet Metal Connectors E-Z Tap), or 45° rectangular with transition to round (equal to Sheet Metal Connectors Inc. High Efficiency Takeoff). Straight taps are acceptable if pressure class is 1" or less, round duct is 12" diameter or less, and the tap is not located between fans and TAB devices.
- h. Duct offsets shall be constructed as shown on drawings. Additional offsets required in the field shall be formed of mitered elbows without turning vanes for offsets up to 30° maximum angle in accordance with SMACNA offset Type 2. Offsets of greater than 30° angle shall be formed of radius elbows with centerline radius R/W=1.0 or greater. SMACNA Type 1 offsets are not permitted.
- i. All lined duct shall utilize dovetail joints where round or conical taps occur. The dovetail joints shall extend past the liner before being folded over.
- j. Cushion heads are acceptable only downstream of TAB devices in ducts up to ± 2" pressure class, and must be less than 6" in length.
- k. Slide-on flanged transverse joint systems are acceptable provided they are a manufactured product that has been tested for conformance with Chapter 2 of the SMACNA HVAC Duct Construction Standards for sheet and joint deflection at the specified pressure class.
 - 1) Apply sealant to all inside corners. Holes at corners are not acceptable.
 - 2) Manufacturers:
 - a) Ductmate Industries - 25/35/45
 - b) Nexus
 - c) Mez
 - d) WDCI
 - e) Other manufacturers must submit test data and fabrication standards and receive Architect/Engineer's approval before any fabrication begins.
- l. Formed-on flanged transverse joint systems are acceptable provided they are a manufactured product that has been tested for conformance with Chapter 2 of the SMACNA HVAC Duct Construction Standards for sheet and joint deflection at the specified pressure class.
 - 1) Apply sealant to all inside corners. Holes at corners are not acceptable.
 - 2) Flanges shall be 24-gauge minimum (not 26 gauge).
 - 3) Manufacturers:
 - a) Lockformer TDC
 - b) TDF
 - c) United McGill
 - d) Sheet Metal Connectors
 - e) Other manufacturers must submit test data and fabrication standards and receive Architect/Engineer's approval before any fabrication begins.

B. Round Spiral Seam Ductwork - Single Wall:

1. Conform to applicable portions of Rectangular Duct Section. Round or flat oval ductwork may be substituted for rectangular ductwork where approved by the Architect/Engineer. The spiral seam ductwork shall meet the standards set forth in this specification. The ductwork shall meet or exceed the specified cross-sectional area and insulation requirements. The substitution shall be coordinated with all other trades prior to installation.
2. 90° elbows shall be smooth radius or have a minimum of five sections with mitered joints and R/D of at least 1.5.
3. Duct and fittings shall meet the required minimum gauges listed in chapter 3 of the SMACNA requirements for the specified pressure class. Ribbed and lightweight duct are not permitted.
4. Ductwork shall be suitable for velocities up to 5,000 fpm.
5. Divided flow fittings may be made as separate fittings or factory installed taps with sound, airtight, continuous welds at intersection of fitting body and tap.
6. Spot weld and bond all fitting seams in the pressure shell. Coat galvanizing damaged by welding with corrosion resistant paint to match galvanized duct color.
7. Ducts with minor axis less than 22" shall be spiral seam type. Larger ducts may be rolled, longitudinal welded seam type. SMACNA seams RL-2 and RL-3 are not permitted.
8. Reinforce flat oval ducts with external angles. Internal tie rods are permitted only as indicated for rectangular ductwork.
9. Transverse Joint Connections:
 - a. Crimped joints are not permitted.
 - b. Ducts and fittings 36" in diameter and smaller shall have slip joint connections. Size fitting ends to slip inside mating duct sections with minimum 2-inch insertion length and a stop bead. Use inside slip couplings for duct-to-duct joints, and outside slip couplings for fitting-to-fitting joints.
 - c. Ducts and fittings larger than 36" shall have flanged connections.
 - d. Secure all joints with at least 3 sheet metal screws before sealing.
 - e. Manufacturers, Slide-on Flanges:
 - 1) Ductmate Industries - SpiralMate
 - 2) Accufflange
 - 3) Sheet Metal Connectors are acceptable.
 - f. Manufacturers, Self-Sealing Duct Systems:
 - 1) Lindab
 - 2) Ward "Keating Coupling"

C. Hangers and Supports General Requirements:

1. Hanger and support materials shall be as defined within Materials and Application Specific section below.
2. Strap Hangers: Strap hanger shall be a minimum of 1 inch, 18 gauge attached to the bottom of ducts with spacing as required by SMACNA.
3. Cable Hangers:
 - a. Aircraft cable and slip cable hangers are acceptable for ducts up to 18" diameter. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. Corner saddles are required when supporting rectangular ductwork.

- b. Manufacturers; Supports:
 - 1) Gripple
 - 2) Ductmate
 - 3) Duro Dyne
 - 4) Architect/Engineer approved
- 4. Integral Corner Connector Hanger: Integral hanger and corner assembly for use with TDC/TDF style duct flanges. Die stamped offset hanger connects to the flanged corner assembly. For use with aircraft cable or 1/4" or 3/8" diameter threaded rods. Tested to hold up to 1,400 lbs.. Install per manufacturer's ratings and instructions.
 - a. Manufacturers; Supports:
 - 1) EZ Hanger

2.2 MATERIAL AND APPLICATION SPECIFIC

A. Galvanized Steel:

- 1. General Requirements:
 - a. Duct and reinforcement materials shall conform to ASTM A653 and A924.
 - b. Interior Ductwork and reinforcements: G60 galvanized (0.60 ounces per square foot total zinc coating for two sides per ASTM A90) unless noted otherwise.
 - c. Exterior Ductwork: G90 galvanized (0.90 ounces per square foot total zinc coating for two sides per ASTM A90) unless noted otherwise. G60 is not acceptable for exterior use.
 - d. Ductwork reinforcement shall be of galvanized steel.
- 2. Duct Hangers and Support Material:
 - a. Ductwork hangers and supports shall be of galvanized or painted steel.
 - b. All fasteners shall be galvanized or cadmium plated.

B. Duct Hangers and Support Material:

- 1. Ductwork hangers and supports shall be of galvanized or painted steel.
- 2. All fasteners shall be galvanized or cadmium plated.

C. Exposed Ductwork (Rectangular, Round):

- 1. The following applies to all ductwork exposed in finished areas in addition to requirements noted above:
 - a. Provide extra shipping protection. Use Cardboard or other protective means to prevent dents and deformed ends.
 - b. Provide cardboard or other means of protection during field fabrication. Protect from scratches. Provide stiffeners to retain shape during fabrication.
 - c. Remove all identification stickers and thoroughly clean exterior of all ducts.
 - d. Locate fitting seams on least visible side of duct.
 - e. Provide exterior finish suitable for field painting without further oil removal.

- f. Provide ramp-type internal joint couplings. Provide bead of sealant around the inside of the duct about 1/2" from the end of the duct.
 - g. Manufacturers, Slide-on Flanges:
 - 1) Ductmate Industries
 - 2) Accuflange
 - 3) Sheet Metal Connectors
 - h. Manufacturers, Self-Sealing Duct System:
 - 1) Lindab
 - 2) Ward "Keating Koupling"
 - i. The system shall be free of visible dents and scratches when viewed from normal occupancy.
 - j. All insulation shall be internal, except at reheat coils.
2. Alternate manufacturers, including shop fabricated duct, must be reviewed before installation. The following information is required:
- a. Metal gauge of duct and fittings.
 - b. Fitting type and construction.
 - c. Type and size of reinforcement.
3. Hangers for Exposed Ductwork:
- a. Round Ducts:
 - 1) Threaded rod with duct fixing bracket and metal strap. Provide single threaded rod centered on the duct. Strap hanger shall be a minimum of 1 inch, 18 gauge galvanized steel wrapping the circumference of the duct. Spacing as required by SMACNA guidelines.
 - 2) Aircraft cable with 2-point support in standard horseshoe arrangement.
 - b. Rectangular Ducts:
 - 1) Aircraft cable and slip cable hangers are acceptable for ducts up to 18" in maximum dimension. Corner saddles are required when supporting rectangular ductwork. Spacing and cable size as required by SMACNA guidelines.
 - a) Manufacturers, Supports: Gripple, Ductmate, Duro Dyne, Architect/Engineer approved.
 - 2) Aircraft cable with 2-point support in standard horseshoe arrangement. Corner saddles are required when supporting rectangular ductwork.
 - c. Strut-channel and all-thread rod is not acceptable for exposed ductwork.
 - d. All fasteners shall be galvanized or cadmium plated.

2.3 DUCTWORK REINFORCEMENT

- A. All reinforcement shall be external to the duct except that tie rods may be used with the following limitations.
 - 1. Ducts must be over 18" wide.
 - 2. Duct dimensions must be increased 2" in one dimension (h or w) for each row of tie rods installed.
 - 3. Tie rods must not exceed 1/2" diameter.
 - 4. Manufacturer of tie rod system must certify pressure classifications of various arrangements, and this must be in the shop drawings.

2.4 DUCTWORK SEALANTS

- A. One-part joint sealers shall be water-based mastic systems that meet the following requirements: maximum 48-hour cure time, service temperature of -20°F to +175°F, resistant to mold, mildew and water, flame spread rating below 25 and smoke-developed rating below 50 when tested in accordance with ASTM E84, suitable for all SMACNA seal classes and pressure classes. Mastic used to seal flexible ductwork shall be marked UL 181B-M. Joint sealers for use on exterior weather exposed ductwork shall be rated for -30°F to +175°F and 2000-hour minimum UV resistance per ASTM G-53.
- B. Two-part joint sealers shall consist of a minimum 3" wide mineral-gypsum compound impregnated fiber tape and a liquid sealant. Sealant system shall meet the following requirements: maximum 48-hour cure time, service temperature of 0°F to 200°F, resistant to mold, mildew, and water, flame spread rating below 25 and smoke developed rating below 50 when tested in accordance with ASTM E84, suitable for all SMACNA seal classes and pressure classes. Joint sealers for use on exterior weather exposed ductwork shall be rated for -30°F to +175°F and 2000-hour minimum UV resistance per ASTM G-53.
- C. Pressure sensitive tape used for sealing ductwork shall be minimum 2.5-inch wide, listed and marked UL 181A-P, having minimum 60 oz/inch peel adhesion to steel, and service temperature range from -20°F to +250°F.
- D. Where pressure sensitive tape is called for on drawings and specifications for sealing flexible ductwork, tape shall be minimum 2.5-inch wide, UL 181 B-FX listed, and marked tape having minimum 60 oz/inch peel adhesion to steel and service temperature range from -20°F to +250°F.
 - 1. Manufacturers, Pressure-Sensitive Tape:
 - a. Venture Tape 1581A
 - b. Compac #340
 - c. Scotch Foil Tape 3326
 - d. Polyken 339

2.5 FLEXIBLE DUCT

- A. Flexible duct shall be listed and labeled as UL 181 Class 1 Air Duct Material, and shall comply with NFPA 90A and 90B, and meet GSA, FHA and other U.S. Government agency standards. Flexible duct shall bear the ADC Seal of Certification.

- B. Flame Spread/Smoke Developed: Not over 25/50.
- C. Stretch all flexible duct to prevent sags and reduce air friction. Shorten and reinstall all sagging or loose flexible duct. Avoid sharp elbows. Elbows shall maintain 1.5 diameter centerline turning radius.
- D. Install per the SMACNA Flexible Duct Manual. Secure inner layer with draw band. Wrap with pressure sensitive tape for protection prior to installing draw band. Pressure sensitive tape alone is not acceptable.
- E. Standard:
 - 1. Flexible duct shall have corrosion-resistant wire helix, bonded to an inner liner that prevents air from contacting the insulation, covered with minimum 1-1/2", 3/4 lb/cf density fiberglass insulation blanket, sheathed in a vapor barrier of metalized polyester film laminated to glass mesh. Usage: All areas unless noted otherwise.
 - 2. Flexible duct shall have polymer wire helix, bonded to an inner liner that prevents air from contacting the insulation, covered with minimum 1-1/2" thick, 3/4 lb/cf density fiberglass insulation blanket, sheathed in a vapor barrier of polyester film laminated to glass mesh. Usage: MRI rooms.
 - 3. Inner liner shall be airtight and suitable for 6" WC static pressure through 16" diameter. Outer jacket shall act as a vapor barrier only with permeance not over 0.1 perm per ASTM E96, Procedure A. "R" value shall not be less than 4.0 ft²*°F*hr/Btuh. Temperature range of at least 0-180°F. Maximum velocity of 4,000 fpm. "R" value shall not be less than 4.0 ft²*°F*hr/Btuh. Ducts in unconditioned spaces and ventilated attics: "R" value shall not be less than 6.0 ft²*°F*hr/Btuh.
 - 4. Usage:
 - a. Connections to air inlets and outlets. Do not exceed 5'-0" in length.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide openings in ducts for thermometers and controllers.
- B. Locate ducts with space around equipment for normal operation and maintenance.
- C. Do not install ducts or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the electrical equipment. Unless intended to serve these rooms, do not install any ductwork or equipment in electrical rooms, transformer rooms, electrical closets, telephone rooms or elevator machine rooms.
- D. Provide temporary closures of metal or taped polyethylene on open ducts to prevent dust from entering ductwork.
- E. Supply ductwork shall be free of construction debris, and shall comply with Level "B" of the SMACNA Duct Cleanliness for New Construction Guidelines.
- F. Repair all duct insulation and liner tears.

- G. Install manual volume dampers in branch supply ducts so all outlets can be adjusted. Do not install dampers at air terminal device or in outlets, unless specifically shown.
- H. Install flexible duct in accordance with the ADC Flexible Duct Performance and Installation Standards.
- I. Install all exterior ductwork per SMACNA Fig. 6-3. Where drawings do not indicate otherwise, ductwork seams and joints shall be sealed watertight and pitched to shed water.
- J. Support all duct systems in accordance with the SMACNA HVAC Duct Construction Standards: Metal and Flexible and the SMACNA Seismic Restraint Manual: Guidelines for Mechanical Systems, where applicable. Refer to Section 230550 for seismic requirements.
- K. Adhesives, sealants, tapes, vapor retarders, films, and other supplementary materials added to ducts, plenums, housing panels, silencers, etc. shall have flame spread/smoke developed ratings of under 25/50 per ASTM E84, NFPA 255, or UL 723.
- L. All duct support shall extend directly to building structure. Do not support ductwork from pipe hangers unless coordinated with piping contractor prior to installation. Do not allow lighting or ceiling supports to be hung from ductwork or ductwork supports.

3.2 DUCTWORK APPLICATION SCHEDULE

- A. Refer to Ductwork Application Schedule on drawings for specific requirements for system, material, shape, pressure class, seal class and insulation application.

3.3 SPECIAL INSULATION REQUIREMENTS

- A. Ductwork Accessories (Fabric Flex Connectors, Equipment Flanges, etc.):
 - 1. Insulation:
 - a. IECC-2021: 1-1/2" thick Type A (R=4.5)
- B. Transfer Ducts
 - 1. Insulation: 1" thick Type C (R=3.6)

3.4 DUCTWORK SEALING

- A. General Requirements:
 - 1. Openings, such as rotating shafts, shall be sealed with bushings or similar.
 - 2. Pressure sensitive tape shall not be used as the primary sealant unless it has been certified to comply with UL-181A or UL-181B by an independent testing laboratory and the tape is used in accordance with that certification.
 - 3. All connections shall be sealed including, but not limited to, taps, other branch connections, access doors, access panels, and duct connections to equipment. Sealing that would void product listings is not required. Spiral lock seams need not be sealed.

4. Mastic-based duct sealants shall be applied to joints and seams in minimum 3 inch wide by 20 mil thick bands using brush, putty knife, trowel, or spray, unless manufacturer's data sheet specifies other application methods or requirements.
- B. All ducts systems, regardless of pressure class, shall be Seal Class A as defined by Section 5-1 of SMACNA HVAC Air Duct Leakage Test Manual per the Energy Code, unless specifically noted otherwise. Seal Class A shall include sealing of all transverse joints, longitudinal seams, and duct wall penetrations with welds, gaskets, mastics, or fabric-embedded mastic system. Joints are inclusive of, but not limited to, girth joints, branch and sub-branch intersections, duct collar tap-ins, fitting subsections, louver and air terminal connections to ducts, access door and access panel frames and jambs, duct, plenum, and casing abutments to building structures.
- C. Double-wall ductwork: Install insulation end fittings at all transitions from double to single-wall construction.

3.5 TESTING

- A. Interior Duct - Less than 3" WG (positive or negative):
 1. Leak testing of these pressure classes is not normally required for interior ductwork (inside the building envelope). However, leak tests will be required if, in the opinion of the Architect/Engineer, the leakage appears excessive. All exterior ductwork shall be tested. If duct has outside wrap, testing shall be done before it is applied.
 2. Leak test shall be at the Contractor's expense and shall require capping and sealing all openings.
 3. Seal ducts to bring the air leakage into compliance.
 4. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing.
- B. Exterior Duct - 1/2" WG and Above (positive or negative):
 1. All exterior ductwork (outside the building envelope) shall be completely pressure tested. If duct has outside wrap, testing shall be done before it is applied.
 2. Leak test shall be at the Contractor's expense and shall require capping and sealing all openings.
 3. Seal ducts to bring the air leakage into compliance.
 4. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing.
- C. Test Procedure:
 1. Testing shall be as listed in the latest edition of the SMACNA HVAC Duct Leakage Manual, with the following additional requirements:
 - a. The required leakage class for Seal Class A, rectangular ducts, shall be 4; round shall be 2.
 - b. Test pressure shall be the specified duct pressure class. Testing at reduced pressures and converting the results mathematically is not acceptable. This is required to test the structural integrity of the duct system.
 - c. If any leak causes discernible noise at a distance of 3 feet, that leak shall be eliminated, regardless of whether that section of duct passed the leakage test.
 - d. All joints shall be felt by hand, and all discernible leaks shall be sealed.

- e. Totaling leakage from several tested sections and comparing them to the allowable leakage for the entire system is not acceptable. Each section must pass the test individually.
- f. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing. Failure to notify the Architect/Engineer of pressure testing may require the contractor to repeat the duct pressure test after proper notification.
- g. Upon completion of the pressure test, the contractor shall submit an air duct leakage test summary report as outlined in the SMACNA HVAC Duct Leakage Test Manual.
- h. All access doors, taps to terminal air boxes, and other accessories and penetrations must be installed prior to testing. Including terminal air boxes in the test is not required.
- i. Positive pressure leakage testing is acceptable for negative pressure ductwork.

3.6 DUCTWORK PENETRATIONS

- A. All duct penetrations of firewalls shall have fire or fire/smoke dampers where required by code.
- B. Dampers shall be compatible with fire rating of wall assembly. Verify actual rating of any wall being penetrated with Architect/Engineer.
- C. Seal all duct penetrations of walls that are not fire rated by caulking or packing with fiberglass. Install trim strip to cover vacant space and raw construction edges of all openings in finished rooms. Install escutcheon ring at all round duct openings in finished rooms. Trim strips and rings shall be same material and finish as exposed duct.

END OF SECTION

SECTION 233300
DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Manual Volume Dampers.
- B. Backdraft Dampers.
- C. Fabric Connectors.
- D. Duct Access Doors.
- E. Duct Test Holes.

1.2 REFERENCES

- A. NFPA 72 - National Fire Alarm and Signaling Code
- B. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
- C. NFPA 90A - Installation of Air-Conditioning and Ventilating Systems.
- D. SMACNA - HVAC Duct Construction Standards (latest edition).

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 230500.
- B. Submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 MANUAL VOLUME DAMPERS

- A. Fabricate in accordance with SMACNA Duct Construction Standards, and as indicated.
- B. Fabricate single blade dampers for duct sizes to 9-1/2 x 30 inches.
- C. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12" x 72". Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

- D. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide molded synthetic or oil-impregnated nylon or sintered bronze bearings.
- E. Provide locking quadrant regulators on single and multi-blade dampers.
- F. On insulated ducts, mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
- G. If blades are in open position and extend into the main duct, mount damper so blades are parallel to airflow.
- H. Contractor assembled modular manual dampers are acceptable as long as it contains the components listed above.

2.2 BACKDRAFT DAMPERS

- A. Gravity backdraft dampers, size 18 inches x 18 inches or smaller, furnished with air moving equipment, may be air moving equipment manufacturer's standard construction.
- B. Fabricate multi-blade, parallel action gravity balanced backdraft dampers of extruded aluminum, with blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90° stop, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.
- C. Models:
 - 1. Ruskin CBD4
 - 2. Arrow 655
 - 3. Safe-Air/Dowco BRL
 - 4. Greenheck EM.

2.3 FABRIC CONNECTORS

- A. Fabric connectors shall be installed between all fans or fan units and metal ducts or casings to prevent transfer of fan or motor vibration.
- B. The fabric connectors shall be completely flexible material which shall be in folds and not drawn tight.
- C. Fabric connectors shall be of glass fabric double coated with neoprene, with UL approval. Weight = 30 oz. per square yard minimum. Fabric shall not be affected by mildew and shall be absolutely waterproof, airtight and resistant to acids, alkalis, grease and gasoline, and shall be noncombustible.
- D. Fabric connections shall not exceed 6" in length on ductwork that has a positive pressure. On ductwork that has a negative pressure, the length shall not exceed 2" in length.
- E. All corners shall be folded, sealed with mastic and stapled on 1" centers.
- F. Fabric connectors shall not be painted.

- G. Unless otherwise shown on the drawings, the fabric connection at the inlet to centrifugal fans shall be at least one duct diameter from the fan to prevent inlet turbulence.
- H. Materials:
 - 1. Durodyne MFN-4-100
 - 2. Vent Fabrics, Inc.
 - 3. "Ventglas"
 - 4. Proflex PFC3NGA
- I. Fabric connectors exposed to sunlight and weather shall be as described above, except the coating shall be hypalon in lieu of neoprene.
- J. Materials:
 - 1. Durodyne "Duralon MFD-4-100"
 - 2. Vent Fabrics, Inc.
 - 3. "Ventlon"
 - 4. Proflex PFC3HGA

2.4 DUCT ACCESS DOORS

- A. Fabricate per Fig. 7-2 and 7-3 of the SMACNA HVAC Duct Construction Standards and as indicated.
- B. Review locations prior to fabrication. Install access doors at fire dampers, smoke dampers, motorized dampers, fan bearings, filters, automatic controls, humidifiers, louvers, duct coils and other equipment requiring service inside the duct.
- C. Construction shall be suitable for the pressure class of the duct. Fabricate rigid, airtight, and close-fitting doors of materials identical to adjacent ductwork with sealing gaskets butt or piano hinges, and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover.
- D. Access doors with sheet metal screw fasteners are not acceptable.
- E. Minimum size for access doors shall be 24" x 16" or full duct size, whichever is less.

2.5 DUCT TEST HOLES

- A. Cut or drill temporary test holes in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Installation Requirements:

1. Install accessories in accordance with manufacturer's instructions.
2. Where duct access doors are located above inaccessible ceilings, provide ceiling access doors. Coordinate location with the Architect/Engineer.
3. Coordinate and install access doors provided by others.
4. Provide access doors for all equipment requiring maintenance or adjustment above an inaccessible ceiling. Minimum size shall be 24" x 24".
5. Provide duct test holes where indicated and as required for testing and balancing purposes.

B. Manual Volume Damper:

1. Provide manual volume dampers at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts where indicated on drawings and as required for air balancing. Use splitter dampers only where indicated.
2. Provide ceiling access doors for manual volume dampers. When manual volume dampers are located above an inaccessible ceiling and an access door cannot be installed, provide a remote-controlled volume control device for operation of the damper. Coordinate location with the Architect/Engineer.

END OF SECTION

SECTION 233416
CENTRIFUGAL FANS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. In-line Centrifugal Fans.
- B. Fabrication: Conform to AMCA 99.

1.2 REFERENCES

- A. AMCA 99 - Standards Handbook.
- B. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
- C. AMCA 300 - Test Code for Sound Rating Air Moving Devices.
- D. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.
- E. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- F. ANSI/AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- G. SMACNA - HVAC Duct Construction Standards (latest edition).

1.3 SUBMITTALS

- A. Submit shop drawings per Section 230500. Include data on all fans and accessories. Submit sound power levels for both fan inlet and outlet at rated capacity. Submit motor ratings and electrical characteristics, plus motor and electrical accessories. Submit multi-speed fan curves including minimum and maximum fan speed with specified operating points clearly plotted. Submit the Fan Energy Index (FEI) at the selected duty point.
- B. Submit operation and maintenance data. Include instructions for lubrication, motor and drive replacement, and spare parts list.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors, shafts, and bearings from weather and construction dust.

PART 2 - PRODUCTS

2.1 IN-LINE CENTRIFUGAL FAN

- A. Fan Description: In-Line Single inlet, single width. backward inclined wheel.
- B. Construction:
 - 1. Wheel: Backward inclined, non-overloading, all aluminum wheel and hub. Dynamically balanced.
 - 2. Housing: Galvanized steel construction with stainless steel or cadmium plated fasteners and galvanized steel belt guard.
 - 3. Drive: Belt drive with motor mounted on top of housing. Cast iron, adjustable pitch sheaves. V-belt drive sized for 1.5 of maximum horsepower. Screw adjustment belt tightener.
 - 4. Support: Steel or aluminum mounting frame with baked enamel finish. Steel mounting brackets suitable for any mounting position.
- C. Protection:
 - 1. Belt guards with tachometer knockouts on indoor fans. Removable weather covers on outdoor fans.
- D. Motor (as scheduled on the drawings):
 - 1. Induction: Furnish externally mounted open drip-proof, ball bearing motor, with adjustable mounts for belt tightening. Refer to motor specification for motor requirements.
 - a. Disconnect as scheduled on drawings.
- E. Bearings: Regreasable bearings rated for 40,000 hour B-10 life at specified operating point. Extend lubrication lines outside of housing.
- F. Manufacturers:
 - 1. Jenco Fan
 - 2. Carnes
 - 3. Cook
 - 4. PennBarry
 - 5. Greenheck
 - 6. FloAire

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General Installation Requirements:
 - 1. Prime all fan parts after cleaning, but prior to assembly. Apply a second finish coat to all exterior surfaces and all accessible interior surfaces after assembly. Apply rust preventative coating to shafts.

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2. Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.
3. Install flexible connections between fan and ductwork. Install metal bands of connectors parallel with minimum 1" flex between ductwork and fan while running.
4. Provide safety screen where inlet or outlet is exposed. Screens shall meet OSHA regulations for size of openings.

END OF SECTION

SECTION 233423
POWER VENTILATORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Roof Exhaust Fan.
- B. Rooftop Fan Curbs.
- C. In-Line Cabinet Fan.

1.2 QUALITY ASSURANCE

- A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.
- B. Sound Ratings: AMCA 301, tested to AMCA 300.
- C. Fabrication: Conform to AMCA 99.

1.3 REFERENCES

- A. AMCA 99 - Standards Handbook.
- B. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
- C. AMCA 230 - AMCA 230 - Laboratory Methods of Testing Air Circulating Fans for Rating and Certification.
- D. AMCA 300 - Test Code for Sound Rating Air Moving Devices.
- E. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.
- F. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- G. ANSI/AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- H. SMACNA - HVAC Duct Construction Standards (latest edition).

1.4 SUBMITTALS

- A. Submit shop drawings per Section 230500. Include data on all fans and accessories. Submit sound power levels for both fan inlet and outlet at rated capacity. Submit motor ratings and electrical characteristics, plus motor and electrical accessories. Submit multi-speed fan curves including minimum and maximum fan speed with specified operating points clearly plotted. Submit the Fan Energy Index (FEI) at the selected duty point (ceiling and HVLS fans are exempt from FEI submittal requirements).
- B. Submit manufacturer's installation instructions.
- C. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.
- D. Submit motor data indicating compliance with Section 230513.

1.5 EXTRA STOCK

- A. Provide one (1) extra belt set for each fan unit.

PART 2 - PRODUCTS

2.1 ROOFTOP EXHAUST FAN - BELT DRIVEN

- A. Fan Wheel: Centrifugal type, aluminum hub and wheel with backward inclined blades, statically and dynamically balanced.
- B. Housing: Removable, spun aluminum dome or rectangular top, with square, one piece, aluminum base and curb cap with Venturi inlet cone.
- C. Fan Shaft: Turned, ground and polished steel; keyed to wheel hub.
- D. Any steel parts shall be galvanized or epoxy coated. Non-corrosive fasteners.
- E. V-belt drive with adjustable pitch drive sheave and adjustable motor mountings for belt tensioning.
- F. Motor mounted outside of airstream and ventilated with outside air. Motor not less than 1/3 HP.
- G. Aluminum or brass bird screen. Plastic mesh will not be allowed.
- H. Mill aluminum finish.
- I. Dampers: Furnish normally closed, electric motorized damper. Provide step-down transformer if required. Install and wire damper to open when fan runs. Damper shall be aluminum with brass bushings, blade seals, and blade tie rods. Leakage shall not exceed 4 cfm/sq. ft. @1" SP (or shall be AMCA Class 1 certified).

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- J. Motor (as scheduled on drawings):
 - 1. Induction: Furnish permanently lubricated sealed ball type motor and drive shaft bearings. Motor and wheel supported by vibration isolators.
 - a. Disconnect as scheduled on drawings.
- K. Speed Controller: For single phase shaded pole or permanent split capacity motor fans, furnish solid-state dial speed controller factory mounted inside fan unless shown otherwise on the drawings. Provide permanent marking at balanced point.
- L. Bearings:
 - 1. Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - 2. Furnish permanently lubricated sealed ball type motor and drive shaft bearings sized for 200,000 hours life at specified operating conditions. Drives sized for 150% of rated motor horsepower. Drive assembly and wheel supported by vibration isolators.
- M. Manufacturers:
 - 1. Aerovent
 - 2. Greenheck
 - 3. Cook
 - 4. Carnes
 - 5. PennBarry
 - 6. ACME
 - 7. ILG
 - 8. Jenco
 - 9. Soler-Palau
 - 10. York

2.2 ROOFTOP EXHAUST FAN - DIRECT DRIVEN

- A. Fan Wheel: Centrifugal type, aluminum or composite with backward inclined or airfoil blades, statically and dynamically balanced.
- B. Housing: Removable, spun aluminum dome or rectangular top, with square, one piece, aluminum base and curb cap with Venturi inlet cone.
- C. Fan Shaft: Turned, ground and polished steel; keyed to wheel hub.
- D. Any steel parts shall be galvanized or epoxy coated. Non-corrosive fasteners.
- E. Direct drive, motor mounted outside of airstream and ventilated with outside air.
- F. Aluminum or brass bird screen. Plastic mesh will not be allowed.
- G. Mill aluminum finish.
- H. Dampers: Furnish normally closed, electric motorized damper. Provide step-down transformer if required. Install and wire damper to open when fan runs. Dampers shall be aluminum with brass bushings, blade seals and blade tie rods. Leakage shall not exceed 4 cfm/sq.ft @1" SP (or shall be AMCA Class 1 certified).

- I. Motor (as scheduled on drawings):
 - 1. Induction: Furnish permanently lubricated sealed ball type motor and drive shaft bearings. Motor and wheel supported by vibration isolators.
 - a. Disconnect as scheduled on drawings.
 - 2. Electronically Commutated Motor (ECM): Motor shall be variable speed, constant torque, brushless permanent magnet (PM) motor for direct-drive applications. Electronics shall be encapsulated for moisture protection and shall include integral surge protection. Motor and controller shall be pre-wired for specific voltage and phase. Motor frame shall be NEMA 48; All EC motors shall be a minimum of 85% efficient at all speeds. Provide motor with onboard motor control module. Motor speed shall be limited to provide electronic overcurrent protection. Provide non-fused, with thermal overload protection, factory mounted and wired disconnect switch mounted inside fan housing. Starter shall provide soft start to reduce inrush current and shall be controllable from 20% to 100% of full rated speed. Operational mode shall be as follows:
 - a. ECM set for constant CFM.
- J. Speed Controller: For single phase shaded pole or permanent split capacity motor fans, furnish solid-state dial speed controller factory mounted inside fan unless shown otherwise on the drawings. Provide permanent marking at balanced point.
- K. Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
- L. Manufacturers:
 - 1. Aerovent "FACX"
 - 2. Cook "ACE-D"
 - 3. Greenheck
 - 4. ILG - CRD
 - 5. ACME PX
 - 6. PennBarry DX
 - 7. Carnes
 - 8. Twin City DCRU
 - 9. Jenco
 - 10. Soler-Palau
 - 11. York

2.3 ROOFTOP FAN CURBS

- A. Furnish and install prefabricated roof curbs for all rooftop fans.
- B. Size curb to match the curb cap of fan.
- C. Roof Mounting Curb: Curb height as shown on drawings, minimum 14 gauge galvanized steel, one-piece construction, insulated, all welded, wood nailer.

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- D. Construction: Unitized construction, continuous arc welded corner seams. Insulated with 1-1/2" thick, 3 lb. density rigid fiberglass board. Damper support angle. Pressure treated wood nailer. Curb with cant.
 - 1. 18-gauge galvanized steel.
- E. If called for in the drawings, curbs shall be of the sound attenuation type. Sound attenuation curbs shall reduce the fan sone rating by at least 40% and not decrease fan cfm more than 8% (which is accounted for in the scheduled fan cfm). Baffles shall be removable for access to the dampers.
- F. Manufacturers:
 - 1. Same manufacturer as the fan
 - 2. Pate
 - 3. RPS
 - 4. Thy

2.4 IN-LINE CABINET FAN

- A. Fiberglass lined, sheet metal housing, arranged for in-line installation.
- B. Rubber torsion motor mounts.
- C. Manual Motor Starter: NEMA ICS 2; AC general-purpose Class A manually operated non-reversing full-voltage controller for fractional horsepower induction motors, with thermal overload relay, toggle operator.
- D. Built-in backdraft damper.
- E. Centrifugal fan.
- F. Provide variable speed controller if shown on the drawings.
- G. Manufacturers:
 - 1. ACME
 - 2. Broan
 - 3. Carnes
 - 4. Cook
 - 5. Jenco
 - 6. PennBarry
 - 7. Greenheck
 - 8. Soler-Palau
 - 9. York

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PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure roof exhausters with cadmium plated lag screws to roof curb.
- C. If manufacturer has no recommendations, secure roof exhaust fans to curbs with 1/4" lag bolts on 8" maximum centers.
- D. MC shall install and wire factory provided damper to open when the fan runs if the manufacturer does not provide an option to pre-wire the damper.

END OF SECTION

SECTION 233700
AIR INLETS AND OUTLETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Grilles And Registers.
- B. Architectural Square Panel Diffusers.
- C. Louvers.

1.2 QUALITY ASSURANCE

- A. Test and rate performance of air inlets and outlets per ASHRAE 70.
- B. Test and rate performance of louvers per AMCA 500L-99.
- C. All air handling and distribution equipment mounted outdoors shall be designed to prevent rain intrusion into the airstream when tested at design airflow and with no airflow, using the rain test apparatus described in Section 58 of UL 1995.

1.3 REFERENCES

- A. AMCA 500-L-12 - Laboratory Methods of Testing Louvers for Rating.
- B. ANSI/ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Inlets and Outlets.
- C. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- D. SMACNA - Duct Construction Standards.

1.4 SUBMITTALS

- A. Submit product data under provisions of Section 230500.
- B. Submit schedule of inlets and outlets indicating type, size, location, application, and noise level.
- C. Review requirements of inlets and outlets as to size, finish, and type of mounting prior to submitting product data and schedules of inlets and outlets.

1.5 REGULATORY REQUIREMENTS

- A. Conform to ANSI/NFPA 90A.
- B. Conform to ASHRAE 90.1.

PART 2 - PRODUCTS

2.1 AIR TERMINALS - GRILLES AND REGISTERS

- A. Reference to a grille means an air supply, exhaust or transfer device without a damper.
- B. Reference to a register means an air supply, exhaust or transfer device with a damper.
- C. The type of unit, margin, material, finish, etc., shall be as shown on the drawing schedule and suitable for the intended use.
- D. All margins shall be compatible with ceiling types specified (including 'Thin-Line' T-bar lay-in grid system). Any discrepancies in contract documents shall be brought to the attention of the Architect/Engineer, in writing, prior to Bid Date. Submission of Bid indicates ceiling and air inlet and outlet types have been coordinated.
- E. The capacity and size of the unit shall be as shown on the drawings.
- F. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10^{-12} watts with a 10 dB room effect.
- G. Refer to the drawings for construction material, color and finish, margin style, deflection, and sizes of grilles and registers.
- H. Provide with 3/4" blade spacing. Blades shall have steel friction pivots to allow for blade adjustment, plastic pivots are not acceptable.
- I. Corners of steel grilles and registers shall be welded and ground smooth before painting. Aluminum grilles and registers shall have staked corners.
- J. Where specified to serve registers, provide opposed blade volume dampers operable from the face of the register.
- K. Screw holes for surface fasteners shall be countersunk for a neat appearance. Provide concealed fasteners for installation in lay-in ceilings and as specified on the drawings.
- L. Manufacturers:
 - 1. Tuttle & Bailey
 - 2. Titus
 - 3. Price
 - 4. Nailor
 - 5. Carnes
 - 6. Metalaire
 - 7. Krueger

8. Anemostat
9. Raymon Donco

2.2 AIR TERMINALS - ARCHITECTURAL SQUARE PANEL DIFFUSERS

- A. Reference to a diffuser means an air supply device, ceiling mounted, that shall diffuse air uniformly throughout the conditioned space.
- B. The type of unit, margin, material, finish, etc., shall be as shown on the drawing schedule. Flat-oval inlets are not acceptable for connection to flexible ducts.
- C. All margins shall be compatible with ceiling types specified (including 'Thin-Line' T-bar lay-in grid system). Any discrepancies in contract documents should be brought to the attention of the Architect/Engineer, in writing, prior to Bid Date. Submission of Bid indicates ceiling and air inlet and outlet types have been coordinated.
- D. The capacity and size of the unit shall be as shown on the drawings.
- E. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10^{-12} watts with a 10 dB room effect.
- F. Diffusers shall be architectural solid square panel and flush with ceiling.
- G. The exposed surface shall be smooth, flat and free of visible fasteners. The face panel shall be 22 gauge steel with a rolled edge or shall be 18 gauge with a smooth ground, uniform edge.
- H. The back pan shall be one piece 22 gauge stamped and shall include an integral inlet. (Welded inlets and corner joints are not acceptable).
- I. Diffusers with a 24x24 back pan shall have a minimum 18x18 face panel size. Diffusers with a 12x12 back pan shall have a minimum 9x9 face panel size.
- J. The face panel shall be mechanically fastened to the back panel with steel components. (Plastic fasteners are not acceptable.)
- K. Manufacturers:
 1. Tuttle & Bailey
 2. Titus
 3. Price
 4. Nailor
 5. Carnes
 6. Metalaire
 7. Krueger
 8. Anemostat
 9. Raymon Donco

2.3 LOUVERS - FIXED - ALUMINUM

- A. Louvers shall be minimum 4" deep and constructed of extruded aluminum. Blade, jamb and sill thickness shall be minimum 0.081". Blades shall be spaced at a maximum of 5.1" apart.
- B. Louvers shall be of the drainable blade design with water collected on the leading edge of the blade and diverted to the jamb.
- C. Louvers shall be furnished with aluminum bird screen mounted on the inside surface.
- D. Size, cfm, finish and pressure drop for louvers shall be as scheduled on the drawings.
- E. AMCA Certified performance for 48" x 48" samples with intake airflow of 8,000 cfm shall not exhibit more than 0.19" pressure drop. Maximum water penetration shall be 0.01 ounces per square foot at the scheduled intake velocity based on 15 minute test duration when subjected to a water flow rate of 0.25 gal/min as described under the Water Penetration Test in AMCA 500-L-07.
- F. Contractor shall provide the General Contractor with the correct sizes and locations of all louvers required in masonry walls.
- G. Louvers shall be sealed around perimeter to avoid moisture penetration between the louver frame and wall.
- H. Louvers shall be suitable for duct connection.
- I. Manufacturers:
 - 1. Air Flow - "EA-403"
 - 2. Arrow - "EA-415-D"
 - 3. American Warming & Ventilating - "LE-21"
 - 4. Construction Specialties - "A4097"
 - 5. Dowco - "DBE-4"
 - 6. Louvers & Dampers, Inc. - "IL-23"
 - 7. Ruskin - "ELF375DX"
 - 8. Vent Products - "2760"
 - 9. Greenheck - ESD "403"
 - 10. Pottorff - EFD
 - 11. United Enertech FL-D-4

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General Installation Requirements:
 - 1. Install items in accordance with manufacturers' instructions.
 - 2. Check location of inlets and outlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.
 - 3. Install diffusers to ductwork with air tight connections.
 - 4. Flexible ducts shall NOT be joined to flat-oval connections. Provide sheet metal oval-to-round transitions where required.

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5. Supply grille and register blades shall be aimed in the field to provide adequate air distribution in the space. All return grilles and registers blades shall be oriented to minimize sight distance beyond installed device.

B. Volume Damper:

1. Provide manual volume dampers on duct take-off to diffusers when there are multiple connections to a common duct. Locate volume dampers as far as possible from the air inlet or outlet.

C. Maintaining Duct Cleanliness:

1. When grilles, registers, and diffusers are installed, Contractor shall prevent construction dust, dirt, and debris from entering ductwork as required by Section 230500.

END OF SECTION

SECTION 234000

AIR CLEANING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Filters and Filter Media.
- B. Filter Frames.
- C. Filter Gauges.

1.2 QUALITY ASSURANCE

- A. Filter media shall be tested under ANSI/UL 900 and labeled.
- B. Provide all filters and filter banks by one manufacturer.

1.3 REFERENCES

- A. ANSI/UL 586 - Test Performance of High Efficiency Particulate, Air Filter Units.
- B. ANSI/UL 867 - Standard for Electrostatic Air Cleaners.
- C. ANSI/UL 900 - Test Performance of Air Filter Units.
- D. ANSI/UL 2998 - Environmental Claim Validation Procedure (ECVP) for Zero Ozone Emissions from Air Cleaners.
- E. ASHRAE 26 - Guideline for Field Testing of General Ventilation Devices and Systems for Removal Efficiency In-Situ by Particle Size and Resistance to Flow.
- F. ASHRAE 52.2 - Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
- G. ANSI/NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

- A. Submit shop drawings per Section 230500. Include data on media, performance, assembly and frames.

1.5 EXTRA STOCK

- A. Provide a total of three (3) sets of filters for all units.
 - 1. Provide clean filters in all units at time of installation.
 - 2. Provide clean filters in all units at project final completion after all interior finishes are complete.
 - 3. Provide one additional set of replacement filters for all units. Deliver to Owner at job site.

PART 2 - PRODUCTS

2.1 MERV 8 (MEDIUM EFFICIENCY) - DISPOSABLE - TYPE D

- A. Pleated media, disposable type with welded wire grid support bonded to the filter media.
- B. Heavy duty, paper board frame with diagonal support members bonded to inlet and exit sides of each pleat. Bond frame to media periphery to eliminate air bypass.
- C. 2" thick media with at least 4.6 square feet of media per square foot of face area. Maximum initial resistance of 0.30" WG at 500 fpm face velocity.
- D. MERV 8 per ASHRAE 52.2.

2.2 HEPA FILTER FRAMES

- A. Side access filter housing for HEPA filters.
- B. All welded supports to withstand 4.0" positive or negative pressure. Seal around all edges of filter bank to prevent air bypass.
- C. Positive seal door latches with neoprene gaskets.
- D. 2" prefilter track with 30% prefilters.
- E. Manufacturers:
 - 1. Camfil
 - 2. American Air Filter

2.3 FILTER GAUGES

- A. Accessories: Static pressure tips with integral compression fittings, 1/4" plastic tubing, 2- or 3-way vent valves, indicating fluid.
- B. Differential Pressure Gauge: Diaphragm actuated, nominal 3" round dial, glass filled nylon housing, polycarbonate lens, zero adjustment, 0-2" W.G. range, 5% of full scale accuracy.
- C. Accessories: Static pressure tips with integral compression fittings and 1/8" NPT plastic tubing.

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D. Manufacturers:

1. Dwyer "Minihelic II" 2-5000
2. Marshalltown Instrument "Series 85C"

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all products per manufacturers' instructions.
- B. Seal filter media to prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.
- C. Do not operate fan systems without filters.
- D. Install static pressure taps upstream and downstream of filters. Mount filter gauges on outside of filter housing or filter plenum, in accessible position. Adjust and calibrate. Every filter bank, including packaged units, shall have a filter gauge.
- E. Install four (4) high efficiency filter test holes, two upstream and two downstream, at all high efficiency filter banks in air handling units and ductwork (85% efficiency and higher). Coordinate location of test holes with Owner.

END OF SECTION

SECTION 235400
FORCED AIR FURNACES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Forced Air Furnaces.
- B. Refrigerant Cooling Coil and Condensing Unit.
- C. Controls.

1.2 QUALITY ASSURANCE

- A. Conform to requirements of UL and applicable codes.
- B. Cooling system tested and rated per AHRI Standard 210.
- C. Conform to ASHRAE 90.1.

1.3 REFERENCES

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. AHRI 210 - Standard for Unitary Air-Conditioning Equipment.

1.4 SUBMITTALS

- A. Submit shop drawings and product data per Section 230500 showing dimensions, connections, arrangement, accessories, and controls.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Bryant
- B. Carrier
- C. Lennox
- D. Trane

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- E. Daikin
- F. Rheem

2.2 TYPE

- A. Provide upflow type with gas burner and electric refrigeration.
- B. Provide self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner or heater, controls, air filter, refrigerant cooling coil and outdoor package containing compressor, condenser coil and condenser fan.

2.3 PERFORMANCE

- A. As scheduled on drawings.

2.4 FABRICATION

- A. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation and reflective liner.
- B. Combustion Chamber: Welded stainless steel.
- C. Supply Fan: Centrifugal type, rubber mounted with direct drive, rubber isolated 1750 rpm, 4-speed motor.
- D. Air Filters: 1" thick glass fiber, disposable type arranged for easy replacement.

2.5 BURNER

- A. Performance: Minimum 95% efficiency natural gas burner. Refer to mechanical schedules for capacity and type.
- B. Gas Burner: Condensing sealed combustion type, combustion gas valve and pressure regulator incorporating manual shutoff, standing pilot, pilot valve, automatic 100% shutoff, and thermocouple pilot safety device. 90% minimum efficiency.
- C. Gas Burner Safety Controls: Thermocouple sensor prevents opening solenoid gas valve until pilot flame is proven and stops gas flow on ignition failure.

2.6 OPERATING CONTROLS

- A. Provide low voltage, adjustable room thermostats to control burner operation.
- B. Provide high limit control, with fixed stop at maximum permissible setting, to de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.

- C. Control supply fan based on bonnet temperature independent of burner controls. Include manual switch for continuous fan operation.

2.7 DRAFT CONTROL

- A. Provide each furnace with PVC combustion air inlet and CPVC outlet piping.
- B. For oil burner, provide barometric draft regulator in flue.
- C. Provide induced draft blower. Pressure switch prove blower operation before allowing gas valve to open. Draft blower shall only operate during heating cycle.

2.8 EVAPORATOR COIL

- A. Mount in furnace supply plenum, copper tube, aluminum fin, coil assembly, and refrigerant piping connections.
- B. Install a drain pan under each cooling coil per ASHRAE 62.1. Extend drain pans the entire width of each coil, including piping and header if in the air stream, and from the upstream face of each coil to a distance 1/2 of the vertical coil height downstream from the downstream face. Pitch drain pans in two directions towards the outlet, with a slope of at least 1/8" per foot.
- C. Provide factory installed thermostatic expansion valve.

2.9 REFRIGERATION PACKAGE

- A. Compressor: Hermetically sealed, 3,600 rpm, resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high pressure control, hard start kit, motor thermal overload protection, service valves, and drier.
- B. Air Cooled Condenser: Aluminum fin and copper tube coil, direct drive propeller fan resiliently mounted, galvanized fan guard.
- C. Shutter head pressure control for starting and operating down to 40 °F .
- D. The use of chlorofluorocarbon (CFC)-based refrigerants is prohibited.

2.10 REFRIGERATION OPERATING CONTROLS

- A. Low voltage, room thermostat controls compressor, condenser fan, and supply fan. Refer to Section 230900 for thermostat description.
- B. Include thermostat system selector switch (heat-cool-off) and fan control switch (on-auto).
- C. Timer shall limit compressor starts to 12 per hour.

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PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount counterflow furnaces on combustible floors, on additive base.
- B. Mount air cooled condenser package on concrete pad.

END OF SECTION

SECTION 236213
AIR COOLED CONDENSING UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Condensing Unit Package.
- B. Charge of Refrigerant and Oil.
- C. Controls and Control Connections.
- D. Refrigerant Circuit.
- E. Motor Starters.
- F. Electrical Power Connections.

1.2 REFERENCES

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. ANSI/UL - Safety for Heating and Cooling Equipment.
- C. AHRI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
- D. ASHRAE 23 - Methods of Testing for Rating Positive Displacement Condensing Units.

1.3 SUBMITTALS

- A. Submit shop drawings per Section 230500 indicating components, assembly, dimensions, weights and loadings, required clearances, location and size of field connections, rated capacities, and electrical nameplate data. Include schematic layouts showing condensing units, cooling coils, refrigerant piping, and accessories required for complete system. Piping diagrams shall apply specifically to this job. Include description of capacity control logic and interface with building control system.
- B. Submit operation and maintenance data including start-up instructions, maintenance instructions, parts lists, controls, and accessories.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
- B. Protect units on site from physical damage. Protect coils.

1.5 WARRANTY

- A. Provide a one-year parts and labor warranty. Compressors shall have an additional four year warranty covering all material and labor costs for compressor repair or replacement at the Owner's option.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Units: Self-contained, packaged, factory assembled and wired units suitable for outdoor use consisting of cabinet, compressors, condensing coil and fans, integral sub-cooling coil, controls, liquid receiver, and screens.
- B. Construction and Ratings: In accordance with AHRI 210/240 and ANSI/UL 207 and 303. Testing shall be in accordance with ASHRAE 14.
- C. Performance Ratings: EER and COP meeting ANSI/ASHRAE 90.1.

2.2 CASING

- A. House components in welded steel frame with galvanized steel panels with painted finish meeting ASTM B117 salt spray test standard.
- B. Mount starters, disconnects, and controls in weatherproof panel with full opening access doors.
- C. Provide gasketed removable access doors or panels with quick fasteners.

2.3 CONDENSER COILS

- A. Aluminum fins mechanically bonded to seamless copper tubing. Provide 12°F of refrigerant subcooling at design conditions.
- B. Coil Guard: Painted expanded metal or PVC coated steel wire.
- C. Provide hail guards on all condenser coils.

2.4 CONDENSER FANS AND MOTORS

- A. Vertical discharge direct drive propeller type condenser fans with fan guards.
- B. Weatherproof motors suitable for outdoor use, single phase permanent split capacitor or 3 phase, with permanent lubricated ball bearings and built in thermal overload protection.
- C. Dynamically and statically balanced fans.
- D. Separate motors for each fan.

2.5 COMPRESSORS

- A. Construction: Semi-hermetic or hermetic scroll type with suction and discharge valves.
- B. Mounting: Dynamically balance rotating parts and mount on vibration isolators.
- C. Lubrication System: Oil pump with oil charging valve, oil level sight glass, oil filter, and magnetic plug or strainer.
- D. Capacity Reduction Equipment: Multiple compressors, and/or multi-speed or variable-speed compressors.
- E. Motor: Suction gas cooled with electronic sensor and winding over temperature protection.
- F. Crankcase Heater: Evaporates refrigerant in crankcase during shutdown.
- G. Suitable for operating on voltages plus or minus 15% of nameplate ratings.

2.6 REFRIGERANT CIRCUIT

- A. Refrigerant may be new or reclaimed, and shall meet ARI-700-2004 Standard for Refrigerant Purity.
- B. Provide each unit with the number of refrigerant circuits needed to provide the scheduled unloading and properly transport oil.
- C. Provide the following for each refrigerant circuit:
 - 1. Replaceable core type filter dryer.
 - 2. Liquid line sight glass and moisture indicator.
 - 3. Thermal expansion valve.
 - 4. Insulated suction line.
 - 5. Suction and liquid line service valves.
 - 6. Schraeder valve.
 - 7. Condenser pressure relief valve.
 - 8. Suction filter.
 - 9. Liquid line solenoid valve.

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- D. For heat pump units, provide reversing valve, suction line accumulator, discharge muffler, flow control check valve, and solid-state defrost control using thermistors.
- E. The use of chlorofluorocarbon (CFC)-based refrigerants is prohibited.

2.7 CONTROLS

- A. On unit, mount NEMA 4 steel control panel containing power and control wiring, factory wired with single point power connection.
- B. For each compressor, provide across-the-line starter, factory wired non-fused disconnects, non-recycling compressor overload, starter relay, and control power transformer. For each condenser fan, provide across-the-line starter with starter relay.
- C. Provide the following safety controls arranged so operating any one will stop unit:
 - 1. Manual reset high discharge pressure switch for each compressor.
 - 2. Automatic reset low suction pressure switch for each compressor.
 - 3. Manual reset oil pressure switch.
- D. Provide the following operating controls:
 - 1. Timer(s) that prevents compressor short cycling.
 - 2. Low ambient temperature (as scheduled) thermostat to lock out compressor.
 - 3. If discharge or return air control is provided with the unit, provide adjustable time delay between stages of operation. All units shall be compatible with direct control of staging by DDC systems. Suction pressure control of staging is not acceptable.
 - 4. Pump down control that activates when the lead compressor of each circuit stops.
 - 5. Hot gas bypass sized for minimum compressor loading, or "Frostat" control. If hot gas is used, the pipe with modulating flow (hot gas or suction) must pitch continuously downward in the direction of flow.
 - 6. Thermostat to cycle fan motors in response to head pressure.
 - 7. Head pressure controlled damper or variable speed fan control on first stage condenser fan. Rated for starting at 0°F.

2.8 MANUFACTURERS

- A. Trane
- B. York
- C. Daikin
- D. Carrier
- E. Units shall be of the same manufacturer as the evaporator coil.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Comb all condenser coils to repair bent fins.
- C. Install on vibration isolators as scheduled on the drawings or in Section 230548.
- D. Connect to refrigeration piping and evaporators.

3.2 MANUFACTURER'S FIELD SERVICES

- A. Provide initial start-up by factory authorized service representatives. Adjust units to provide proper superheat.
- B. Supply initial charge of refrigerant and oil for each refrigerant circuit. Replace losses of refrigerant and oil during the warranty period.

END OF SECTION

SECTION 237223

PACKAGED AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Packaged Energy Recovery Equipment.
- B. Unit Controls.
- C. Roof Mounting Frame and Base.

1.2 QUALITY ASSURANCE

- A. All insulation inside the unit and in the airstream must comply with the requirement of NFPA 90A (maximum flame spread of 25 and maximum smoke developed of 50).
- B. All units must be UL or ETL listed and must contain UL labeled components.
- C. Fans shall be tested and rated in cabinet in accordance with AMCA Standard 210. All fan assemblies shall be dynamically balanced in cabinet at final assembly.
- D. Conform to ASHRAE 90.1.
- E. All air handling and distribution equipment mounted outdoors shall be designed to prevent rain intrusion into the airstream when tested at design airflow and with no airflow, using the rain test apparatus described in Section 58 of UL 1995.

1.3 REFERENCES

- A. AHRI 210 - Unitary Air Conditioning Equipment.
- B. AHRI 240 - Air Source Unitary Heat Pump Equipment.
- C. AHRI 270 - Sound Rating of Outdoor Unitary Equipment.
- D. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- E. ASHRAE 37 - Methods of Testing for Rating Unitary Air Conditioning and Heat Pump Equipment.
- F. NFPA 70 - National Electrical Code.

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- G. NFPA 90A - Installation of Air Conditioning and Ventilating System.
- H. UL - Underwriters' Laboratory.

1.4 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 230500.
- B. Indicate electrical service and duct connections on shop drawings or product data.
- C. Submit manufacturer's installation instructions.
- D. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.
- E. Submit fan curves, including minimum and maximum fan speed, with specified operating points clearly plotted.
- F. Provide 8-octave maximum sound power levels at unit discharge and exhaust connection.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from physical damage by storing off site until roof mounting frames are in place, ready for immediate installation of units.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data.
- B. Include manufacturer's descriptive literature, installation instructions, maintenance and repair data, and parts listing.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of air-to-air energy recovery equipment that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Packaged Energy Recovery Units: Two years.

PART 2 - PRODUCTS

2.1 PACKAGED ENERGY RECOVERY UNITS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on drawings or comparable product by one of the following:
1. American Aldes
 2. Carnes
 3. Des Champs Technologies
 4. Engineered Air
 5. Greenheck Fan Corporation
 6. Loren Cook Company
 7. RenewAire LLC
 8. SEMCO Incorporated
 9. Venmar CES Inc.
- B. Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Housing: Manufacturer's standard construction for exterior applications with corrosion-protection coating and exterior finish, gasketed and caulked weathertight, with neoprene gaskets for inspection and access to internal parts, minimum 1-inch thick thermal insulation, knockouts for electrical and piping connections, exterior drain connection, and lifting lugs.
1. Inlet: Weatherproof hood, with damper for exhaust and supply.
 - a. Exhaust: Gravity backdraft damper.
 - b. Supply: Gravity backdraft damper.
- D. Heat Recovery Device:
1. Polymer plate heat exchanger.
- E. Supply and Exhaust Fans: Forward-curved, centrifugal fan with spring isolators and flexible duct connections.
1. Fans:
 - a. Supply Fans: DWDI centrifugal; SWSI plenum or vane axial fan.
 - b. Exhaust Fans: DWDI centrifugal; SWSI plenum or vane axial fan.
 - c. All fans shall be aluminum or composite construction with fan shaft; turned, ground and polished steel; keyed wheel hub.
 - d. Fan and motor assemblies shall be resiliently mounted.
 - e. Direct drive motor.
 - f. All fan bearings must be capable of being lubricated by easily accessible grease fittings.
 - g. All fans must be statically and dynamically balanced.

2. Motor (as scheduled on drawings):
 - a. Induction: Furnish permanently lubricated sealed ball type motor and drive shaft bearings. Motor and wheel supported by spring isolators having 1-inch static deflection.
 - 1) Disconnect as scheduled on drawings.
 - b. Electronically Commutated Motor (ECM): Motor shall be variable speed, constant torque, brushless permanent magnet (PM) motor for belt drive applications. Electronics shall be encapsulated for moisture protection and shall include integral surge protection. Motor and controller shall be pre-wired for specific voltage and phase. Motor frame shall be NEMA 48; all EC motors shall be a minimum of 85% efficient at all speeds. Provide motor with onboard motor control module. Motor speed shall be limited to provide electronic overcurrent protection. Provide non-fused, with thermal overload protection, factory mounted and wired disconnect switch mounted inside fan housing. Starter shall provide soft start to reduce inrush current and shall be controllable from 20% to 100% of full rated speed. Operational mode shall be as follows:
 - 1) ECM set for constant CFM.
 - c. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

F. Disposable Panel Filters:

1. Comply with NFPA 90A.
2. Filter Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.
3. Factory-fabricated, viscous-coated, flat-panel type.
4. Thickness: 2 inch.
5. Minimum MERV: 8, according to ASHRAE 52.2.
6. Media: Interlaced glass fibers sprayed with nonflammable adhesive.
7. Frame: Galvanized steel with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles.

G. Piping and Wiring: Fabricate units with space within housing for piping and electrical conduits. Wire motors and controls so only external connections are required during installation.

1. Indoor Enclosure: NEMA 250, Type 12 enclosure contains relays, starters, and terminal strip.
2. Outdoor Enclosure: NEMA 250, Type 3R enclosure contains relays, starters, and terminal strip.
3. Include fused disconnect switches.
4. Variable-speed controller to vary fan capacity from 100 to approximately 50 percent.

H. Accessories:

1. Intake weather hood with 2-inch thick filters.
2. Louvered intake weather hood with 2-inch thick filters in V-bank configuration.
3. Exhaust weather hood with birdscreen.

4. Low-Leakage, Isolation Dampers: Double-skin, airfoil-blade, extruded-aluminum dampers with compressible jamb seals and extruded-vinyl blade edge seals, in opposed-blade arrangement with cadmium-plated steel operating rods rotating in stainless-steel sleeve bearings mounted in a single extruded-aluminum frame, with operating rods connected with a common linkage, and electric damper operator factory wired. Leakage rate shall not exceed 5 cfm/sq. ft. at 1-inch wg and 9 cfm/sq. ft. at 4-inch wg.
5. Duct flanges.
6. Rubber-in-shear isolators for ceiling-mounted units.
7. Hinged access doors with quarter-turn latches.
8. Drain pans for condensate removal complying with ASHRAE 62.1.

2.2 CONTROLS

A. FMCS Controls:

1. Fan Control: Terminal strip for EC motors.
2. Bypass Economizer Control: Dry bulb control, two-position dampers with 100% airflow through the core or 100% airflow bypassing the core.
3. Sensors: None.
4. Time Clock: Digital time clock wall mount, with up to 8 on/off cycles per day or 50 per week, 24VAC power, with battery backup protection of program settings against power failure to energize unit.

2.3 SCHEDULE

- ### **A. Refer to schedule for capacities and characteristics.**

PART 3 - EXECUTION

3.1 EXAMINATION

1. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings and illustrated by the manufacturer.
2. Verify that proper power supply is available.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Mount units on factory-built roof mounting curb and provide watertight enclosure to protect ductwork and utility services. Install unit level.
- C. All field wiring shall be in accordance with the National Electrical Code.
- D. P-traps must be provided for all drain pans.

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- E. Comb all coils to repair bent fins.
- F. Contractor shall coordinate unit access stair and walkway placement to ensure compliance with OSHA requirements.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Provide initial startup and shutdown during first year of operation.

END OF SECTION

SECTION 237313
AIR ROTATION UNITS

PART 1 - GENERAL

- A. DX Cooling Air Rotation System.

1.2 QUALITY ASSURANCE

- A. All insulation inside the unit and in the airstream must comply with the requirement of NFPA 90A (maximum flame spread of 25 and maximum smoke developed of 50).
- B. All units must be UL or ETL listed and must contain UL labeled components.
- C. Fans shall be tested and rated in cabinet in accordance with AMCA Standard 210. All fan assemblies shall be dynamically balanced in cabinet at final assembly.
- D. Conform to ASHRAE 90.1.

1.3 REFERENCES

- A. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
- B. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
- C. AHRI 410 – Forced Circulation Air-Cooling and Air-Heating Coils.
- D. ASTM B75- Standard for copper tubing pressure application.
- E. UL -The unit shall be manufactured and installed in accordance with the requirements of the Underwriters Laboratory standard; “Ductless Large Open Building Heating and Cooling Equipment - Category LZPG” and bear the official UL Label.

1.4 SUBMITTALS

- A. Submittal Procedures: Submittals of all equipment drawings, schedules and specifications must accompany quote.
- B. Shop Drawings: Indicate assembly, required clearances, and locations and sizes of field connections.
- C. Product Data: Submit manufacturer's literature and data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- D. Manufacturer's Installation Instructions: Submit/Indicate rigging and assembly.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 EXTRA STOCK

- A. Provide clean filters in all units at time of installation.
- B. Provide clean filters in all units at project final completion after all interior finishes are complete.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site with protective coverings in-place. Loose shipped items must be in factory-provided protective coverings, with factory-installed shipping skids and lifting lugs.
- B. Store unit in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.7 WARRANTY

- A. Provide a manufacturer's 1-year parts and labor warranty against defects in material and workmanship.

PART 2 - PRODUCTS

2.1 DX COOLING AIR ROTATION UNITS.

- A. Manufacturers:
 - 1. Applied Air - Mato
 - 2. Johnson Air Rotation
 - 3. Mestex
 - 4. Approved Equal
- B. Air Rotation Unit (ARU) Design Criteria
 - 1. Self-contained, pre-wired unit consisting of cabinet, supply fan, dx cooling coils, and accessories:
 - a. The unit shall be designed for indoor mounting. The unit will have the capabilities of cooling, filtering, and circulating as detailed in the submittal drawing.
 - b. The unit shall be factory assembled and tested prior to shipping, disassembled for shipping, and reassembled on site by the awarded contractor as required.
 - c. System and accessories to be UL listed and approved as a complete unit. Unit shall be manufactured to FM standards as required.
 - d. Unit Configuration: Vertical with horizontal discharge and return. Units shall have control panel serviceable from ground level.
 - e. Lifting Provisions: Lifting provisions shall be included on all units as an integral part of the equipment.
 - f. Supply Voltage: 208V, 3ph., 60 Hz
 - g. Control Voltage: 120 or 24 volt, 1ph, 60 Hz
 - h. The unit shall be complete factory wired with a single point electrical connection.
 - i. All bolting hardware and wiring harnesses shall be furnished, tagged and labeled for ease of installation by the installing contractor.

C. Casing

1. Frame Construction: Shall be angle iron framing with 3/16" horizontal flange and 1/8" vertical framing and factory painted, suitably reinforced and braced to permit the loading, shipping, unloading and rigging to the unit location and general handling of completed sections without damage to external or internal components or misalignment of factory assembled components due to normal handling techniques.
2. Cabinet Construction: 18-gauge A-60 bonderized steel suitable for factory painting. The panels shall be factory assembled using flat bar screwed construction and have a reinforced steel angle flange assembly. Unit shall be factory painted using factory standard enamel finish.
3. Single-Wall Insulation: All sections of the Air Rotation unit shall be double-wall insulated with a 1" 1.5# density fiberglass insulation core and minimum 22-gauge galvanized interior liner.

D. Access Doors:

1. Access Panels: Hinged access doors in the unit housing shall be provided to permit ready access to all internal components. The access doors shall be a minimum of 18-gauge galvanized steel. The doors shall be designed to swing out. The doors shall be provided with a continuous 16-gauge stainless steel piano hinge. The unit's wall panels shall be an integral part of the doorframe. The unit's fan compartment access for inspection and adjustment shall be UL approved. A warning placard shall be affixed at the access door indicating that the unit is to be shut off before opening the door and entering the fan compartment.

E. Electrical and Controls:

1. Electrical:
 - a. The power panel shall have a locking dead front main power cabinet with disconnect and containing necessary fuses, sub-circuits, magnetic starters with 3-leg protection, relays and contactors requiring only single 3-phase connection.
 - b. The unit shall incorporate factory-mounted transformers to step down the main power supply voltage to be 120 volts and 24 volts (as required).
 - c. Variable frequency drive – One per unit with manual controls, no bypass included. Motors shall be inverter capable for use with VFD.
 - d. Actuator power and control by ARU manufacturer, enthalpy economizer type.
 - e. Two high temperature limits shall be installed, one for automatic reset (factory set at 200°F) and one for manual reset (factory set at 250°F).
 - f. Refer to control diagrams for additional control information and requirements.
2. Controls:
 - a. A NEMA 1 control panel with hinged access door shall be mounted on the unit. All control components are to be labeled and individually wired to a numbered terminal strip to aid in servicing. All wiring shall be color-coded and number-tagged at each end to match the control diagram supplied. Full operating and maintenance manuals shall accompany each unit. All wiring between the controls shall be run in flexible conduit. All electrical components shall bear the U.L. label.
 - b. Unit shall have U.L. label on main control panel showing compliance with U.L. Standard 508 for Industrial Control Panels.

- c. The control system shall include, but not be limited to, the following components required for automatic operation: control circuit transformer; fan motor starters, overloads and sub-circuit fuses; control circuit fuses; and control relays.
- d. The AdaptAire MRT Touch Control System shall be used to control the space temperature and shall include setpoints for room air temperature and both minimum and maximum discharge air temperature and the unit DDC Controller with full BACnet compatibility, a signal conditioner, an inlet air sensor, a discharge air sensor, space temperature sensor and an Equipment Touch touchscreen controller for remote panel to change setpoints and monitor the unit's operation. The features included with the DDC Controller shall include but not be limited to electronic time clock with normal, holiday, and override schedules, and on-off night setback thermostat for lower temperatures in unoccupied mode.

F. Fan(s) and Motor(s):

1. Supply Fans:

- a. The supply fans, a minimum of two per unit, shall be airfoil premium propeller type with low-noise blades and a smooth inlet venturi. The pitch of the fan blades shall be field adjustable for ease of air flow adjustment and removal / replacement in case of fan failure. The propeller blades shall be supported by two bearings, which shall be of a self-aligning, ball bearing type and shall be designed for at least 100,000 hours average life.
- b. Fans shall have the capacity, and class, as scheduled.
- c. Blower Shafts - Blower shafts shall be solid ground and polished. The shafts shall not pass through their first critical speed when the unit comes up to the rated RPM. Shaft shall be coated with a rust inhibitor.
- d. V-Belt Drives - All V-belt drives shall be standard capacity dual belt type, furnished in matched sets with reinforced rubber belts. The sheaves shall be of a cast iron type.
- e. The service factor used for V-belt drive selection shall be not less than 1.25.
- f. Lubrication - Mount all grease fittings directly on the bearings.
- g. Motors shall be TEFC, 1800 RPM, 460 volt, 3 phase, 60 Hz. Motor horsepower shall be as indicated on the schedule. Motors will be manufacturer's premium efficiency design.
- h. Motors shall be provided with shaft grounding rings or grounding brushes or ceramic bearings as a means to protect bearings from adverse shaft currents. Providing grounding rings internal to the motor housing is an acceptable solution, provided the motor is affixed with a label clearly indicating the presence of a grounding assembly. The grounding ring shall be listed for 40,000 hours of motor service and shall be accessible via the drive endplate. Motor shafts 2 and larger require shaft grounding on the drive end and the non-drive end.

G. Coils:

1. Cooling Coils:

- a. Cooling coils shall be placed in the A-frame position.
- b. Cooling coils shall use 0.020" copper tubes and 0.0075" aluminum fins. Coil casings shall be galvanized steel.
- c. Drain pans shall be pitched for complete drainage and be constructed of all welded 304 stainless steel. The underside of the drain pan shall be completely insulated. Intermediate drain pans (as required) shall be stainless steel and have a stainless steel downspout to the lower drain pan.
- d. Provide condensate overflow sensor by ARU manufacturer.

- e. Face velocity of cooling coils shall not exceed 500 fpm.
- f. Access door(s) shall be provided into fan section for motor and drive access. Internal walk-on grating shall be provided in bottom of fan section, full-width and full-length of unit.

H. Filters:

- 1. Air Filter Frame and Air Filters: Filter frame shall be fabricated of 16-gauge galvanized steel. Filters shall be upstream service, mounted in the V-bank position. Filters will be 2" thick MERV 8 pleated throwaway type.

I. Dampers:

- 1. Low leak outside air dampers with blade and jamb seals (Ruskin CD-60 or equivalent) sized for 0-100% outside air.
- 2. Low leak return air dampers with blade and jamb seals (Ruskin CD-60 or equivalent) sized for 0-100% return air.
- 3. Belimo 24V modulating actuators to be provided, mounted, and wired by ARU manufacturer at all damper openings.

J. Diffusers.

- 1. Discharge Louvers:
 - a. Adjustable horizontal and vertical louvers mounted within a welded frame shall be painted to match cabinet finish.
 - b. Turning vanes will be factory installed in air discharge section of units. Substitutions to the basis of design manufacturer that do not provide turning vanes shall account for loss of air flow due to system effect by adding 0.25" of internal static pressure loss to their fan selections. Manufacturer shall be responsible for any additional cost due to higher unit MCA/ MOCP to achieve scheduled air flow.
 - c. Supply louvers shipped loose for field installation.
 - d. Return grill shipped loose for field installation.

K. Accessories

- 1. UL-approved double-wall flue piping with stainless steel liner (including penetration assembly and rain cap) provided by ARU manufacturer, ships loose.
- 2. Outside air intake hood with bird screen.
- 3. Freight to job site and factory-assisted start-up services shall be included with all bids.

L. Identification and Labeling

- 1. The unit nameplate shall include the unit model number, serial number, Full Load Amps, and supply voltage.
- 2. The units shall be permanently marked with the equipment number ARU-# as identified in the performance section.
- 3. All matching pieces of units shipped in sections shall be marked for easy identification of adjoining sections.
- 4. Proper warning labels for high voltage and moving parts shall be permanently affixed to access doors.

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5. An electrical ladder diagram shall be permanently affixed inside of the electrical control panel. The schematic shall be specific to the project and not be a generic type encompassing features or options not present on the unit. The schematic shall include the fuse replacement values and types.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Installation Requirements

1. Install per manufacturer's instructions.
2. During construction provide temporary closures of metal or taped polyethylene over openings into housing ducts to prevent dust from entering ductwork.
3. Seal all contractor installed penetrations airtight. Seal all openings prior to cleaning. Seal holes with proper SMACNA closures conforming to pressure class of the housing.
4. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

B. Coil Requirements:

1. Comb all coils to repair bent fins.
2. Extend coil drain and vent connections to outside unit housing. Provide normally closed valve on drain and vent connection outside of unit housing.

3.2 MANUFACTURER'S FIELD SERVICES

- A. Provide factory authorized field representative for starting unit and training operator.
- B. Prepare and start systems with installing contractor observation.

END OF SECTION

SECTION 237416.12

PACKAGED ROOFTOP AIR CONDITIONING UNITS 25 TON AND BELOW

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Packaged Rooftop Unit.
- B. Unit Controls.
- C. Roof Mounting Frame and Base.
- D. Economizers.
- E. Power Exhaust.

1.2 QUALITY ASSURANCE

- A. All insulation inside the unit and in the air stream must comply with the requirement of NFPA 90A (maximum flame spread of 25 and maximum smoke developed of 50).
- B. All units must be UL or ETL listed and must contain UL labeled components.
- C. Fans shall be tested and rated in cabinet in accordance with AMCA Standard 210. All fan assemblies shall be dynamically balanced in cabinet at final assembly.
- D. Conform to ASHRAE 90.1.
- E. All air handling and distribution equipment mounted outdoors shall be designed to prevent rain intrusion into the airstream when tested at design airflow and with no airflow, using the rain test apparatus described in Section 58 of UL 1995.

1.3 REFERENCES

- A. AHRI 210 - Unitary Air Conditioning Equipment.
- B. AHRI 270 - Sound Rating of Outdoor Unitary Equipment.
- C. ASHRAE 37 - Methods of Testing for Rating Unitary Air Conditioning and Heat Pump Equipment.
- D. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- E. NFPA 70 - National Electrical Code.

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- F. NFPA 90A - Installation of Air Conditioning and Ventilating System.
- G. UL - Underwriters' Laboratory.

1.4 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 230500.
- B. Indicate electrical service and duct connections on shop drawings or product data.
- C. Submit manufacturer's installation instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from physical damage by storing off site until roof mounting frames are in place, ready for immediate installation of units.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data.
- B. Include manufacturer's descriptive literature, installation instructions, maintenance and repair data, and parts listing.

1.7 WARRANTY

- A. Provide five (5) year manufacturer's warranty for compressors.
- B. Provide five (5) year manufacturer's warranty for heat exchanger.
- C. Provide three (3) year manufacturer's warranty for controls and electrical components (thermostats, VFD, etc.).

1.8 MAINTENANCE SERVICE

- A. Contractor shall furnish complete service and maintenance of packaged roof top units for one year from Date of Substantial Completion.
- B. Provide maintenance service with a two-month interval as maximum time period between calls. Provide 24-hour emergency service on breakdowns and malfunctions.
- C. Include maintenance items as outlined in manufacturer's operating and maintenance data, including minimum of four (quarterly) filter replacements, minimum of one fan belt replacement, and controls checkout, seasonal adjustments, and recalibrations.
- D. Submit copy of service call work order or report and include description of work performed to Owner and Architect/Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: The scheduled manufacturer is the Basis of Design. The Contractor is responsible for all costs, schedule impacts, and construction coordination, including design costs and regulatory agency approvals, related to using a specified alternate product other than the Basis of Design. Refer to Section 230500 for additional information.
- B. Trane
- C. York
- D. Daikin
- E. Carrier
- F. Lennox
- G. Ruud
- H. Valent
- I. Aaon

2.2 MANUFACTURED UNITS

- A. Provide roof-mounted units having gas burner, and electric refrigeration.
- B. Unit shall be self-contained, packaged, factory assembled, pre-wired and tested, consisting of cabinet and frame, supply fan, exhaust fan, heat exchanger and burner, controls, air filters, refrigerant cooling coil and compressor, condenser coil, condenser fan, and a full refrigerant charge.
- C. Unit shall be furnished with non-fused disconnect switch, short fuse protection of all internal electrical components, and all necessary motor starters, contactors, and over-current protection.
 - 1. AHRI rated for direct expansion use with R-32 or R-454B.

2.3 FABRICATION

- A. Cabinet: Galvanized steel with baked enamel finish, access doors with quick fasteners locking door handle type with piano hinges. Access doors shall be provided at each section (e.g., filter section, supply fan section, etc.). All exterior access must be permanently labeled on the outside indicating what is behind the panel. Structural members shall be minimum 18 gauge, with access doors of minimum 20 gauge.

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- B. Outside Air Intakes: The outside air intakes shall be located a minimum of 15 inches above the roof mounting curb to minimize the effect of heat pickup from the roof during the natural cooling cycle and the effects of snow on the roof during winter operation. Each air intake shall be furnished with rain eliminators.
- C. Insulation: Minimum of 1" thick 1.5lb./cu. ft. aluminum foil faced glass fiber on all sections.
- D. Heat Exchangers: Stainless steel, of welded construction.
- E. Air Filters: Two inch thick glass fiber disposable media in metal frames.

2.4 ROOF MOUNTING FRAME AND BASE

- A. Roof Mounting Curb: Minimum 12 inches high, minimum 14 gauge galvanized steel, one-piece construction, insulated, all welded, wood nailer.

2.5 FANS/MOTORS

- A. Fans:
 - 1. Supply Fans: centrifugal; SWSI plenum or vane axial fan.
 - 2. Exhaust Fans: Propeller or SWSI plenum fan.
 - 3. All fans shall be aluminum or composite construction with fan shaft: turned, ground and polished steel; keyed to wheel hub.
 - 4. Fan and motor assemblies shall be resiliently mounted.
 - 5. Direct drive motor or with V-belt drive and rubber isolated hinge mounted motor.
 - 6. All fan bearings must be capable of being lubricated by easily accessible grease fittings.
 - 7. All fans must be statically and dynamically balanced.
- B. Motors:
 - 1. Motors shall be "variable frequency drive rated" when controlled by VFDs. Refer to Section 230513.
 - 2. No equipment shall be selected or operate above 90% of its motor nameplate rating.
 - 3. Motor shall have 1.15 service factor.

2.6 BURNER

- A. Gas Burner: Atmospheric type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shutoff, intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shutoff pilot. fully modulating gas valve with minimum 4:1 turndown.
- B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after airflow proven and slight delay, allow gas valve to open.
- C. High Limit Control: Temperature sensor with fixed stop at maximum permissible setting, de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.

- D. Supply Fan Control: Temperature sensor sensing bonnet temperatures and independent of burner controls, or adjustable time delay relays with switch for continuous fan operation.

2.7 EVAPORATOR COIL

- A. Provide copper tube with aluminum fin coil assembly.
- B. Install a drain pan under each cooling coil meeting requirements as outlined in ASHRAE 62.1. The drain pans shall extend the entire width of each coil, including piping and header if in the air stream. The length shall be as necessary to limit water droplet carryover beyond the drain pan to 0.0044oz per ft² of face area per hour under peak sensible and peak dew point design conditions, considering both latent load and coil face velocity. Pitch drain pans in two directions towards the outlet, with a slope of at least 1/8" per foot.
- C. Provide capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.
- D. Provide insulation on liquid refrigerant and suction piping between compressor and evaporator coil where not protected by drain pans. Insulation shall be elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.27 maximum 'K' value at 75°F, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Maximum 1" thick per layer where multiple layers are specified.
- E. Drain Pan Condensate Overflow Switch: Float with integral magnet overflow switch conforming to UL508. Factory installed in drain pan and wired to shut the rooftop unit down with a fault alarm. No standby power required.

2.8 HOT GAS REHEAT COIL

- A. Provide copper tube with aluminum fin coil assembly.
- B. Valves to reroute hot refrigerant gas from the discharge line of the compressor through the reheat coil.

2.9 COMPRESSOR

- A. Provide hermetic or semi-hermetic compressors (quantity as scheduled on drawings), 3600 rev/min maximum, resiliently mounted with positive lubrication, crankcase heater for operation down to 0°F, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports, and filter drier.
- B. Provide capacity control by staging multiple compressors, or inverter duty scroll compressors.
- C. Five minute timed off circuit shall delay compressor start.
- D. The use of hydrochlorofluorocarbon (HCFC) or chlorofluorocarbon (CFC) based refrigerants is prohibited.

2.10 CONDENSER

- A. Condenser shall provide design capacity between the minimum and maximum ambient conditions scheduled on the drawings.
- B. Condenser Coil:
 - 1. Round Copper Tube and Aluminum Fins: Construct condenser coils of aluminum fins mechanically bonded to seamless copper tubing. Air test under water to 450 psig.
 - 2. Microchannel: All aluminum brazed fin construction. The maximum allowable working pressure of the condenser is 450 psig. Air test under water to 450 psig.
- C. Condenser Fans: Provide direct drive low noise blade design propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Fan blade shall be aluminum or composite material.
- D. Condenser Motors: Fan motors shall be an ECM type motor for proportional control. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase.
- E. Entire fan assembly shall be statically and dynamically balanced.
- F. Provide refrigerant pressure switches to cycle condenser fans.
- G. Provide hail guards on all condenser coils.
- H. Liquid and discharge isolation valves with staged and digital scrolls.

2.11 MIXING SECTION

- A. Dampers: Provide outside, return, and relief dampers with damper operator and control package to automatically vary outside air quantity. Outside air damper shall fail to closed position.
- B. Gaskets: Provide tight fitting dampers with edge gaskets. Gaskets must be mechanically fastened (use of adhesive alone shall not be acceptable). Damper blades shall be gasketed with side seals to provide an air leakage rate of Class 1A at 1" w.c. pressure differential for a 24"x 24" damper.
- C. Damper Actuator: 24 volt with gear train sealed in oil, with spring return on units 7.5 tons cooling capacity and larger.

2.12 ECONOMIZERS

- A. Factory installed by approved rooftop unit manufacturer with fully modulating motorized outside air and return air dampers.
- B. To be controlled by differential enthalpy with fixed dry-bulb controller with minimum position setting.

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- C. Shall be equipped with 100% capable relief barometric damper relieving up to 100% return air and sealed to meet ASHRAE 90.1 requirements.
- D. Shall be capable of introducing up to 100% outside air.
- E. Shall maintain minimum airflow into the building during occupied period and provide design ventilation rate for full occupancy.
- F. Dampers shall be capable of completely closing when unit is in unoccupied mode.
- G. Outside air damper normally closed and return air damper normally open.
- H. Provide factory installed and tested, outdoor air monitor that controls outdoor air \pm 15% accuracy down to 40 CFM per ton.
- I. Provide a field installed duct/space-mounted CO₂ sensor (RTU-2 only). Outside air damper position shall modulate between the demand control ventilation limit (minimum position setpoint) and the ventilation limit (maximum non-economizer position setpoint) to satisfy the space requirements. Damper position shall be controlled to the greater of the two command signals, either minimum outside airflow or space IAQ (CO₂).

2.13 POWER EXHAUST

- A. Factory installed by economizer supplier or compatible equivalent.
- B. Controlled by economizer controls.
- C. Power exhaust shall be factory wired to electrical section complete with conduit, feeders, disconnect, and overcurrent protection. Power exhaust shall be energized based on building pressure or when dampers open past the adjustable setpoint of the economizer control.
- D. Must comply with Energy Code Fan Power Limitation formula.
- E. Fans:
 - 1. Exhaust Fans: Propeller
 - 2. All fans shall be aluminum or composite construction with fan shaft: turned, ground and polished steel; keyed to wheel hub.
 - 3. Fan and motor assemblies shall be resiliently mounted
 - 4. Direct drive motor.
 - 5. All fan bearings must be capable of being lubricated by easily accessible grease fittings.
 - 6. All fans must be statically and dynamically balanced.
- F. Motors:
 - 1. Motors shall be open drip-proof with grease lubricated bearings.
 - 2. Motors shall be "variable frequency drive rated" when controlled by VFDs. Refer to Section 230513.
 - 3. No equipment shall be selected or operate above 90% of its motor nameplate rating.

2.14 ELECTRICAL

- A. Provide with single point power connection to service all controls, dampers, outlet, and fans, complete with non-fused disconnect switch, short circuit protection of all internal electrical components, and all necessary motor starters, contactors, and over-current protection, transformer, and convenience outlet.
- B. All units must be so constructed that when the electrical section access panel is opened, all electrical power to the unit (with the exception of the 120 volt duplex convenience outlet) is disconnected by means of a single disconnect.
- C. All wiring must be labeled, numbered, and terminate in "spade clips". All terminal strips must be keyed to the wiring numbers. Each control device must be permanently labeled to indicate its function.
- D. Wiring diagrams for all circuits must be permanently affixed to the inside of the electrical section access panel. The markings of terminal strips and wiring must agree with the numbering on the wiring diagrams.
- E. All units shall include a transformer for controls and convenience outlet.
- F. Only one power cable connection to the unit shall be necessary.
- G. Motor shall include phase failure protection and prevent the motor from operation in the event of phase loss.

2.15 OPERATING CONTROLS - SINGLE ZONE UNITS

- A. When ECM are applied:
 - 1. Single Zone VAV: The unit controller shall proportionally control the ECM motors on the supply fan based on space temperature. The unit controller shall increase/decrease the speed of the supply fan in order to maintain the space temperature within its setpoint and deadband. The unit controller shall provide discharge air temperature control with the compressor modulation.
- B. Room thermostat shall incorporate:
 - 1. Automatic switching from heating to cooling.
 - 2. Preferential rate control to minimize overshoot and deviation from set point.
 - 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 weekdays, Saturday and Sunday.
 - 7. Switch selection features including imperial or metric display, 12 or 24 hour clock, keyboard disable, remote sensor, fan on-auto.
- C. Room thermostat display shall include:
 - 1. Time of day.
 - 2. Actual room temperature.
 - 3. Programmed temperature.

4. Programmed time.
 5. Duration of timed override.
 6. Day of week.
 7. System model indication: heating, cooling, auto, off, fan auto, fan on.
 8. Stage (heating or cooling) operation.
- D. Provide low limit sequence to close outside air dampers and stop supply fan.
- E. Mixed Air Controls: Maintain selected supply air temperature and revert dampers to minimum outside air position on a call for heating.
- F. Dehumidification Controls: Maintain the relative humidity setpoint with the hot refrigerant gas reheat coil.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings and illustrated by the manufacturer.
- B. Verify that proper power supply is available.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Mount units on factory built roof mounting curb and provide watertight enclosure to protect ductwork and utility services. Install unit level.
- C. All field wiring shall be in accordance with the National Electrical Code.
- D. P-traps must be provided for all drain pans.
- E. Comb all coils to repair bent fins.
- F. Contractor shall coordinate unit access stair and walkway placement to ensure compliance with OSHA requirements.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Provide initial start-up and shutdown during first year of operation.

END OF SECTION

SECTION 238126

SPLIT SYSTEM AIR CONDITIONING UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Split system air conditioning, ceiling-mounted, and/or ceiling-concealed units.

1.2 REFERENCES

- A. ARI 210 - Unitary Air Conditioning Equipment
- B. ARI 240 - Air Source Unitary Heat Pump Equipment
- C. ANSI NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
- D. ANSI/ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality.
- E. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- F. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- G. ASHRAE 52 - Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
- H. ASTM B1003 - Standard Specification for Seamless Copper Tube for Linesets.
- I. FS TT-C-490 - Cleaning Method and Pretreatment of Ferrous Surfaces for Organic Coatings.
- J. UL - Underwriters' Laboratories.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 230500.
- B. Indicate drain, electrical, and refrigeration rough-in connections on shop drawings or product data.
- C. Submit manufacturer's installation instructions.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.
- B. Comply with manufacturer's installation instruction for rigging, unloading, and transporting units.
- C. Protect units from weather and construction traffic by storing in dry, roofed location until units are ready for immediate installation.

1.5 REGULATORY REQUIREMENTS

- A. Conform to ANSI/NFPA 90A for the installation of computer room air conditioning units.
- B. Conform to ASHRAE 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data.
- B. Include manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.7 WARRANTY

- A. Provide five (5) year manufacturer's warranty on all compressors.

PART 2 - PRODUCTS

2.1 SPLIT SYSTEM WALL AND CEILING-MOUNTED UNITS

- A. Manufacturers:
 - 1. LG
 - 2. Samsung
 - 3. Daikin Applied
 - 4. Trane/Mitsubishi
 - 5. Lennox
- B. Manufactured Units:
 - 1. Provide packaged, air-cooled, factory assembled, pre-wired and pre-piped unit consisting of cabinet, fans, filters, remote condensing unit, and controls. Wall-mounted units shall be furnished with integral wall mounting bracket and mounting hardware.
 - 2. Assemble unit for wall-mounted or ceiling installation with service access required.
 - 3. Performance shall be as scheduled on the drawings.
 - 4. Unit shall be rated per AHRI Standards 210/240 and listed in the AHRI directory as a matched system.

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5. Provide unit with factory-supplied cleanable air filters.
6. The units shall be listed by Electrical Laboratories (ETL) in accordance with UL-1995 certification and bear the ETL label.
7. All wiring shall be in accordance with the National Electric Code (NEC).

C. Evaporator Cabinet and Frame:

1. Cabinet:
 - a. Refer to schedule on drawings for mounting type (ceiling-recessed cassette, or ceiling concealed).
 - b. Exposed units shall have a finished appearance with concealed refrigerant piping, condensate drain piping, and wiring connections.
2. Air Distribution Panel (for ceiling-mounted units): Heavy molded plastic 4-way discharge plenum with return air grille and unit filter. Designed for installation into T-bar ceiling system, 24" x 24" size.

D. Evaporator Fans and Motors:

1. Fans:
 - a. The evaporator fan shall be direct drive with a single motor having permanently lubricated bearings.
 - b. The fan shall be statically and dynamically balanced.
 - c. The indoor fan shall have at least three speeds.
2. Motor:
 - a. Direct driven, digitally controlled with multiple speeds. Permanently lubricated with internal overload protection.

E. Evaporator Coils (Direct Expansion):

1. Direct expansion cooling coil of seamless copper tubes expanded into aluminum fins.
2. Single refrigeration circuit with externally equalized expansion valve.
3. Coils shall be pressure tested at the factory.
4. A sloped, corrosion-resistant condensate pan with drain shall be provided under the coil.

F. Electrical Panel:

1. Service Connections, Wiring, and Disconnect Requirements: Conform to the National Electrical Code and local electrical codes.

G. Control:

1. The unit shall have a hard-wired 7-day programmable remote controller to operate the system. Provide wall mounting bracket for controller.
2. Remote controller shall have "automatic", "dry" (dehumidification), and "fan only" operating modes.

3. The remote controller shall have the following features:
 - a. On/Off power switch.
 - b. Mode Selector to operate the system in auto, cool, heat, fan, or dehumidification (dry) operation.
 - c. Fan Setting to provide multiple fan speeds.
 - d. Swing Louver for adjusting supply louver discharge.
 - e. On/Off Timer for automatically switching the unit off or on.
 - f. Temperature Adjustment allows for the increase or decrease of the desired temperature.
 - g. Powerful Operation to allow quick cool down or heating up in the desired space to achieve maximum desired temperature in the shortest allowable time.
4. The remote controller shall perform fault diagnostic functions that may be system related, indoor or outdoor unit related depending on the fault code.
5. Temperature range on the remote controller shall be 64°F to 90°F in cooling mode and 50°F to 86°F in heating mode.
6. The indoor unit microprocessor shall have the capability to receive and process commands via return air temperature and indoor coil temperature sensors enabled by commands from the remote controller.

H. Outdoor Unit:

1. General:
 - a. The outdoor unit shall be specifically matched to the corresponding indoor unit size. The outdoor unit shall be completely factory assembled and pre-wired with all necessary electronic and refrigerant controls.
2. Cabinet:
 - a. The outdoor unit shall be fabricated of galvanized steel, bonderized and coated with a baked enamel finish for corrosion protection.
3. Fan:
 - a. The fan shall be direct drive, propeller type fan with fan guard.
 - b. Fan blades shall be statically and dynamically balanced.
 - c. The fan shall have permanently lubricated type bearings.
 - d. Motor shall be protected by internal thermal overload protection.
 - e. Airflow shall be horizontal discharge.
4. Coil:
 - a. The outdoor coil shall be nonferrous construction with corrugated fin tube.
 - b. The coil shall be protected with an internal guard.
 - c. Refrigerant flow from the condenser shall be controlled via a metering device.
5. Compressor:
 - a. Hermetic or scroll refrigerant compressors with resilient suspension system, inverter driven, oil strainer, sight glass/moisture indicator, internal motor protection, high pressure switch, and crankcase heater.
 - b. The outdoor unit shall have an accumulator and four-way reversing valve.

6. Refrigerant:
 - a. Unit shall use R-32 or R-454B.
 - b. The use of chlorofluorocarbon (CFC)-based refrigerants is prohibited.

I. Integral Condensate Pump:

1. Packaged unit matched to evaporator unit including float switch, pump, motor assembly, check valve, and reservoir.
2. Provide alarm to indicate high level reservoir.
3. Unit shall be powered from evaporator unit with appropriate field connections available.

2.2 PIPING

A. Design Pressure: 450 psig; Maximum Design Temperature: 250°F

B. Type ACR Seamless Copper Tube Linesets; Brazed Joints:

1. 3/4" and under.
2. Tubing: Type ACR seamless copper tube linesets, ASTM B1003. Sizes indicated are nominal designation.
3. Joints: Brazed with silver solder.
4. Fittings: Wrought copper solder joint, ANSI B16.22.
5. Special Requirements: All tubing shall be cleaned, dehydrated, pressurized with dry nitrogen, plugged, and tagged by manufacturer "for refrigeration service". During brazing operations, continuously purge the interior of the pipe with nitrogen to prevent oxide formation.
6. Limitations:
 - a. Only between refrigerant splitter box and indoor terminal unit.
 - b. For use above ceiling only. Do not use in exposed areas.

C. Type ACR Hard Drawn Seamless Copper Tube; Brazed Joint:

1. 4" and under.
2. Tubing: Type ACR hard drawn seamless copper tube, ASTM B280. Sizes indicated are nominal designation.
3. Joints: Brazed with silver solder.
4. Fittings: Wrought copper solder joint, ANSI B16.22.
5. Special Requirements: All tubing shall be cleaned, dehydrated, pressurized with dry nitrogen, plugged and tagged by manufacturer "for refrigeration service". During brazing operations, continuously purge the interior of the pipe with nitrogen to prevent oxide formation.

D. Refrigerant linesets are permitted.

1. Provide manufacturer-packaged refrigerant linesets and accessories of sizes needed for installation. Verify lengths of piping required for installation.

2.3 INSULATION

- A. EPDM (NBR/PVC Blend is not permitted) elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.25 maximum 'K' value at 75°F, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Minimum 1/2" thick for pipe sizes less than 1-1/4" and 3/4" thick for pipe sizes 1-1/4" and above.

2.4 EXPANSION COMPENSATION

- A. Assembly consisting of two flexible connectors, two copper flexible connectors, two 90° elbows, and a 180° return pipe. Unit shall be in the form of a pipe loop.
- B. Connectors shall have corrugated copper hose bodies with copper braided casings.
- C. Connectors shall be rated for 150 psi working pressure at 70°F.
- D. Sizes 2" and smaller shall have copper sweat ends.
- E. Connectors shall be suitable for 1/2" permanent misalignment.
- F. Manufacturer:
 - 1. Metraflex Type MLS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that proper power supply is available.

3.2 INSTALLATION

- A. General Installation Requirements:
 - 1. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
 - 2. Install units in accordance with manufacturer's instructions. Install all units level and plumb. Indoor units shall be installed using manufacturer's standard mounting hardware securely fastened to building structure.
 - 3. Refer to Section 230529 for concrete base for outdoor unit.
 - 4. Coordinate the exact mounting location of all indoor and outdoor units with architectural and electrical work. Coordinate installation of ceiling-mounted units with ceiling grid layout. Provide additional ceiling grid reinforcement or modification as required and coordinate the work with the GC. Locate the indoor unit where it is readily accessible for maintenance and filter changes. Where outdoor units are located on the roof, locate at least 10' from the roof edge.
 - 5. Verify locations of wall-mounted remote controllers with drawings and room details before installation. Coordinate mounting heights to be consistent with other wall-mounted devices. Height above finished floor shall not exceed 48".

6. Maintain minimum clearances to all equipment. Maintain manufacturer's minimum maintenance, and airflow clearances, and maintain minimum spaces about electrical equipment, whichever is greater.
 - a. 120V: 36" deep x 30" wide or the width of the panel whichever is wider.
 - b. 208V: 42" deep x 30" wide or the width of the panel whichever is wider.
 - c. 480V: 42" deep x 30" wide or the width of the panel whichever is wider.
- B. Condensate Removal:
 1. Install condensate piping with trap and route from drain pan to nearest drain. Discharge to nearest code-approved receptor or to a properly vented indirect waste fitting. Flush all piping before making final connections to units.
- C. Comb all coils to repair bent fins.
- D. Install new filters in the unit at Substantial Completion.
- E. A factory-authorized service agent shall assist in commissioning the unit and inspecting the installation prior to startup. Submit startup report with O&M manuals.

3.3 REFRIGERANT PIPING

- A. Install refrigerant piping from the indoor unit(s) to the condensing unit. Refrigerant pipe sizes, lengths, specialties and configurations shall be as recommended by the manufacturer. Evacuate refrigerant piping and fully charge system with refrigerant per manufacturer's requirements.
- B. Provide weather-tight insulated roof curb to accommodate refrigerant piping and conduit roof penetrations.
- C. Insulate all refrigerant piping. Both liquid and suction lines shall be insulated between the indoor and outdoor units.
- D. Joining of Piping:
 1. Brazed Joints:
 - a. Make up joints with brazing filler metal conforming to ANSI/AWS A5.8. Cut copper tubing ends perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt, and grease just prior to brazing. Apply flux evenly, but sparingly, to all surfaces to be joined. Brazing filler metal with a flux coating may also be used. Heat joints uniformly to proper brazing temperature so braze filler metal flows to all mated surfaces. Wipe excess braze filler metal, leaving a uniform fillet around cup of fitting.
 - b. Flux shall conform to ANSI/AWS A5.31.
 - c. Remove composition discs and all seals during brazing if not suitable for a minimum of 840°For greater than the melting temperature of the brazing filler metal, whichever is greater.

2. Mechanical Press Connection:

- a. Copper press fitting shall be made in accordance with the manufacturer's installation instructions.
- b. Examination: Upon delivery to the jobsite, examine copper tubing and fittings for debris, defects, incise marks (manufacturer's engraving on tube), holes, or cracks.
- c. Fully insert tubing into the fitting and mark tubing.
- d. Prior to making connection, the fitting alignment shall be checked against the mark made on the tube to ensure the tubing is fully engaged in the fitting.
- e. Joint shall be pressed with a tool approved by the manufacturer.
- f. Installers shall be trained by manufacturer personnel or representative. Provide documentation upon request.

3. Axially Swaged Connection:

- a. Brass axially swaged connectors shall be installed in accordance with the manufacturer's installation instructions.
- b. Installers shall be trained by a certified Vulkan LOKRING trainer. Provide proof of certification upon request.

E. Insulation:

1. Insulate all refrigerant pipes between the heat pump and indoor units. This includes the liquid pipe, the suction pipe, the hot gas pipe, and the high/low pressure gas pipe. All fittings, valves, and specialty refrigerant components in the piping between the indoor and heat pump units shall also be insulated. The insulation shall have a continuous vapor barrier and shall pass through hangers and supports unbroken. All exterior insulated piping shall be painted with minimum of one (1) coat of UV resistant paint. Over size hangers and supports to allow the insulation to pass through unbroken. Following are the minimum insulation thicknesses unless noted otherwise in the manufacturer's literature or required by local AHJ:

- a. Code/Year: IECC 2015
- b. Refrigerant Suction (40°F & Below):
 - 1) Up to 1": 1/2"
 - 2) 1" and up: 1"
- c. Refrigerant Suction (41°F to 60°F):
 - 1) Up to 1-1/2": 1/2"
 - 2) 1-1/2" and up: 1"

END OF SECTION

SECTION 238200
TERMINAL HEAT TRANSFER UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Electric Unit Heaters.

1.2 QUALITY ASSURANCE

- A. All electrical equipment shall have a UL label.
- B. All gas trains shall comply with utility company and code requirements.

1.3 REFERENCES

- A. ANSI/ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality.
- B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. ANSI/NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

- A. Submit shop drawings per Section 230500.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Protect units from physical damage by storing in protected areas and leaving factory covers in place.

1.6 REGULATORY REQUIREMENTS

- A. Conform to ASHRAE 90.1.

PART 2 - PRODUCTS

2.1 ELECTRIC UNIT HEATERS

- A. Horizontal or vertical discharge as scheduled on the drawings.

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- B. Horizontal units shall have adjustable outlet louvers.
- C. Metal sheathed fin tube electric heating elements.
- D. Casing: Heavy gauge steel with baked enamel finish.
- E. Automatic reset thermal overload wired for instantaneous pilot operation of contactor holding coil.
- F. Motors shall be totally enclosed continuous duty with built-in thermal overload protection.
- G. Provide unit mounted and wired disconnect.
- H. Provide resiliently mounted fan guard/motor support.
- I. Fans: Direct drive propeller type, factory balanced.
- J. Manufacturers:
 - 1. Trane
 - 2. Chromalox
 - 3. Modine
 - 4. Reznor
 - 5. Berko
 - 6. Redd-i
 - 7. QMark

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General Installation Requirements:
- B. Install all products per manufacturers' instructions.
 - 1. Coordinate recess sizes for recessed equipment.
 - 2. Protect units with protective covers during construction.
 - 3. Comb all coils to repair bent fins.

3.2 CLEANING

- A. After construction is complete, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.
- B. Touch-up marred or scratched surfaces of factory-finished cabinets, with materials furnished by manufacturer.
- C. Install new filters.

END OF SECTION

SECTION 238216

AIR COILS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Electric Coils.

1.2 REFERENCES

- A. ANSI/AHRI 410 - Forced-Circulation Air Cooling and Air Heating Coils.
- B. ANSI/NFPA 70 - National Electrical Code.
- C. ANSI/UL 1096 - Electric Central Air Heating Equipment.
- D. SMACNA - HVAC Duct Construction Standards, Metal and Flexible.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 230500.
- B. Submit shop drawings indicating coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors.
- B. Protect coils from entry of dirt and debris with pipe caps or plugs.

PART 2 - PRODUCTS

2.1 ELECTRIC COILS

- A. Assembly: ANSI/UL 1096 listed and labeled, with terminal control box and hinged cover, splice box, coil, casing, and controls.
- B. Coil: Exposed helical coil of nickel-chrome resistance wire with refractory ceramic support bushings.

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- C. Casing: Die formed channel frame of 16 gauge galvanized steel with 3/8-inch mounting holes on 6-inch centers. Provide tube supports for coils longer than 36-inches.
- D. Controls: Automatic reset thermal cut-out, built-in magnetic contactors, control circuit transformer and fuse, manual reset thermal cut-out, airflow proving device, supplementary fusing for heaters over 48 amps, fused disconnect solid-state control with built-in zero-cross switching silicone controlled rectifier (SCR) and field installed thermostat.
- E. Manufacturers:
 - 1. Brasch
 - 2. Indeeco
 - 3. Chromalox

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General Installation Requirements:
 - 1. Install coils in accordance with manufacturer's instructions. Pipe coils with air flow and water flow in opposite directions (counter flow).
 - 2. Protect coils to prevent damage to fins and flanges.
 - 3. Make connections to coils with offsets and unions or flanges to allow coil to be removed without disturbing valves.
 - 4. Comb all coils to repair bent fins.
- B. Duct Mounted Coil:
 - 1. Install in ducts and casings in accordance with SMACNA HVAC Duct Construction Standards, Metal and Flexible.

END OF SECTION

SECTION 260500
BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Requirements applicable to all Division 26 Sections. Also refer to Division 1 - General Requirements. This section is also applicable to Interior Communications Pathways Section 270528. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 REFERENCES

- A. NFPA 70 - National Electrical Code (NEC)

1.3 SCOPE OF WORK

- A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Electrical Systems.
- B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make the portion of the Electrical Work a finished and working system.
- C. Separate contracts will be awarded for the following work. The division of work listed below is for the contractors' convenience and lists a normal breakdown of the work. Please refer to the Construction Manager's scope statements for complete scope of work description.
- D. Description of Systems shall be as follows:
 - 1. Electrical power system to and including luminaires, equipment, motors, devices, etc.
 - 2. Electrical power service system from the Utility Company to and including service entrance equipment, distribution and metering.
 - 3. Grounding system.
 - 4. Wiring of equipment furnished by others.
 - 5. Removal work and/or relocation and reuse of existing systems and equipment.
 - 6. Technology Systems as described in Division 27/28 and on the T-series documents as described in the Suggested Matrix of Scope Responsibility.
 - 7. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
- E. Work Not Included:
 - 1. Telecommunications cabling will be by Division 27, in raceways and conduits furnished and installed as part of the Electrical work.
 - 2. Temperature control wiring for plumbing and HVAC equipment (unless otherwise indicated) will be by other Contractors.

1.4 OWNER FURNISHED PRODUCTS

- A. The Owner will supply manufacturer's installation data for Owner-purchased equipment for this project.
- B. This Contractor shall make all electrical system connections shown on the drawings or required for fully functional units.
- C. This Contractor is responsible for all damage to Owner furnished equipment caused during installation.

1.5 WORK SEQUENCE

- A. All work that will produce excessive noise or interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during unoccupied hours. The Owner reserves the right to determine when restricted construction hours are required.
- B. Itemize all work and list associated hours and pay scale for each item.

1.6 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL, and CONTROL CONTRACTORS

- A. Division of work is the responsibility of the Prime Contractor. Any scope of work described at any location on the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described on the contract documents on bid day. The following division of responsibility is a guideline based on typical industry practice.
- B. Definitions:
 - 1. "Mechanical Contractors" refers to the Contractors listed in Division 21/22/23 of this Specification.
 - 2. "Technology Contractors" refers to the Contractors furnishing and installing systems listed in Division 27/28 of this Specification.
 - 3. Motor Power Wiring: The single phase or 3 phase wiring extending from the power source (transformer, panelboard, feeder circuits, etc.) through disconnect switches and motor controllers to, and including the connections to the terminals of the motor.
 - 4. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case, the devices are usually single phase, have "Manual-Off-Auto" provisions, and are usually connected into the motor power wiring through a manual motor starter.
 - 5. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
 - 6. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. When the motor power wiring exceeds 120 volts, a control transformer is usually used to give a control voltage of 120 volts.

7. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring that directly powers or controls a motor used to drive equipment such as fans, pumps, etc. This wiring will be from a 120-volt source and may continue as 120 volt, or be reduced in voltage (24 volt), in which case a control transformer shall be furnished as part of the temperature control wiring.
8. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
9. Low Voltage Technology Wiring: The wiring associated with the technology systems, used for analog or digital signals between equipment.
10. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation or mounting of telecommunications/technology information outlets.

C. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractors' responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors, etc. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals approved. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall furnish complete wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. The Electrical Contractor shall establish electrical utility elevations prior to fabrication and installation. The Electrical Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:
 - a. Luminaires.
 - b. Gravity flow piping, including steam and condensate.
 - c. Electrical bus duct.
 - d. Sheet metal.
 - e. Cable trays, including access space.
 - f. Other piping.
 - g. Conduits and wireway.

D. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment furnished by the Mechanical Contractor.
2. Assumes all responsibility for miscellaneous items furnished by the Mechanical Contractor that require wiring but are not shown on the electrical drawings or specified in the Electrical Specification. If items such as relays, flow switches, or interlocks are required to make the mechanical system function correctly or are required by the manufacturer, they are the responsibility of the Mechanical Contractor.
3. Assumes all responsibility for Temperature Control wiring, if the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.

4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.
- E. Temperature Control Contractor's or Subcontractor's Responsibility:
1. Wiring of all devices needed to make the Temperature Control System functional.
 2. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor or Subcontractor.
 3. Coordinating equipment locations (such as PE's, EP's, relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.
- F. Electrical Contractor's Responsibility:
1. Furnishes and installs all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor in the Mechanical Drawings or Specifications.
 2. Installs and wires all remote-control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.
 3. Furnishes and installs motor control and temperature control wiring, when noted on the drawings.
 4. Furnishes, installs, and connects all relays, etc., for automatic shutdown of certain mechanical equipment (supply fans, exhaust fans, etc.) upon actuation of the Fire Alarm System.
 5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.
- G. General (Electrical/Technology):
1. "Electrical Contractor" as referred to herein shall be responsible for scope listed in Division 27/28 of this specification when the "Suggested Matrix of Scope Responsibility" indicated work shall be furnished and installed by the EC. Refer to the Contract Documents for this "Suggested Matrix of Scope Responsibility".
 2. The purpose of these Specifications is to outline the Electrical and Technology Contractor's work responsibilities as related to Telecommunications Rough-in, conduit, cable tray, power wiring and Low Voltage Technology Wiring.
 3. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals approved. Therefore, only known wiring, conduits, raceways and electrical power related to such items is shown on the Technology drawings. Other wiring, conduits, raceways, junction boxes and electrical power not shown on the Technology Drawings but required for operation of the systems is the responsibility of the Technology Contractor and included in said Contractor's bid.
 4. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of Technology systems, the final installation shall not be until a coordination meeting between the Electrical Contractor and the Technology Contractor has convened to determine the exact location and requirements of the installation.
 5. Where the Electrical Contractor is required to install cable tray that will contain Low Voltage Technology Wiring, installation shall not begin prior to a coordination review of the cable tray shop drawings by the Technology Contractor.

H. Technology Contractor's Responsibility:

1. Assumes all responsibility for the low voltage technology wiring of all systems, including cable support where open cable is specified.
2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being furnished and installed by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility".
3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).
4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of technology equipment which is required to be bonded to the telecommunications ground bar.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.7 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
 - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - d. Maintenance clearances and code-required dedicated space shall be included.
 - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.
 - a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.

3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.

3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
 - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
 - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain sign-off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.8 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing/Bid Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guides, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Architect/Engineer any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.

2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Architect/Engineer will be done at the Contractor's risk.
- B. Qualifications:
1. Only products of reputable manufacturers as determined by the Architect/Engineer are acceptable.
 2. All Contractors and subcontractors shall employ only workmen who are skilled in their trades. At all times, the number of apprentices at the job site shall be less than or equal to the number of journeymen at the job site.
- C. Compliance with Codes, Laws, Ordinances:
1. Conform to all requirements of the City of Des Moines, Iowa's Codes, Laws, Ordinances and other regulations having jurisdiction.
 2. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
 3. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
 4. All changes to the system made after the letting of the contract to comply with codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.
 5. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
 6. If there are no local codes having jurisdiction, the current issue of the National Electrical Code shall be followed.
- D. Permits, Fees, Taxes, Inspections:
1. Procure all applicable permits and licenses.
 2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
 3. Pay all charges for permits or licenses.
 4. Pay all fees and taxes imposed by State, Municipal, and other regulatory bodies.
 5. Pay all charges arising out of required inspections by an authorized body.
 6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
 7. Where applicable, all fixtures, equipment and materials shall be listed by Underwriter's Laboratories, Inc. or a nationally recognized testing organization.
 8. Pay all telephone company charges related to the service or change in service.
- E. Utility Company Requirements:
1. Secure from the private or public utility company all applicable requirements.
 2. Comply with all utility company requirements.
 3. The Owner shall make application for and pay for new electrical service equipment and installation. The Contractor shall coordinate schedule and requirements with the Owner and Utility Company.

4. The contractor is responsible for completing utility requested forms and sharing utility requested load data from the construction documents.
5. Furnish the metering external C.T. cabinet and meter socket. Verify approved manufacturers and equipment with the Utility Company.
6. The Owner shall apply and pay for any changes for removal of existing electrical service by the utility company. The Contractor shall verify approved manufacturers and equipment with the Utility Company.

F. Examination of Drawings:

1. The drawings for the electrical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of raceways to best fit the layout of the job. Conduit entry points for electrical equipment including, but not limited to, panelboards, shall be determined by the Contractor unless noted in the contract documents.
3. Scaling of the drawings will not be sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as junction boxes, pull boxes, conduit fittings, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either shown on the drawings or called for in the specifications, it shall be included in this contract.
7. The Contractor shall determine quantities and quality of material and equipment required from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater and better-quality number shall govern.
8. Where used in electrical documents the word "furnish" shall mean supply for use, the word "install" shall mean connect up complete and ready for operation, and the word "provide" shall mean to supply for use and connect up complete and ready for operation.
9. Any item listed as furnished shall also be installed unless otherwise noted.
10. Any item listed as installed shall also be furnished unless otherwise noted.

G. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.

8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

H. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any conduit, conductors, wireways, bus duct, fittings, etc.

1.9 WEB-BASED PROJECT SOFTWARE

- A. The General Contractor shall provide a web-based project software site for the purpose of hosting and managing project communication and documentation until completion of the warranty phase.
- B. The web-based project software shall include, at a minimum, the following features: construction schedule, submittals, RFIs, ASIs, construction change directives, change orders, drawing management, specification management, payment applications, contract modifications, meeting minutes, construction progress photos.
- C. Provide web-based project software user licenses for use by the Architect/Engineer. Access will be provided from the start of the project through the completion of the warranty phase.
- D. At project completion, provide digital archive of entire project in format that is readable by common desktop software applications in format acceptable to Architect/Engineer. Provide data in locked format to prevent further changes.

1.10 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification Section	Submittal Item
26 09 13	Energy Metering and Management System
26 09 33	Lighting Control System
26 20 00	Service Entrance
26 24 16	Panelboards
26 27 23	Indoor Service Poles
26 27 26	Wiring Devices
26 28 16	Disconnect Switches
26 36 00	Transfer Switch
26 43 00	Surge Protection Devices
26 51 19	LED Lighting

- B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:
1. Transmittal: Each transmittal shall include the following:
 - a. Date
 - b. Project title and number
 - c. Contractor's name and address
 - d. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
 - e. Description of items submitted and relevant specification number
 - f. Notations of deviations from the contract documents
 - g. Other pertinent data
 2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
 - a. Date
 - b. Project title and number
 - c. Architect/Engineer
 - d. Contractor and subcontractors' names and addresses
 - e. Supplier and manufacturer's names and addresses
 - f. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
 - g. Description of item submitted (using project nomenclature) and relevant specification number
 - h. Notations of deviations from the contract documents
 - i. Other pertinent data
 - j. Provide space for Contractor's review stamps
 3. Composition:
 - a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
 - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
 - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
 4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
 5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.

- c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.
6. Submittal Identification and Markings:
- a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
- 7. Schedule submittals to expedite the project. Coordinate submission of related items.
 - 8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
 - 9. Reproduction of contract documents alone is not acceptable for submittals.
 - 10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
 - 11. Submittals not required by the contract documents may be returned without review.
 - 12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
 - 13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
 - 14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.

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15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
 - a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal, excluding mailing.
16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineers opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 26 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 26 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.11 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 1.
- B. Format:
 1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
 2. Submit in Excel format.
 3. Support values given with substantiating data.
- C. Preparation:
 1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
 2. Break down all costs into:
 - a. Material: Delivered cost of product with taxes paid.
 - b. Labor: Labor cost, excluding overhead and profit.

3. Itemize the cost for each of the following:
 - a. Overhead and profit.
 - b. Bonds.
 - c. Insurance.
 - d. General Requirements: Itemize all requirements.

4. For each line item having an installed cost of more than \$5,000, break down costs to list major products or operations under each item. At a minimum, provide material and labor cost line items for the following:
 - a. Each piece of equipment requiring shop drawings. Use the equipment nomenclature (SB-1, PANEL P-1, etc.) on the Schedule of Values.
 - b. Each type of small unitary equipment (e.g., FDS, FCS, CS, etc.). Multiple units of the same type can be listed together provided quantities are also listed so unit costs can be determined.
 - c. Each conduit system (medium voltage, normal, emergency, low voltage systems, etc.). In addition, for larger projects breakdown the material and labor for each conduit system based on geography (building, floor, and/or wing).
 - d. Site utilities (5' beyond building)
 - e. Testing
 - f. Commissioning
 - g. Record drawings
 - h. Punchlist and closeout

D. Update Schedule of Values when:

1. Indicated by Architect/Engineer.
2. Change of subcontractor or supplier occurs.
3. Change of product or equipment occurs.

1.12 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.

- B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.

- C. Change order work shall not proceed until authorized.

1.13 PRODUCT DELIVERY, STORAGE, HANDLING and MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage.

- B. Protect equipment, components, and openings with airtight covers and exercise care at every stage of storage, handling, and installation of equipment to prevent airborne dust and dirt from entering or fouling equipment to include, but not limited to:
 - 1. Distribution equipment - branch panels, distribution panels.
 - 2. Electronic equipment.
 - 3. Lighting luminaires and lighting control systems.
- C. Equipment and components that are visibly damaged or have been subject to environmental conditions prior to building turnover to Owner that could shorten the life of the component (for example, water damage, humidity, dust and debris, excessive hot or cold storage location, etc.) shall be repaired or replaced with new equipment or components without additional cost to the building owner.
- D. Keep all materials clean, dry and free from damaging environments.
- E. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Electrical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- F. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

1.14 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.
- B. The following network connected equipment shall be equipped with restricted access protocols:
 - 1. Power monitoring and control
 - 2. Electrical controls
 - 3. Lighting control system
 - 4. Transfer switch and remote annunciator

1.15 WARRANTY

- A. Provide one-year warranty for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this specification Division shall commence on the date of Substantial Completion or successful system performance whichever occurs later. The warranty may also commence if a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization of the Owner. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

- C. Warranty requirements extend to correction, without cost to the Owner, of all work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage due to defects or nonconformance with contract documents excluding repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.16 INSURANCE

- A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.17 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality.
- B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Architect/Engineer shall make the final determination of whether a product is equivalent.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.
- D. Voluntary add or deduct prices for alternate materials may be listed on the bid form. These items will not be used in determining the low bidder. This Contractor assumes all costs incurred as a result of using the offered material or equipment on the Contractors part or on the part of other Contractors whose work is affected.
- E. All material substitutions requested after the final addendum must be listed as voluntary changes on the bid form.

1.18 PROJECT COMMISSIONING

- A. The Contractor shall work with the Commissioning Agent (CxA) as described in Section and 26 08 00 and provide all services as described in the Commissioning Plan.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All items of material having a similar function (e.g., safety switches, panelboards, motor starters) shall be of the same manufacturer unless specifically stated otherwise on drawings or elsewhere in specifications.

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 EXCAVATION, FILL, BACKFILL, COMPACTION

- A. General:
 - 1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811.
 - 2. The Contractor shall do all excavating, filling, backfilling, compacting, and restoration in connection with the work.
- B. Excavation:
 - 1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
 - 2. If excavations are carried in error below indicated levels, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer shall be placed in such excess excavations under the foundation. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
 - 3. Trim bottom and sides of excavations to grades required for foundations.
 - 4. Protect excavations against frost and freezing.
 - 5. Take care in excavating not to damage surrounding structures, equipment or buried pipe. Do not undermine footing or foundation.
 - 6. Perform all trenching in a manner to prevent cave-ins and risk to workmen.
 - 7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.

8. If satisfactory bearing soil is not found at the indicated levels, immediately notify the Architect/Engineer or their representative, and do no further work until the Architect/Engineer or their representative gives further instructions.
9. Excavation shall be performed in all ground conditions, including rock, if encountered. Bidders shall visit the premises and determine the soil conditions by actual observations, borings, or other means. The cost of all such inspections, borings, etc., shall be borne by the bidder.
10. If a trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.
11. Mechanical excavation of the trench to line and grade of the conduit or to the bottom level of masonry cradles or encasements is permitted, unless otherwise indicated on the electrical drawings.

C. Dewatering:

1. Furnish, install, operate and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, conduit, feeders, foundations, and other obstructions in the vicinity of construction are not shown on the drawings. Review all Bid Documents for all trades on the project to determine obstructions indicated. Take great care in making installations near underground obstructions.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

E. Fill and Backfilling:

1. No rubbish or waste material is permitted for fill or backfill.
2. Provide all necessary sand and/or CA6 for backfilling.
3. Native soil materials may be used as backfill if approved by the Geotechnical Engineer.
4. Dispose of the excess excavated earth as directed.
5. Backfill materials (native soil material, sand, and/or CA6) shall be suitable for required compaction, clean and free of perishable materials, frozen earth, debris, earth with a high void content, and stones greater than 4 inches in diameter. Water is not permitted to rise in unbackfilled trenches.
6. Backfill all trenches and excavations immediately after installing of conduit, or removing forms, unless other protection is directed.
7. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Spread fill and backfill materials in 6" uniform horizontal layers with each layer compacted separately to required density.
8. For conduits that are not concrete encased, lay all conduits on a compacted bed of sand at least 3" deep. Backfill around conduits with sand, in 6" layers and compact each layer.
9. Backfill with native soil material (if approved) or sand up to grade for all conduits under slabs or paved areas. All other conduits shall have sand backfill to 6" above the top of the conduit.
10. Place all backfill above the sand in uniform layers not exceeding 6" deep. Place then carefully and uniformly tamp each layer to eliminate lateral or vertical displacement.

11. Where the fill and backfill will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density as determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content as determined by AASHTO T-99 or ASTM D-698 test.
12. After backfilling of trenches, no superficial loads shall be placed on the exposed surface of the backfill until a period of 48 hours has elapsed.

F. Surface Restoration:

1. Where trenches are cut through graded, planted or landscaped areas, the areas shall be restored to the original condition. Replace all planting and landscaping features removed or damaged to its original condition. At least 6" of topsoil shall be applied where disturbed areas are to be seeded or sodded. All lawn areas shall be sodded unless seeding is called out in the drawings or specifications.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition. Broken edges shall be saw cut and repaired as directed by Architect/Engineer.

3.3 ARCHITECT/ENGINEER OBSERVATION OF WORK

- A. The contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:
1. Placing fill over underground and underslab utilities.
 2. Covering interior partitions and chases.
 3. Installing hard or suspended ceilings and soffits.
- B. The Architect/Engineer will review the installation and provide a written report noting deficiencies requiring correction. The contractor's schedule shall account for these reviews and show them as line items in the approved schedule.
- C. Above-Ceiling Final Observation:
1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
 - a. All junction boxes are closed and identified in accordance with Section 260553 Electrical Identification.
 - b. Luminaires, including ceiling-mounted exit and emergency lights, are installed and operational.
 - c. Luminaire whips are supported above the ceiling.
 - d. Conduit identification is installed in accordance with Section 260553 Electrical Identification.
 - e. Luminaires are suspended independently of the ceiling system when required by these contract documents.
 - f. All wall penetrations have been sealed.
 2. To prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
 3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to seven days elapsing, the Architect/Engineer may not recommend further payments to the contractor until full access has been provided.

3.4 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 1.
- B. Final Jobsite Observation:
 - 1. To prevent the Final Jobsite Observation from occurring too early, the Contractor shall review the completion status of the project and certify that the job is ready for the final jobsite observation.
 - 2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review. The Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
 - 3. It is understood that if the Architect/Engineer finds the job not ready for the final observation and additional trips and observations are required to bring the project to completion, the cost of the additional time and expenses incurred by the Architect/Engineer will be deducted from the Contractor's final payment.
 - 4. Contractor shall notify Architect/Engineer 48 hours prior to installation of ceilings or lay-in ceiling tiles.
- C. The following must be submitted before Architect/Engineer recommends final payment:
 - 1. Operation and maintenance manuals with copies of approved shop drawings.
 - 2. Record documents including marked-up reproducible drawings and specifications.
 - 3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of this Contractor and shall be signed by the Owner's representatives.
 - 4. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and submit receipt to Architect/Engineer.
 - 5. Start-up reports on all equipment requiring a factory installation or start-up.
- D. Circuit Directories:
 - 1. Provide custom typed circuit directory for each branch circuit panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEIPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

3.5 OPERATION AND MAINTENANCE MANUALS

- A. General:
 - 1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
 - 2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

- B. Operation and Maintenance Instructions shall include:
1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
 2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
 3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
 4. Copies of all factory inspections and/or equipment startup reports.
 5. Copies of warranties.
 6. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
 7. Dimensional drawings of equipment.
 8. Detailed parts lists with lists of suppliers.
 9. Operating procedures for each system.
 10. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
 11. Repair procedures for major components.
 12. Replacement parts and service material requirements for each system and the frequency of service required.
 13. Instruction books, cards, and manuals furnished with the equipment.
 14. Include record drawings of the one-line diagrams for each major system. The graphic for each piece of equipment shown on the one-line diagram shall be an active link to its associated Operation & Maintenance data.
 15. Copies of all panel schedules in electronic Microsoft Excel spreadsheet (.xlsx) file. Each panelboard shall be a separate tab in the workbook.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVE

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of the complete systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representatives by **FACTORY PERSONNEL** in the care, maintenance, and operation of the equipment and systems.
- C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- D. The instructions shall include:
1. Maintenance of equipment.
 2. Start-up procedures for all major equipment.
 3. Description of emergency system operation.
- E. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can be present if desired.
- F. Minimum hours of instruction time for each item and/or system shall be as indicated in each individual specification section.

G. Operating Instructions:

1. Contractor is responsible for all instructions to the Owner's representatives for the electrical and specialized systems.
2. If the Contractor does not have staff that can adequately provide the required instructions, the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 RECORD DOCUMENTS

- A. The following paragraphs supplement Division 1 requirements.
- B. Maintain at the job site a separate and complete set of electrical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.
- C. Mark drawings and specifications to indicate approved substitutions; Change Orders, and actual equipment and materials used. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should this Contractor fail to complete Record Documents as required by this contract, this Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.
- D. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.
- E. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.
- F. Record actual routing of conduits exceeding 2 inches.

3.8 PAINTING

- A. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available. All equipment shall have a finished coat of paint applied unless specifically allowed to be provided with a prime coat only.
- B. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, the Contractor shall have the equipment and all its supports, hangers, etc., painted to match the room decor. Painting shall be performed as described in project specifications.
- C. Equipment cabinets, casings, covers, metal jackets, etc., located in equipment rooms or concealed spaces, shall be furnished in standard finish, free from scratches, abrasions, chippings, etc.
- D. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chipping, etc. If color option is specified or is standard to the unit, verify with the Architect the color preference before ordering.

- E. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, and storage rooms. Equipment furnished with a suitable factory finish need not be painted; provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.
- F. Do NOT paint electric conduits in crawl spaces, tunnels, or spaces above suspended ceilings except that where conduit is in a damp location give exposed threads at joints two coats of sealer after joint is made up.
- G. After surfaces have been thoroughly cleaned and are free of oil, dirt or other foreign matter, paint all raceway and equipment with the following:
 - 1. Bare Metal Surfaces - Apply one coat of metal primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
 - 2. Plastic Surfaces - Paint plastic surfaces with two coats of semi-gloss acrylic latex paint.

3.9 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.
- B. Clean all foreign paint, grease, oil, dirt, labels, stickers, etc. from all equipment.
- C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.10 SPECIAL REQUIREMENTS

- A. Coordinate the installation of all equipment, controls, devices, etc., with other trades to maintain clear access area for servicing.
- B. Install all equipment to maximize access to parts needing service or maintenance. Review the final location, placement, and orientation of equipment with the Owner's representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's representative will result in removal and reinstallation of the equipment at the Contractor's expense.
- D. Raceway and Cable Routing Restrictions: Raceways and cable are restricted from being routed in the following locations, unless serving the space or permitted by the authority having jurisdiction.
 - 1. Exit enclosures.
 - 2. Other areas restricted by code.
 - 3. Technology, data, server rooms.
 - 4. Sprinkler rooms.

3.11 SYSTEM STARTING AND ADJUSTING

- A. The electrical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes all calibration and adjustment of electrical controls, balancing of loads, troubleshooting and verification of software, and final adjustments that may be needed.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper equipment operation and does not pose a danger to personnel or property.
- C. All operating conditions and control sequences shall be tested during the start-up period. Testing all interlocks, safety shut-downs, controls, and alarms.
- D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.12 FIELD QUALITY CONTROL

- A. General:
 - 1. Conduct all tests required during and after construction. Submit test results in NETA format, or equivalent form, that shows the test equipment used, calibration date, tester's name, ambient test conditions, humidity, conductor length, and results corrected to 40°C.
 - 2. Supply necessary instruments, meters, etc., for the tests. Supply competent technicians with training in the proper testing techniques.
 - 3. All cables and wires shall be tested for shorts and grounds following installation and connection to devices. Replace shorted or grounded wires and cables.
 - 4. Any wiring device, electrical apparatus or luminaire, if grounded or shorted on any integral "live" part, shall have all defective parts or materials replaced.
 - 5. Test cable insulation of service and panel feeder conductors for proper insulation values. Tests shall include the cable, all splices, and all terminations. Each conductor shall be tested and shall test free of short circuits and grounds and have an insulation value not less than Electrical Code Standards. Take readings between conductors, and between conductors and ground.
 - 6. If the results obtained in the tests are not satisfactory, make adjustments, replacements, and changes as needed. Then repeat the tests, and make additional tests, as the Architect/Engineer or authority having jurisdiction deems necessary.
- B. Ground Resistance:
 - 1. Conduct service ground resistance tests using an approved manufactured ground resistance meter. Submit to the Architect/Engineer a proposed test procedure including type of equipment to be used. (The conventional ohmmeter is not an acceptable device.)
 - 2. Make ground resistance measurements during normal dry weather and not less than 48 hours after a rain.

3. If the ground resistance value obtained is more than the value set forth in Section 260526, the following shall be done to obtain the value given:
 - a. Verify that all connections in the service ground system are secure.
 - b. Increase the depth to which ground rods are driven by adding section lengths to the rods and retest. If the resistance is still excessive increase the depth by adding an additional rod section and retest.
 - c. If the resistance is still excessive, furnish and install additional ground rods, spaced not less than 20 feet from other ground rods unless otherwise noted on plans, and connect into the ground electrode system. Retest.
 - d. Review results with the Architect/Engineer.
 4. Before final payment is made to the Contractor submit a written report to the Architect/Engineer including the following:
 - a. Date of test.
 - b. Number of hours since the last rain.
 - c. Soil condition at the time of the test in the ground electrode location. That is: dry, wet, moist, sand, clay, etc.
 - d. Diagram of the test set-up showing distances between test equipment, ground electrode, auxiliary electrodes, etc.
 - e. Make, model, and calibration date of test equipment.
 - f. Tabulation of measurements taken and calculations made.
- C. Ground-Fault Equipment Performance Testing:
1. Test: Perform ground-fault performance testing when system is installed. The test process shall use primary current injection per manufacturer instruction and procedures. Perform test for the following:
 - a. Service disconnects
 - b. Solid state molded case circuit breakers and solid-state insulated case circuit breakers equipped with ground fault protection.
 - c. Fusible switches with ground fault relay protection.
 - d. Outside branch circuits and feeders.
 - e. Code required.
 2. Report: Provide copy of test result report with Operation and Maintenance manuals. Provide report to Authority Having Jurisdiction when requested.
- D. Other Equipment:
1. Give other equipment furnished and installed by the Contractor all standard tests normally made to assure that the equipment is electrically sound, all connections properly made, phase rotation correct, fuses and thermal elements suitable for protection against overloads, voltage complies with equipment nameplate rating, and full load amperes are within equipment rating.
- E. If any test results are not satisfactory, make adjustments, replacements and changes as needed and repeat the tests and make additional tests as the Architect/Engineer or authority having jurisdiction deem necessary.
- F. Report shall include color printouts, in binder, of pictures taken to use as a baseline reading after building is occupied.

3.13 UTILITY REBATE

- A. Submit utility rebate forms, where offered at project location, with rebate items completed. Rebate may include lighting, lighting controls, variable speed drives, heat pumps, package terminal A/C, air conditioners, chillers, water heaters, programmable thermostats, and motors.
- B. Contractor must submit notification of any value engineering or product substitution that will affect the utility rebate amount prior to approval.

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations of fire-rated construction fire sealed in accordance with specifications.
2. Electrical panels have typed circuit identification.
3. Per Section 260500, cable insulation test results have been submitted.
4. Per Section 260500, ground resistance test results have been submitted.
5. Operation and Maintenance manuals have been submitted as per Section 260500.
6. Bound copies of approved shop drawings have been submitted as per Section 260500.
7. Report of instruction of Owner's representative has been submitted as per Section 260500.
8. Start-up reports from factory representative have been submitted as per Section 260500.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

END OF SECTION

SECTION 260503
THROUGH PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Through-Penetration Firestopping.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.
- B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.3 REFERENCES

- A. UL 263 - Fire Tests of Building Construction and Materials
- B. UL 723 - Surface Burning Characteristics of Building Materials
- C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops
- D. UL 2079 - Tests for Fire Resistance of Building Joint Systems
- E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)
- F. Intertek / Warnock Hersey - Directory of Listed Products
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops
- I. The Building Officials and Code Administrators National Building Code
- J. 2018 International Building Code
- K. NFPA 5000 - Building Construction Safety Code

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.

- B. Install material prior to expiration of product shelf life.

1.5 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
 - 1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
 - 2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- C. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- D. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.6 MEETINGS

- A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.
 - 1. Review foreseeable methods related to firestopping work.
 - 2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

1.7 WARRANTY

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 - PRODUCTS

2.1 THROUGH PENETRATION FIRESTOP SYSTEMS

- A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.
- B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.
- C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.
- D. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.
- E. Provide firestopping systems allowing continuous insulation for all insulated pipes.
- F. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.
- G. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.
- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.
- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.2 CLEANING AND PROTECTING

- A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.

- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.3 INSPECTION

- A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.
- B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.
- C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.
- D. The Contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the Contractor and witnessed by the Architect/Engineer and manufacturer's factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The Contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Architect/Engineer's discretion and the Contractor's expense.

END OF SECTION

SECTION 260505

ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Electrical demolition

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work shall be as specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. THE DRAWINGS ARE INTENDED TO INDICATE THE SCOPE OF WORK REQUIRED AND DO NOT INDICATE EVERY BOX, CONDUIT, OR WIRE THAT MUST BE REMOVED. THE CONTRACTOR SHALL VISIT THE SITE PRIOR TO SUBMITTING A BID AND VERIFY EXISTING CONDITIONS.
- B. Where walls, ceilings, structures, etc., are indicated as being removed on general or electrical drawings, the Contractor shall be responsible for the removal of all electrical equipment, devices, fixtures, raceways, wiring, systems, etc., from the removed area.
- C. Where ceilings, walls, structures, etc., are temporarily removed and replaced by others, this Contractor shall be responsible for the removal, storage, and replacement of equipment, devices, fixtures, raceways, wiring, systems, etc.
- D. Where mechanical or technology equipment is indicated as being removed on electrical, mechanical, or technology drawings, the Contractor shall be responsible for disconnecting the equipment and removing all starters, VFD, controllers, electrical equipment, raceways, wiring, etc. associated with the device.
- E. Verify that abandoned wiring and equipment serve only abandoned equipment or facilities. Extend conduit and wire to facilities and equipment that will remain in operation following demolition. Extension of conduit and wire to equipment shall be compatible with the surrounding area. Extended conduit and conductors to match existing size and material.
- F. Coordinate scope of work with all other Contractors and the Owner at the project site. Schedule removal of equipment and electrical service to avoid conflicts.

- G. Bid submittal shall mean the Contractor has visited the project site and has verified existing conditions and scope of work.

3.2 PREPARATION

- A. The Contractor shall obtain approval from the Owner before turning off power to circuits, feeders, panels, etc. Coordinate all outages with Owner.
- B. Coordinate utility service outages with 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. Assume all equipment and systems must remain operational unless specifically noted otherwise on drawings.
- D. Disconnect electrical systems in walls, floors, structures, and ceilings scheduled for removal.
- E. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Service changeover shall be completed on an overtime basis.
- F. Existing Fire Alarm System: Maintain existing system in service. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Provide a watchman to make required premise observations during all outages, requirements as dictated by codes and Owner's insurance carrier.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Demolish and extend existing electrical work under provisions of Division 1 of Specifications and this Section.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring and raceway to source of supply. Existing conduit in good condition may be reused in place by including an equipment ground conductor in reused conduit. Reused conduit and boxes shall have supports revised to meet current codes. Relocating conduit shall not be allowed.
- D. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces. Remove all associated clamps, hangers, supports, etc. associated with raceway removal.
- E. Disconnect and remove outlets and devices that are to be demolished. Remove conduit, supports, and conductors back to source. Devices' back box and conduit mounted in walls that are to remain can be abandoned in place. Provide appropriate cover plate for all abandoned back boxes. Cover plates shall match existing plates used in the adjacent areas.
- F. Disconnect and remove abandoned panelboards and distribution equipment.

- G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories. Ballasts in light fixtures installed prior to 1980 shall be incinerated in EPA approved incinerator or disposed of in EPA certified containers and deposited in an EPA landfill certified for PCB disposal or recycled by permitted ballast recycler. Punctured or leaking ballasts must be disposed of according to Federal Regulations under the Toxic Substance Control Act. Provide Owner and Architect/Engineer with a Certificate of Destruction to verify proper disposal.
- I. Repair adjacent construction and finishes damaged during demolition and extension work. Patch openings to match existing surrounding finishes.
- J. Maintain access to existing electrical installations that remain active. Modify installation or provide junction boxes and access panel as appropriate.
- K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified. Extended conduit and conductors to match existing size and material.
- L. HID and fluorescent lamps, determined by the Toxicity Characteristic Leachate procedure (TCLP), to be hazardous waste shall be disposed of in an EPA-permitted hazardous waste disposal facility or by a permitted lamp recycler.
- M. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- N. Floor slab on grade is a structural slab. All penetrations shall be X-rayed prior to cutting and/or drilling to avoid rebar or utilities encased in floor construction. Provide rebar dowels to replace damaged rebar and pin existing slab with patched slab. Refer to structural plans for additional information.
- O. 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.

3.4 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment that remain or are to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
- C. ELECTRICAL ITEMS (E.G., LIGHTING FIXTURES, RECEPTACLES, SWITCHES, CONDUIT, WIRE, ETC.) REMOVED AND NOT RELOCATED REMAIN THE PROPERTY OF THE OWNER. CONTRACTOR SHALL PLACE ITEMS RETAINED BY THE OWNER IN A LOCATION COORDINATED WITH THE OWNER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DISPOSAL OF MATERIAL THE OWNER DOES NOT WANT.

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3.5 INSTALLATION

- A. Install relocated materials and equipment under the provisions of Division 1 of Specifications.

END OF SECTION

SECTION 260513
WIRE AND CABLE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Building wire
- B. Cabling for remote control, signal, and power limited circuits
- C. Metal-clad cable (MC)

1.2 RELATED WORK

- A. Section 260553 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 REFERENCES

- A. ASTM B800-05 - Standard Specification for 8000 Series Aluminum Alloy Wire Electrical Purposes-Annealed and Intermediate Tempered.
- B. ASTM B801-07 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation
- C. NEMA WC 70 - Power Cables Rated 2,000V or Less for the Distribution of Electrical Energy
- D. NFPA 70 - National Electrical Code (NEC)
- E. UL 44 - Thermoset-Insulated Wires and Cables
- F. UL 83 - Thermoplastic-Insulated Wires and Cables
- G. UL 854 - Service-Entrance Cables
- H. UL 1581 - Standard for Electrical Wires, Cables, and Flexible Cords

PART 2 - PRODUCTS

2.1 BUILDING WIRE

- A. Feeders and Branch Circuits 8 AWG and larger: Copper, stranded conductor, 600-volt insulation, THHN/THWN or XHHW-2.

- B. Feeders and Branch Circuits 8 AWG and larger in Underground Conduit: Copper, stranded conductor, 600-volt insulation, THWN or XHHW-2.
- C. Feeders and Branch Circuits 10 AWG and Smaller: Copper, solid or stranded conductor, 600-volt insulation, THHN/THWN, unless otherwise noted on the drawings. Aluminum, compact stranded conductor is not acceptable for feeder and branch circuits 6 AWG and smaller.
- D. Control Circuits: Copper, stranded conductor 600-volt insulation, THHN/THWN.
- E. Aluminum conductors are not to be used for feeds to motor loads.
- F. Each 120 volt branch circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for wire derating.

2.2 CABLING FOR REMOTE CONTROL, SIGNAL, AND POWER LIMITED CIRCUITS

- A. Wire for the following specialized systems shall be as designated on the drawings, or elsewhere in these specifications. If not designated on the drawings or specifications, the system manufacturer's recommendations shall be followed.
 - 1. Low voltage switching and lighting control
 - 2. Electronic control
 - 3. Other specialized cabling, signal, and power limited cabling. Refer to the appropriate Division 23, 27, or 28 requirements; including, but not limited, to the following:
 - a. Building Automation Systems and Controls, Division 23.
 - b. Information Technology Backbone and Horizontal Cabling, Division 27.
 - c. Electronic Access Control, Intrusion Detection Systems, Video Surveillance, Division 28.
- B. Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a PVC jacket.
- C. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a PVC jacket; UL listed.
- D. Plenum Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a nonmetallic jacket; UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.

PART 3 - EXECUTION

3.1 WIRE AND CABLE INSTALLATION SCHEDULE

- A. Above Accessible Ceilings:
 - 1. Metal clad cable, Type MC, 1/2" size with minimum #12 conductors and ground, shall be allowed for flexible whips to individual luminaires on non-essential circuits. The flexible whips shall be between 18" to 72" in length per Electrical Code.
- B. All Other Locations: Building wire in raceway.
- C. Above Grade: All conductors installed above grade shall be type "THHN".
- D. Underground or In Slab: All conductors shall be type "THWN".
- E. Low Voltage Cable (less than 100 volts): Low voltage cables in ducts, plenums, and other air handling spaces shall be plenum listed. Low voltage cables in non-accessible areas shall be installed in conduit. Low voltage cable may be installed without conduit in accessible areas using the following types of cable supports. Cable support types/systems shall comply with the warranty requirements of the low voltage cable manufacturer.
 - 1. J-hooks
 - 2. Bridle rings with saddle supports
- F. Low Voltage Cable (less than 100 volts): Low voltage cable shall be installed in raceway.

3.2 CONTRACTOR CHANGES

- A. The basis of design is copper conductors installed in raceway based on ambient temperature of 30°C, NEC Table 310.16 (2011 - 2017 edition 310.15(B)(16)). Service entrance conductors are based on copper conductor installed in underground electrical ducts, NEC Table B.2(7) (2011 - 2017 edition Table B310.15(B)(2)(7); 2008 or later edition B.301.7) or calculated in accordance with Annex B Application Information for Ampacity Calculation.
- B. The Contractor shall be responsible for derating and sizing conductors and conduits to equal or exceed the ampacity of the basis of design circuits, if he/she chooses to use methods or materials other than the basis of design.
- C. Underground electrical duct ampacity rating shall be in accordance with NEC Table 310.16 (2011 - 2017 edition 310.15(B)(16)) or calculated in accordance with Annex B Application Information for Ampacity Calculation. The calculations and a sketch of the proposed installation shall be submitted prior to any conduit being installed.
- D. Conductor length(s) listed on plans and schedules. The drawings are diagrammatic with intent to convey the components of the electrical distribution system. Conductor length(s) when listed on plans and schedules are for engineering calculation purposes. Conductor length(s) shall NOT be used for bidding purposes.
- E. Record drawing shall include the calculations and sketches.

3.3 GENERAL WIRING METHODS

- A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.
- B. Use no wire smaller than 18 AWG for low voltage control wiring below 100 volts.
- C. Use 10 AWG conductor for 20 ampere, 120-volt branch circuit home runs longer than 75 feet.
- D. The ampacity of multiple conductors in one conduit shall be derated per the Electrical Code. In no case shall more than 4 conductors be installed in one conduit to such loads as motors larger than 1/4 HP, panelboards, motor control centers, etc.
- E. Where installing parallel feeders, place an equal number of conductors for each phase of a circuit in same raceway or cable.
- F. Splice only in junction or outlet boxes.
- G. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- H. Make conductor lengths for parallel circuits equal.
- I. All conductors shall be continuous in conduit from last outlet to their termination.
- J. Terminate all spare conductors on terminal blocks, and label the spare conductors.
- K. Cables or wires shall not be laid out on the ground before pulling.
- L. Cables or wires shall not be dragged over earth or paving.
- M. Care shall be taken so as not to subject the cable or wire to high mechanical stresses that would cause damage to the wire and cable.
- N. At least six (6)-inch loops or ends shall be left at each outlet for installation connection of luminaires or other devices.
- O. All wires in outlet boxes not connected to fixtures or other devices shall be rolled up, spliced if continuity of circuit is required, and insulated.

3.4 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires. Do not use wire pulling lubricant for isolated (ungrounded) power system wiring.
- B. Pulling shall be continuous without unnecessary stops and starts with wire or cable only partially through raceway.
- C. Where reels of cable or wire are used, they shall be set up on jacks close to the point where the wire or cable enters the conduit or duct so that the cable or wire may be unreeled and run into the conduit or duct with a minimum of change in the direction of the bend.

- D. Conductors shall not be pulled through conduits until plastering or masonry work is completed and conduits are free from moisture. Care shall be taken so that long pulls of wire or pulls around several bends are not made where the wire may be permanently stretched and the insulation damaged.
- E. Only nylon rope shall be permitted to pull cables into conduit and ducts.
- F. Completely and thoroughly swab raceway system before installing conductors.
- G. Conductor Supports in Vertical Raceways:
 - 1. Support conductors in vertical raceways in accordance with the Electrical Code Spacing of Conductors Supports.
 - 2. Supports shall be of insulated wedge type (OZ Gedney Type S, or equal) and installed in a tapered insulated bushing fitting or a metal woven mesh with a support ring that fits inside conduit fitting installed in an accessible junction box (Hubbell Kellems support grip or equal).

3.5 CABLE INSTALLATION

- A. Provide protection for exposed cables where subject to damage.
- B. Use suitable cable fittings and connectors.
- C. Run all open cable parallel or perpendicular to walls, ceilings, and exposed structural members. Follow the routing as illustrated on the drawings as closely as possible. Cable routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatical, unless noted otherwise. The correct routing, when shown diagrammatically, shall be chosen by the Contractor based on information in the contract documents; in accordance with the manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", recognized industry standards; and coordinated with other contractors.
- D. Open cable shall be supported by the appropriate size J-hooks or other means if called for on the drawings. Wire and cable from different systems shall not be installed in the same J-hook. J-hooks shall be sized with 20% spare capacity. J-hooks shall provide proper bend radius support for data cable and fiber cables.
- E. Open cable installed above suspended ceilings shall not rest on the suspended ceiling construction, nor utilize the ceiling support system for wire and cable support.
- F. J-hook support spans shall be based on the smaller of the manufacturer's load ratings and code requirements. In no case shall horizontal spans exceed 5 feet and vertical spans exceed 4 feet. All J-hooks shall be installed where completely accessible and not blocked by piping, ductwork, inaccessible ceilings, etc. J-hooks shall be independently rigidly attached to a structural element. J-hooks shall be installed to provide 2" horizontal separation and 6" vertical separation between systems.
- G. Open cable shall only be installed where specifically shown on the drawings, or permitted in these specifications.

3.6 WIRING CONNECTIONS AND TERMINATIONS

- A. Splice and tap only in accessible junction boxes.
- B. Use solderless, tin-plated copper, compression terminals (lugs) applied with circumferential crimp for conductor terminations, 8 AWG and larger.
- C. Use solderless, tin-plated, compression terminals (lugs) applied with indenter crimp for copper conductor terminations, 10 AWG and smaller.
- D. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.
- E. Use compression connectors applied with circumferential crimp for conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor
- F. Thoroughly clean wires before installing lugs and connectors.
- G. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- H. Phase Sequence: All apparatus shall be connected to operate in the phase sequence A-B-C representing the time sequence in which the phase conductors so identified reach positive maximum voltage.
- I. As a general rule, applicable to switches, circuit breakers, starters, panelboards, switchgear and the like, the connections to phase conductors are intended thus:
 - 1. Facing the front and operating side of the equipment, the phase identification shall be:
 - a. Left to Right - A-B-C
 - b. Top to Bottom - A-B-C
- J. Connection revisions as required to achieve correct rotation of motors shall be made at the load terminals of the starters or disconnect switches.
- K. Use antioxidant joint compound on all aluminum conductor terminations. Apply antioxidant joint compound per manufacturer's recommendations.

3.7 AC, MC CABLE INSTALLATION

- A. Cable shall be supported by an approved means every 4.5' and within 12" of outlet boxes, junction boxes, cabinets, or fittings.
- B. Cable may be unsupported in the following conditions:
 - 1. Cable is no longer than 2' in length at terminals where flexibility is necessary.
 - 2. Cable is not more than 4.5' from the last point of support for connections within an accessible ceiling to light fixtures or equipment.

- C. Conductor ampacity shall be derated as required by the Electrical Code where more than three current carrying conductors are used.
- D. Each 120 volt circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for cable derating.
- E. Cables shall be cut using a rotary cutter as recommended by the manufacturer to eliminate nicking and cutting of the conductors.
- F. Bending radius shall comply with the requirements listed in the Electrical Code for the type and size of cable being installed, but shall not be less than 5-times the diameter of the cable in any case.
- G. At cable terminations, a fitting shall be provided to protect wires from abrasion, unless the design of the outlet boxes or fittings is such as to afford equivalent protection, and, in addition, an insulating bushing or its equivalent protection shall be provided between the conductors and the armor.
- H. All wiring devices supplied by nonmetallic-sheathed cables shall be mounted in an outlet box.

3.8 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Building Wire and Power Cable Testing: Perform an insulation-resistance test on each conductor with respect to ground and adjacent conductors. Test shall be made by means of a low-resistance ohmmeter, such as a "Megger". The applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. The test duration shall be one minute. Insulation resistance must be greater than 100 mega-ohm for 600 volt and 25 mega-ohm for 300 volt rated cables per NETA Acceptance Testing Standard. Verify uniform resistance of parallel conductors.
- C. Inspect wire and cable for physical damage and proper connection.
- D. Torque test conductor connections and terminations to manufacturer's recommended values.
- E. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.
- F. Provide documentation of the manufacturer's recommended lug torque value for Documentation indicating that the torque wrench has been calibrated not more than 30 days prior to tightening of lugs shall be provided.
- G. Protection of wire and cable from foreign materials:
 - 1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any wire or cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited to, overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid, or compound that could come in contact with the cable, cable jacket, or cable termination components.

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- H. Overspray of paint on any wire or cable will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed.

END OF SECTION

SECTION 260526
GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Equipment grounding system
- B. Bonding system
- C. Grounding electrode system

1.2 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.
- B. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site testing specified in Part 3.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in Electrical Code, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with UL 467 Grounding and Bonding Equipment.

1.3 REFERENCES

- A. NFPA 70 - National Electrical Code (NEC)

1.4 SUMMARY

- A. This section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 26 Section 260513 "Wire and Cable".

- B. Material: Copper.
- C. Equipment Grounding Conductors: Insulated. Refer to Section 260553 for insulation color.
- D. Isolated Ground Conductors: Insulated. Refer to Section 260553 for insulation color.
- E. Grounding Electrode Conductors: Stranded cable.
- F. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- G. Copper Bonding Conductors: As follows:
 - 1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in diameter.
 - 2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
 - 3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.2 CONNECTOR PRODUCTS

- A. Comply with UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Connectors: Hydraulic compression type, in kit form, and selected per manufacturer's written instructions.
- C. Bolted Connectors: Bolted-pressure-type connectors.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Sectional type; copper-clad steel.
 - 1. Size: 3/4" in diameter by 120 inches per section.

PART 3 - EXECUTION

3.1 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. 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 to 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.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
 - C. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
 - D. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
 - E. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
 - F. Structural Steel Connection: Exothermic-welded connections to structural steel. Coordinate with structure to provide physical protection.
 - G. Underground Connections: Hydraulic compression connection. Use for underground connections, except those at test wells.
 - H. Connections at back boxes, junction boxes, pull boxes, and equipment terminations: The equipment grounding conductor(s) associated with all circuits in the box shall be connected together and to the box using a suitable grounding screw. The removal of the respective receptacle, luminaire, or other device served by the box shall not interrupt the grounding continuity. The connection to the non-metallic boxes shall be made to any metallic fitting or device requiring grounding.
 - I. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
 - J. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.2 INSTALLATION

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. Grounding electrode conductor (GEC) shall be protected from physical damage by rigid polyvinyl chloride conduit (PVC) in exposed locations.

- C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then use a bolted clamp. Bond straps directly to the basic structure, taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
- D. In raceways, use insulated equipment grounding conductors.
- E. Underground Grounding Conductors: Use copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.
- F. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, below access floors, and elsewhere as indicated, with bolted connections to form a continuous ground path.

3.3 EQUIPMENT GROUNDING SYSTEM

- A. Comply with Electrical Code, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by Electrical Code are indicated.
- B. Install equipment grounding conductors in all feeders and circuits. Terminate each end on a grounding lug or bus.
- C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by Electrical Code:
 - 1. Lighting and receptacle circuits. Terminate each end on a grounding lug or bus.
 - 2. Single-phase and three-phase motor and appliance branch circuits.
 - 3. Flexible raceway runs, including FMC and LFMC.
 - 4. Armored and metal-clad cable runs.
- D. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

3.4 BONDING SYSTEM

- A. At building expansion joints, provide flexible bonding jumpers to connect to columns or beams on each side of the expansion joint.
- B. Exterior Metallic Pull and Junction Box Covers, Metallic Hand Rails: Bond to grounding system using flexible grounding conductors.
- C. Equipment Circuits: Install a bonding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, dampers, and heaters. Bond conductor to each unit and to air duct. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps or copper conductor sized equal to the equipment grounding conductor.

- D. Water Heater, Heat-Tracing, Metal Well Casing, and Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and anti-frost heating cable. Bond conductor to heater units, piping, well casing, connected equipment, and components.
- E. Connect bonding conductors to metal water pipe using a suitable ground clamp. Make connections to flanged piping at street side of flange. Provide bonding jumper around water meter.
- F. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 6 AWG minimum insulated bonding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location. Leave 10 feet of slack conductor at terminal board.
- G. Telecom Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bar.
- H. Equipment Ground Conductor Continuity: All spliced equipment grounding conductors in junction boxes, cabinets, and distribution equipment shall be connected together and bonded to the metal enclosure.
- I. Remote control, signaling, and fire alarm circuits shall be bonded in accordance with the most recent version of the National Electric Code.

3.5 GROUNDING ELECTRODE SYSTEM

- A. Supplementary Grounding Electrode: Use driven ground rod on exterior of building.
- B. Provide bonding at Utility Company's metering equipment and pad mounted transformer.
- C. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- D. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters, filtering devices, and similar equipment. Connect to pipe with grounding clamp connectors.
- E. Natural Gas Service Piping: Bond to natural gas main service with grounding clamp connectors. Bonding conductor shall be connected to the main service ground bar. Provide grounding jumpers around all breaks in metallic continuity.
- F. Natural Gas Equipment Piping: Bond each aboveground portion of natural gas metallic piping system at each equipment location with grounding clamp connectors. Bonding shall be performed after any flexible attachment nearest the equipment. The equipment grounding conductors may serve as the bonding means.

3.6 CONCRETE OR WOOD BUILDING GROUNDING SYSTEM

- A. Provide a copper common grounding electrode conductor for the attachment of multiple separately derived systems in accordance with Electrical Code. Individual grounding conductor taps from the separately derived systems to the common grounding electrode shall be sized in accordance with Electrical Code. All tap connections shall be made in an accessible location in such a manner that common grounding electrode conductor remains without a splice or joint.

3.7 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

- A. Pad-Mounted Transformers and Switches: Install two ground rods and counterpoise circling pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Use tinned-copper conductor not less than No. 2 AWG for counterpoise and for taps to equipment ground pad. Bury counterpoise not less than 18 inches below grade and 6 inches from the foundation. The pad rebar shall be attached to the counterpoise conductor at the four corners.

3.8 GRADING AND PLANTING

- A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 2. Maintain restored surfaces. Restore disturbed paving.

END OF SECTION

SECTION 260527
SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Conduit and Equipment Supports
- B. Fastening Hardware
- C. Concrete Housekeeping Pads

1.2 QUALITY ASSURANCE

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

1.3 REFERENCES

- A. UL 62275 - Cable Management Systems - Cables Ties for Electrical Installations

1.4 COORDINATION

- A. Coordinate size, shape and location of concrete pads with section on Cast-in-Place Concrete or Concrete Topping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Allied Support Systems
- B. Cooper B-Line
- C. Erico, Inc.
- D. Hilti
- E. Power Fasteners
- F. Orbit Industries

2.2 MATERIAL

- A. Support Channel: Hot-dip galvanized for wet/damp locations; painted steel for interior/dry locations. All field cut ends shall be touched up with matching finish to inhibit rusting.
- B. Hardware: Corrosion resistant.
- C. Anchorage and Structural Attachment Components:
 - 1. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to Authorities Having Jurisdiction.
 - a. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.
 - 2. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
 - 3. Welding Lugs: Comply with MSS-SP-69, Type 57.
 - 4. Beam clamps for Steel Beams and Joists: Double sided or concentric open web joist hangers. Single-sided type is not acceptable.
 - 5. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
 - 6. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.
 - 7. Concrete Anchors: Fasten to concrete using cast-in or post-installed anchors designed per the requirements of Appendix D of ACI 318-05. Post-installed anchors shall be qualified for use in cracked concrete by ACI-355.2.
 - 8. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.
- D. Conduit Sleeves and Lintels:
 - 1. Each Contractor shall provide, to the General Contractor for installation, lintels for all openings required for the Contractor's work in masonry walls and conduit sleeves for floors, unless specifically shown as being by others.
 - 2. Refer to Structural General Notes for lintel requirements in masonry construction.
 - 3. Fabricate all lintels from structural steel shapes or as indicated on the drawings. All lintels and grouped wall openings shall be approved by the Architect or Structural Engineer.
 - 4. Fabricate all sleeves from standard weight black steel pipe. Provide continuous sleeve. Cut or split sleeves are not acceptable. Sleeves through concrete walls may be high density polyethylene pipe penetration sleeve with a water stop collar, suitable for use with Link-Seal mechanical seals. Century-Line Model CS.
 - 5. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.
 - 6. Sleeves shall not penetrate structural members without approval from the Structural Engineer.
 - 7. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.

8. Install all sleeves concentric with conduits. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
9. Where conduits rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (asphalt and cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
10. Size sleeves large enough to allow expansion and contraction movement.

E. Concrete Housekeeping Pads:

1. Concrete bases for all floor mounted equipment and wall mounted equipment which is surface mounted and extends to within 6" of the finished floor, unless shown otherwise on the drawings, shall be 3-1/2" thick concrete.
2. Bases shall extend 3" on all sides of the equipment (6" larger than factory base).
3. Where the base is less than 12" from a wall, the base shall be carried to the wall to prevent a "dirt-trap".
4. Concrete materials and workmanship required for the Contractor's work shall be provided by the Contractor. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6" x 6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at twenty-eight days.

F. Rooftop Support System:

1. Provide pre-fabricated roof supports for all conduit and equipment installed above the roof. Support all conduit and equipment a minimum of 4" above roof.
2. Support system shall be compatible with single ply, bituminous, metal, and spray foam roof systems. The base shall be rounded to prevent damage to the roof, and drainage holes shall prevent ponding of water in the support.
3. All metal components shall be hot dipped galvanized. Mounting hardware shall be stainless steel or hot dipped galvanized. Support shall be UV, corrosion, and freeze/thaw resistant. Support shall include orange paint, reflective safety orange accents, or similar markings for increased visibility.
4. Products:
 - a. Anvil International HBS-Base Series
 - b. Cooper B-Line Dura-Blok
 - c. Erico Caddy Pyramid 50, 150, 300, or 600 (to match load).

G. Truss and Joist Support System: Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:

1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:
 - a. The hanger is attached within 6" from a web/chord joint.
 - b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.
3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.

4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.

H. Cable Ties for Cable Management Systems:

1. Cables ties, UL Listed, Type 21 or Type 21S, and test to UL Standard 62275 for Cable Management Systems.
2. Acceptable Applications: Low Voltage Wire and Cabling.
 - a. Bundle wires and cables within cable trays, auxiliary gutters, and similar applications.
 - b. Organize and support wiring and cables within equipment and distribution systems.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors in concrete and beam clamps on structural steel.
- B. Trapeze support installation: Cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.
- C. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
- D. Do not fasten supports to ceiling systems, piping, ductwork, mechanical equipment, or conduit, unless otherwise noted.
- E. Do not use powder-actuated anchors without specific permission.
- F. Do not drill structural steel members.
- G. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- H. In wet locations and on all building floors below exterior earth grade install free-standing electrical equipment on concrete pads.
- I. Install cabinets and panelboards with minimum of four anchors. Provide horizontal backing/support framing in stud walls for rigid mounting. Provide steel channel supports to stand surface-mounted panelboard or cabinet one inch off wall.
- J. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.
- K. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

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- L. Refer to Section 260533 for special conduit supporting requirements.

3.2 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
- B. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

END OF SECTION

SECTION 260533
CONDUIT AND BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Rigid metallic conduit and fittings (RMC)
- B. Electrical metallic tubing and fittings (EMT)
- C. Flexible metallic conduit and fittings (FMC)
- D. Liquidtight flexible metallic conduit and fittings (LFMC)
- E. Wall and ceiling outlet boxes
- F. Electrical connection
- G. Pull and junction boxes

1.2 RELATED WORK

- A. Section 260553 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated
 - 2. ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated and Fittings
 - 3. ANSI C80.4 - Fittings for Rigid Metal Conduit and Electrical Metallic Tubing
 - 4. ANSI C80.6 - Intermediate Metal Conduit, Zinc Coated
 - 5. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
 - 6. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
- B. Federal Specifications (FS):
 - 1. A-A-50553A - Fittings for Conduit, Metal, Rigid, (Thick-Wall and Thin-Wall (EMT) Type
 - 2. A-A-55810 - Specification for Flexible Metal Conduit
- C. NECA "Standards of Installation"

- D. National Electrical Manufacturers Association (NEMA):
 - 1. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
 - 2. TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit
 - 3. TC 9 - Fittings for PVC Plastic Utilities Duct for Underground Installation
- E. NFPA 70 - National Electrical Code (NEC)
- F. Underwriters Laboratories (UL): Applicable Listings
 - 1. UL 1 - Flexible Metal Conduit
 - 2. UL 6 - Rigid Metal Conduit
 - 3. UL 360 - Liquid Tight Flexible Steel Conduit
 - 4. UL514-B - Conduit Tubing and Cable Fittings
 - 5. UL746A - Standard for Polymeric Materials - Short Term Property Evaluations
 - 6. UL797 - Electrical Metal Tubing
- G. American Standard of Testing and Materials (ASTM):
 - 1. ASTM D 570 - Standard Test Method for Water Absorption of Plastics
 - 2. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics
 - 3. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics under Flexural Load in the Edge Wise Position
 - 4. ASTM D 2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
 - 5. ASTM D 2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
 - 6. ASTM D 3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Material
- H. Definitions:
 - 1. Fittings: Conduit connection or coupling.
 - 2. Body: Enlarged fittings with opening allowing access to the conductors for pulling purposes only.
 - 3. Mechanical Spaces: Enclosed areas, usually kept separated from the general public, where the primary use is to house service equipment and to route services. These spaces generally have exposed structures, bare concrete and non-architecturally emphasized finishes.
 - 4. Finished Spaces: Enclosed areas where the primary use is to house personnel and the general public. These spaces generally have architecturally emphasized finishes, ceilings and/or floors.
 - 5. Concealed: Not visible by the general public. Often indicates a location either above the ceiling, in the walls, in or beneath the floor slab, in column coverings, or in the ceiling construction.
 - 6. Above Grade: Not directly in contact with the earth. For example, an interior wall located at an elevation below the finished grade shall be considered above grade but a wall retaining earth shall be considered below grade.
 - 7. Slab: Horizontal pour of concrete used for a floor or sub-floor.

PART 2 - PRODUCTS

2.1 RIGID METALLIC CONDUIT (RMC) AND FITTINGS

A. Manufacturers:

1. Atkore Allied Tube & Conduit
2. NUCORNUCOR
3. Electroline
4. Western Tube
5. Wheatland Tube Co
6. or approved equal.

B. Manufacturers of RMC Conduit Fittings:

1. ABB/Thomas & Betts
2. Eaton/Crouse-Hinds
3. Electroline
4. Emerson Appleton & OZ Gedney
5. Hubbell Raco and Killark
6. NSI Bridgeport
7. Orbit Industries
8. Wesco Regal
9. or approved equal.

C. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted.

D. Fittings and Conduit Bodies:

1. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.
2. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
3. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
4. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. High impact phenolic threaded type bushings are not acceptable.
5. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.

2.2 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

A. Minimum Size Electrical Metallic Tubing: 3/4 inch, unless otherwise noted.

B. Manufacturers of EMT Conduit:

1. Allied Tube & Conduit
2. Calbond Calpipe
3. NUCORNUCOR

4. Electroline
5. Western Tube
6. Wheatland Tube Co
7. or approved equal.

C. Fittings and Conduit Bodies:

1. 2" Diameter or Smaller: steel set screw type of steel designed for their specific application.
2. 1/2" and 3/4" Conduit: Push-on connectors and couplers with locking ring and washer of zinc plated steel, listed for use in dry locations.
3. Larger than 2": Compression type of steel designed for their specific application.
4. Manufacturers of EMT Conduit Fittings:
 - a. ABB/Thomas & Betts
 - b. Eaton/Crouse-Hinds
 - c. Electroline
 - d. Emerson Appleton & OZ Gedney
 - e. Hubbell Raco and Killark
 - f. NSI Bridgeport
 - g. Orbit Industries
 - h. Wesco Regal
 - i. or approved equal.

2.3 FLEXIBLE METALLIC CONDUIT (FMC) AND FITTINGS

- A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted. Lighting branch circuit wiring to an individual luminaire may be a manufactured, UL listed 3/8" flexible metal conduit and fittings with #14 AWG THHN conductors and an insulated ground wire. Maximum length of 3/8" FMC shall be six (6) feet.
- B. Manufacturers:
1. ABB/Thomas & Betts
 2. Anamet Electrical
 3. Atkore American Flex AFC and Flexicon
 4. Electri-Flex Co
 5. Electroline
 6. Southwire Alflex
 7. or approved equal.
- C. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel. Provide a separate equipment grounding conductor when used for equipment where flexibility is required.
- D. Fittings and Conduit Bodies:
1. Threadless hinged clamp type, galvanized zinc coated cadmium plated malleable cast iron or screw-in type, die-cast zinc.
 2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.

3. Manufacturers:
 - a. ABB/Thomas & Betts
 - b. Eaton/Crouse-Hinds
 - c. Electroline
 - d. Emerson Appleton & OZ Gedney
 - e. Hubbell Raco and Killark
 - f. NSI Bridgeport
 - g. Orbit Industries
 - h. Wesco Regal
 - i. or approved equal.

2.4 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC) AND FITTINGS

- A. Manufacturers:
 1. ABB/Thomas & Betts
 2. Anamet Electrical
 3. Atkore American Flex AFC and Flexicon
 4. Electri-Flex Co
 5. Electroline
 6. Southwire Alfex
 7. or approved equal.
- B. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel and an extruded PVC cover.
- C. Fittings and Conduit Bodies:
 1. Watertight, compression type, galvanized zinc coated cadmium plated malleable cast iron, UL listed.
 2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
 3. Manufacturers:
 - a. ABB/Thomas & Betts
 - b. Eaton/Crouse-Hinds
 - c. Electroline
 - d. Emerson Appleton & OZ Gedney
 - e. Hubbell Raco and Killark
 - f. NSI Bridgeport
 - g. Orbit Industries
 - h. Wesco Regal
 - i. or approved equal.

2.5 RIGID NON-METALLIC CONDUIT (PVC) AND FITTINGS

- A. Minimum Size Rigid Smooth-Wall Nonmetallic Conduit: 3/4 inch, unless otherwise noted.

- B. Acceptable Manufacturers:
 - 1. ABB/Carlton
 - 2. Chevron Phillips Chemical Company
 - 3. Cantex, J.M. Mfg.
 - 4. Atkore Heritage Plastics
 - 5. or approved equal.
- C. Construction: Schedule 40 and Schedule 80 rigid polyvinyl chloride (PVC), UL labeled for 90°C.
- D. Fittings and Conduit Bodies: NEMA TC 3; sleeve type suitable for and manufactured especially for use with the conduit by the conduit manufacturer.
- E. Plastic cement for joining conduit and fittings shall be provided as recommended by the manufacturer.

2.6 OUTLET BOXES

- A. Nonmetallic Outlet Boxes: ANSI/NEMA OS 2.
- B. Cast Boxes: Nema FB1, Type FD, Aluminum, cast ferrous alloy, or stainless steel deep type, gasketed cover, threaded hubs.
- C. Outlet boxes for luminaires to be not less than 1-1/2" deep, deeper if required by the number of wires or construction. The box shall be coordinated with surface luminaires to conceal the box from view or provide a finished trim plate.
- D. Switch outlet boxes for local light control switches, dimmers and occupancy sensors shall be 4 inches square by 2-1/8 inches deep, with raised cover to fit flush with finish wall line. Multiple gang switch outlets shall consist of the required number of gang boxes appropriate to the quantity of switches comprising the gang. Where walls are plastered, provide a plaster raised cover. Where switch outlet boxes occur in exposed concrete block walls, boxes shall be installed in the block cavity with a raised square edge tile cover of sufficient depth to extend out to face of block or masonry boxes.
- E. Outlet boxes for telephone substations in walls and columns shall be 4 inches square and 2-1/8 inches deep with single gang raised cover to fit flush with finished wall line equipped with flush telephone plate.
- F. Wall or column receptacle outlet boxes shall be 4 inches square with raised cover to fit flush with finished wall line. Boxes in concrete block walls shall be installed the same as for switch boxes in block walls.

2.7 ECONN; ELECTRICAL CONNECTION

- A. Electrical connection to equipment and motors, sized per Electrical Code. Coordinate requirements with contractor furnishing equipment or motor. Refer to specifications and general installation notes for terminations to motors.

2.8 JB; PULL AND JUNCTION BOXES

- A. Sheet metal boxes larger than 12 inches in any dimension that contain terminations or components: Continuous hinged enclosure with 1/4 turn latch and white back panel for mounting terminal blocks and electrical components.
- B. Cast Metal Boxes for Outdoor and Wet Location Installations: NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
- C. Flanged type boxes shall be used where installed flush in wall.

PART 3 - EXECUTION

3.1 CONDUIT INSTALLATION SCHEDULE AND SIZING

- A. In the event the location of conduit installation represents conflicting installation requirements as specified in the following schedule, a clarification shall be obtained from the Architect/Engineer. If this Contractor is unable to obtain a clarification as outlined above, concealed rigid galvanized steel conduit installed per these specifications and the Electrical Code shall be required.
- B. Installation Schedule: Refer to drawings.
- C. Size conduit as shown on the drawings and specifications. Where not indicated in the contract documents, conduit size shall be according to the Electrical Code. Conduit and conductor sizing shall be coordinated to limit conductor fill to less than 40%, maintain conductor ampere capacity as required by the Electrical Code (to include enlarged conductors due to temperature and quantity derating values) and to prevent excessive voltage drop and pulling tension due to long conduit/conductor lengths.
- D. Minimum Conduit Size (Unless Noted Otherwise):
 - 1. Above Grade: 3/4 inch. (The use of 1/2 inch would be allowed for installation conduit to individual light switches, individual receptacles and individual fixture whips from junction box.)
 - 2. Below Grade 5' or less from Building Foundation: 1 inch.
 - 3. Below Grade More than 5' from Building Foundation: 1 inch.
 - 4. Telecommunication Conduit: 1 inch.
 - 5. Controls Conduit: 1/2 inch.
- E. Conduit sizes shall change only at the entrance or exit to a junction box, unless specifically noted on the drawings.

3.2 CONDUIT ARRANGEMENT

- A. In general, conduit shall be installed concealed in walls, in finished spaces and where possible or practical, or as noted otherwise. Conduit shall be installed parallel or perpendicular to walls, ceilings, and exposed structural members. In unfinished spaces, mechanical and utility areas, conduit may run either concealed or exposed as conditions dictate and as practical unless noted otherwise on drawings. Installation shall maintain headroom in exposed vicinities of pedestrian or vehicular traffic.
- B. Exposed conduit on exterior walls or above roof will not be allowed without prior written approval of Architect/Engineer. A drawing of the proposed routing and a photo of the location shall be submitted 14 days prior to start of conduit rough-in. Routing shall be shown on coordination drawings.
- C. Conduit shall not share the same cell as structural reinforcement in masonry walls.
- D. Conduit runs shall be routed as shown on large scale drawings. Conduit routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatic, unless noted otherwise. The correct routing, when shown diagrammatically shall be chosen by the Contractor based on information in the contract documents, in accordance with manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", in accordance with recognized industry standards, and coordinated with other contractors.
- E. Contractor shall adapt Contractor's work to the job conditions and make such changes as required and permitted by the Architect/Engineer, such as moving to clear beams and joists, adjusting at columns, avoiding interference with windows, etc., to permit the proper installation of other mechanical and/or electrical equipment.
- F. Contractor shall cooperate with all contractors on the project. Contractor shall obtain details of other contractor's work to ensure fit and avoid conflict. Any expense due to the failure of This Contractor to do so shall be paid for in full by Contractor. The other trades involved as directed by the Architect/Engineer shall perform the repair of work damaged as a result of neglect or error by This Contractor. The resultant costs shall be borne by This Contractor.

3.3 CONDUIT SUPPORT

- A. Conduit runs installed above a suspended ceiling shall be properly supported. In no case shall conduit rest on the suspended ceiling construction, nor utilize ceiling support system for conduit support.
 - 1. Support wire used to independently support raceway and wiring systems above suspending ceilings shall be supported on both ends, minimum 12 gauge suspended ceiling support wire, and distinguishable from ceiling support systems by color (field paint), tagging, or equivalent means.
- B. Conduit shall not be supported from ductwork, water, sprinkler piping, or other non-structural members, unless approved by the Architect/Engineer. All supports shall be from structural slabs, walls, structural members, and bar joists, and coordinated with all other applicable contractors, unless noted otherwise.
- C. Conduit shall be held in place by the correct size of galvanized one-hole conduit clamps, two-hole conduit straps, patented support devices, clamp back conduit hangers, or by other means if called for on the drawings.

- D. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- E. Spring-steel conduit clips specifically designed for supporting single conduits or tubing may be used in lieu of malleable-iron hangers for 1" and smaller raceways serving lighting and receptacle branch circuits above accessible ceilings and for securing raceways to slotted channel and angle supports.
- F. Group conduits in parallel runs where practical and use conduit racks or trapeze hangers constructed of steel channel, suspended with threaded solid rods or wall mounted from metal channels with conduit straps or clamps. Provide space in each rack or trapeze for 25% additional conduits.
- G. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Supports for metallic conduit shall be no greater than 10 feet. A smaller interval may be used if necessitated by building construction, but in no event shall support spans exceed the Electrical Code requirements. Conduit shall be securely fastened within 3 feet of each outlet box, junction box, device box, cabinet, or fitting.
- J. Supports of flexible conduit shall be within 12 inches of each outlet box, junction box, device box, cabinet, or fitting and at intervals not to exceed 4.5 feet.
- K. Supports for non-metallic conduit shall be at sufficiently close intervals to eliminate any sag in the conduit. The manufacturer's recommendations shall be followed, but in no event shall support spans exceed the Electrical Code requirements.
- L. Finish:
 - 1. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
 - 2. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

3.4 CONDUIT INSTALLATION

- A. Conduit Connections:
 - 1. Shorter than standard conduit lengths shall be cut square using industry standards. The ends of all conduits cut shall be reamed or otherwise finished to remove all rough edges.
 - 2. Metallic conduit connections in slab on grade installation shall be sealed and one coat of rust inhibitor primer applied after the connection is made.
 - 3. Where conduits with tapered threads cannot be coupled with standard couplings, then approved split or Erickson couplings shall be used. Running threads will not be permitted.

4. Install expansion/deflection joints where conduit crosses structure expansion/seismic joints.
- B. Conduit terminations for all low voltage wiring shall have nylon bushings installed on each end of every conduit run.
- C. Conduit Bends:
1. Use a hydraulic one-shot conduit bender or factory elbows for bends in conduit 2" in size or larger. All steel conduit bending shall be done cold; no heating of steel conduit shall be permitted.
 2. A run of conduit shall not contain more than the equivalent of four (4) quarter bends (360°), including those bends located immediately at the outlet or body.
 3. Telecommunications 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.
 - a. A third bend is acceptable if:
 - 1) The total run is not longer than (33) feet.
 - 2) The conduit size is increased to the next trade size.
 4. Telecommunications pull boxes shall not be used in lieu of a bend. Align conduits that enter the pull box from opposite ends with each other. Pull box size shall be twelve (12) times the diameter of the largest conduit. Slip sleeves or gutters can be used in place of a pull box.
 5. Telecommunications Conduit(s): Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of less than 2", maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter 2" or greater, maintain a bend radius of at least 10 times the internal diameter.
 6. Rigid polyvinyl chloride conduit (PVC) runs longer than 100 feet or runs which have more than two 90° equivalent bends (regardless of length) shall use rigid metal or RTRC factory elbows for bends.
 7. Use conduit bodies to make sharp changes in direction (i.e. around beams).
- D. Conduit Placement:
1. Conduit shall be mechanically continuous from source of current to all outlets. Conduit shall be electrically continuous from source of current to all outlets, unless a properly sized grounding conductor is routed within the conduit. All metallic conduits shall be bonded per the Electrical Code.
 2. Route exposed conduit and conduit above suspended ceilings (accessible or not) parallel/perpendicular to the building structural lines, and as close to building structure as possible. Wherever possible, route horizontal conduit runs above water and steam piping.
 3. Route conduit through roof openings provided for piping and ductwork where possible. If not provided or routing through provided openings is not possible, route through roof jack with pitch pocket. Coordinate roof penetrations with other trades.
 4. Conduits, raceway, and boxes shall not be installed in concealed locations in metal deck roofing or less than 1.5" below bottom of roof decking.
 5. Avoid moisture traps where possible. Where unavoidable, provide a junction box with drain fitting at conduit low point.
 6. All conduits through walls shall be grouted or sealed into openings. Where conduit penetrates firewalls and floors, seal with a UL listed sealant. ; refer to Section 260503 for through penetration firestopping requirements.

7. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL OPENINGS REQUIRED IN MASONRY OR EXTERIOR WALLS UNDER THIS DIVISION. A QUALIFIED MASON AT THE EXPENSE OF THIS CONTRACTOR SHALL REPAIR ALL OPENINGS TO MATCH EXISTING CONDITIONS.
8. Seal interior of conduit at exterior entries, air handling units, coolers/freezers, etc., and where the temperature differential can potentially be greater than 20°F, to prevent moisture penetration. Seal shall be placed where conduit enters warm space. Conduit seal fitting shall be a drain/seal, with sealing compound, identified for use with cable and raceway system.
9. Do not route conduits across each other in slabs on grade.
10. Contractor shall provide suitable mechanical protection around all conduits stubbed out from floors, walls or ceilings during construction to prevent bending or damaging of stubs due to carelessness with construction equipment.
11. Contractor shall provide a polypropylene pull cord with 2000 lbs. tensile strength in each empty conduit (indoor and outdoor), except in sleeves and nipples.
12. Telecommunications conduits that protrude through the structural floor shall be installed 1 to 3" above finished floor (AFF).
13. Telecommunications conduits that enter into Telecommunications rooms below the finished ceiling shall terminate a minimum of 4" below ceiling and as close to the wall as possible.
14. Telecommunications conduits that are below grade and enter into a building shall terminate a minimum of 4" above finished floor (AFF) and as close to the wall as possible.

3.5 CONDUIT TERMINATIONS

- A. Where conduit bonding is indicated or required in the contract documents, the bushings shall be a grounding type sized for the conduit and ground bonding conductor as manufactured by O-Z/Gedney, Appleton, Thomas & Betts, Burndy, Regal, Orbit Industries or approved equal.
- B. Conduits with termination fittings shall be threaded for one (1) lock nut on the outside and one (1) lock nut and bushing on the inside of each box.
- C. Where conduits terminate in boxes with knockouts, they shall be secured to the boxes with lock nuts and provided with approved screw type tinned iron bushings or fittings with plastic inserts.
- D. Where conduits terminate in boxes, fittings, or bodies with threaded openings, they shall be tightly screwed against the shoulder portion of the threaded openings.
- E. Conduit terminations to all motors shall be made with flexible metallic conduit (FMC), unless noted otherwise. Final connections to roof exhaust fans, or other exterior motors and motors in damp or wet locations shall be made with liquidtight flexible metallic conduit (LFMC). Motors in hazardous areas, as defined in the Electrical Code, shall be connected using flexible conduit rated for the environment. Flexible conduit shall not exceed 6' in length. Route equipment ground conductors from circuit ground to motor ground terminal through flexible conduit.
- F. All conduit ends shall be sealed with plastic immediately after installation to prevent the entrance of any foreign matter during construction. The seals shall be removed and the conduits blown clear of all foreign matter prior to any wires or pull cords being installed.

3.6 UNDERGROUND CONDUIT INSTALLATION

- A. Conduit Connections:
 - 1. Conduit joints in a multiple conduit run shall be staggered at least one foot apart.
- B. Conduit Bends (Lateral):
 - 1. Conduits shall have long sweep radius elbows instead of standard elbows wherever special bends are indicated and noted on the drawings, or as required by the manufacturer of the equipment or system being served.
 - 2. Telecommunications conduit bend radius shall be six times the diameter for conduits under 2" and ten times the diameter for conduits over 2". Where long cable runs are involved, sidewall pressures may require larger radius bends. Coordinate with Architect/Engineer prior to conduit installation to determine bend radius.
- C. Conduit Elbows (vertical):
 - 1. Minimum metal or RTRC elbow radiuses shall be 30 inches for primary conduits (greater than 600V) and 18 inches for secondary conduits (less than 600V). Increase radius, as required, based on pulling tension calculation requirements.
- D. Expansion Fittings at Finished Grade: Provide underground raceways with an expansion fitting after emerging from finished grade and exterior equipment pads. Field locate the expansion fitting above and within 24 inches of finished grade. Raceways extending less than 12 inches above finished grade, transitioning to LFMC within 12 inches of finished grade, and interior concrete building slabs do not require an expansion fitting unless required by code.
- E. Conduit Placement:
 - 1. Conduit runs shall be pitched a minimum of 4" per 100 feet to drain toward the terminations. Duct runs shall be installed deeper than the minimum wherever required to avoid any conflicts with existing or new piping, tunnels, etc.
 - 2. For parallel runs, use suitable separators and chairs installed not greater than 4' on centers. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete placement or backfilling.
 - 3. Before the Contractor pulls any cables into the conduit, Contractor shall have a mandrel 1/4" smaller than the conduit inside diameter pulled through each conduit and if any concrete or obstructions are found, the Contractor shall remove them and clear the conduit. Spare conduit shall also be cleared of all obstructions.
 - 4. Conduit terminations in manholes, masonry pull boxes, or masonry walls shall be with malleable iron end bell fittings.
 - 5. All spare conduits not terminated in a covered enclosure shall have its terminations plugged as described above.
 - 6. Conduit shall be installed a minimum of 24" below finished grade, unless otherwise noted on the drawings or elsewhere in these specifications.
 - 7. All non-metallic conduit installed underground outside of a slab shall be rigid.
- F. Horizontal Directional Drilling:
 - 1. Entire drill path shall be accurately surveyed, with entry and exit stakes placed and coordinated with other contractors. If using a magnetic guidance system, entire drill path shall be surveyed for any surface geo-magnetic variations or anomalies.

2. Any utility locates within 20 feet of the bore path shall have the exact location physically verified by hand digging or vacuum excavation. Restore inspection holes to original condition after verification.

3.7 BOX INSTALLATION SCHEDULE

- A. Galvanized steel boxes may be used in:
 1. Concealed interior locations above ceilings and in hollow studded partitions.
 2. Exposed interior locations in mechanical rooms and in rooms without ceilings; higher than 8' above the highest platform level.
 3. Direct contact with concrete except slab on grade.
- B. Cast boxes shall be used in:
 1. Exterior locations.
 2. Hazardous locations.
 3. Exposed interior locations within 8' of the highest platform level.
 4. Direct contact with earth.
 5. Direct contact with concrete in slab on grade.
 6. Wet locations.

3.8 COORDINATION OF BOX LOCATIONS

- A. Provide electrical boxes as shown on the drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
- B. Electrical box locations shown on the Contract Drawings are approximate, unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.
- C. Locate and install boxes to allow access. Avoid interferences with ductwork, piping, structure, equipment, etc. Recessed luminaires shall not be used as access to outlet, pull, and junction boxes. Where installation is inaccessible, provide access doors. Coordinate locations and sizes of required access doors with the Architect/Engineer and General Contractor.
- D. Locate and install to maintain headroom and to present a neat appearance.
- E. Coordinate locations with Heating Contractor to avoid baseboard radiation cabinets.

3.9 OUTLET BOX INSTALLATION

- A. Do not install boxes back-to-back in walls.
 1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.

2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.
- B. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.
 - C. The Contractor shall anchor switch and outlet box to wall construction so that it is flush with the finished masonry, paneling, drywall, plaster, etc. The Contractor shall check the boxes as the finish wall surface is being installed to assure that the box is flush. (Provide plaster rings as necessary.)
 - D. Mount at heights shown or noted on the drawings or as generally accepted if not specifically noted.
 - E. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.
 - F. Provide knockout closures for unused openings.
 - G. Support boxes independently of conduit.
 - H. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
 - I. Install boxes in walls without damaging wall insulation.
 - J. Coordinate mounting heights and locations of outlets mounted above counters, benches, backsplashes, and below baseboard radiation.
 - K. Position outlets to locate luminaires as shown on reflected ceiling drawings.
 - L. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioned to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
 - M. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
 - N. Provide cast outlet boxes in exterior locations and wet locations, and where exposed rigid or intermediate conduit is used.

3.10 PULL AND JUNCTION BOX INSTALLATION

- A. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.
- B. Support pull and junction boxes independent of conduit.

- C. Do not install boxes back-to-back in walls.
 - 1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.
 - 2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.
- D. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.

3.11 EXPOSED BOX INSTALLATION

- A. Boxes shall be secured to the building structure with proper size screws, bolts, hanger rods, or structural steel elements.
- B. On brick, block and concrete walls or ceilings, exposed boxes shall be supported with no less than two (2) Ackerman-Johnson, Paine, Phillips, or approved equal screw anchors or expansion shields and round head machine screws. Cast boxes shall not be drilled.
- C. On steel structures, exposed boxes shall be supported to the steel member by drilling and tapping the member and fastening the boxes by means of round head machine screws.
- D. Boxes may be supported on steel members by APPROVED beam clamps if conduit is supported by beam clamps.
- E. Boxes shall be fastened to wood structures by means of a minimum of two (2) wood screws adequately large and long to properly support. (Quantity depends on size of box.)
- F. Wood, plastic, or fiber plugs shall not be used for fastenings.
- G. Explosive devices shall not be used unless specifically allowed.

END OF SECTION

SECTION 260553
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 REFERENCES

- A. NFPA 70E - National Electrical Safety Code
- B. NFPA 70 - National Electrical Code (NEC)
- C. ANSI A13.1 - Standard for Pipe Identification
- D. ANSI Z535.4 - Standard for Product Safety Signs and Labels

1.2 QUALITY ASSURANCE

- A. Electrical identification products shall be suitable for the environment installed. Identification labels damaged by the environment due to ultraviolet light fading, damp or wet conditions, physical damage, corrosion, or other conditions shall be replaced with labels suitable for the environment.

PART 2 - PRODUCTS

2.1 ADHESIVE MARKINGS AND FIELD LABELS

- A. Adhesive Marking Labels for Raceway: Pre-printed, flexible, self-adhesive vinyl labels with legend indicating voltage and service (Emergency, Lighting, Power, HVAC, Communications, Control, Fire).
 - 1. Label Size as follows:
 - a. Raceways: Kroy or Brother labels 1-inch high by 12-inches long (minimum).
 - 2. Color: As specified for various systems.
- B. Colored Adhesive Marking Tape for banding Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch to 2 inches in width.
- C. Pretensioned Flexible Wraparound Colored Plastic Sleeves for Cable Identification: flexible acrylic bands sized to suit the cable diameter and arranged to stay in place by pre-tensioned gripping action when coiled around the cable.
- D. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.

- E. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from -40°F to 185°F (-40°C to 85°C), type 2/2S or type 21/21S based on application. Provide ties in specified colors when used for color coding. Cable ties shall be listed and identified for the application, securement, and support.
- F. Underground Plastic Markers: Bright colored continuously printed plastic ribbon tape of not less than 6 inches wide by 4 mil thick, printed legend indicating type of underground line, manufactured for direct burial service. Tape shall contain a continuous metallic wire to allow location with a metal detector.
- G. Aluminum, Wraparound Marker Bands: 1-inch width, 0.014 (5mm) inch thick aluminum bands with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.
- H. Brass or Aluminum Tags: 2" (50mm) by 2" (50mm) by .05-inch metal tags with stamped legend, punched for fastener.
- I. Indoor/Outdoor Number and Letters: Outdoor grade vinyl label with acrylic adhesive designed for permanent application in severe indoor and outdoor environments.
- J. Text Sizes:
 - 1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.
 - a. Font: Normal 721 Swiss Bold
 - b. Adhesive Labels: 3/16 inch minimum text height
 - c. Vinyl / Plastic Laminate Labels: 3/4" inch minimum text height

2.2 NAMEPLATES AND SIGNS

- A. Engraved, Plastic-Laminated Labels, Signs and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8 inch thick for larger sizes. Labels shall be punched for mechanical fasteners.
- B. Text Sizes:
 - 1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.
 - a. Text Height: 3/8 inch minimum
- C. Baked-Enamel Signs for interior Use: Preprinted aluminum signs, punched, or drilled for fasteners, with colors, legend, and size required for application. Mounting 1/4" grommets in corners.
- D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396 inch galvanized-steel backing: and with colors, legend, and size required for application. Mounting 1/4" grommets in corners.
- E. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.

- F. Fasteners for Plastic-Laminated Signs; Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.

2.3 PRODUCT COLORS

A. Adhesive Markings and Field Labels:

- 1. Normal Power and General Labels: Black letters on white face
- 2. Control Labels: Black letters on white face
- 3. Emergency: Red letters on white face

B. Nameplates and Signs:

- 1. NORMAL POWER: Black letters on white face
- 2. Control Labels: Black letters on white face
- 3. EMERGENCY: White letters on red face
- 4. GROUNDING: White letters on green face.
- 5. CAUTION: Black letters on yellow face

C. Box Covers:

- 1. Box covers shall be painted to correspond with system type as follows:
 - a. Normal Power and General: Silver
 - b. Emergency Power and Distribution:
 - 1) All Emergency: Orange
 - c. Temperature Controls: Refer to mechanical cover sheet for color
 - d. Ground: Green
 - e. Low Voltage and Telephone: Purple
 - f. Clock, Sound, Security System, and Intercom: Black

D. Conductor Color Identification: Refer to Part 3 for additional information.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.
- B. Exposed Ceilings and Finished Spaces: The project includes exposed ceilings in finished spaces. The installation of colored raceways and labeling may not be aesthetically desirable in finished spaces. The contractor shall coordinate identification requirements in exposed ceilings of finished spaces with the Architect/Engineer prior to installation and ordering of materials.
- C. Electrical System Color Chart: This Contractor shall furnish and install framed 8" x 12" charts of the color-coded identification scheme used for the electrical system in all electrical rooms.

- D. Install identification devices in accordance with manufacturer's written instruction and requirements of Electrical Code.
- E. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work. All mounting surfaces shall be cleaned and degreased prior to identification installation.
- F. Circuit Identification: Tag or label conductors as follows:
 - 1. Multiple Power or Lighting Circuits in Same Enclosure: Where multiple branch circuits are terminated or spliced in a box or enclosure, label each conductor with source and circuit number.
 - 2. Multiple Control Wiring and Communication/Signal Circuits in Same Enclosure: For control and communications/signal wiring, use wire/cable marking tape at terminations in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tape.
 - 3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.
- G. Apply Danger, Warning, Caution and instruction signs as follows:
 - 1. Install Danger, Warning, Caution or instruction signs where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
 - 2. 'Danger' indicates a hazardous situation which, if not avoided, will result in death or serious injury. ANSI standard red background, white letters.
 - 3. 'Warning' indicates a hazardous situation which, if not avoided, could result in death or serious injury. ANSI standard orange background, black letters.
 - 4. 'Caution' indicates a hazardous situation which, if not avoided, may result in minor or moderate injury. ANSI standard yellow background, black letters.
 - 5. Emergency Operating Signs: Install, where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect, engraved laminate signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.
- H. Apply circuit/control/item designation labels of engraved plastic laminate for pushbuttons, pilot lights, alarm/signal components, and similar items, except where labeling is specified elsewhere.
- I. Install labels parallel to equipment lines at locations as required and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
- J. Install ARC FLASH WARNING signs on all switchboards, switchgear, distribution panels, branch panelboards, industrial control panels, and motor control centers.
 - 1. Sample Label:

! WARNING
ARC FLASH AND SHOCK HAZARD

APPROPRIATE PPE REQUIRED
FAILURE TO COMPLY CAN RESULT IN DEATH OR INJURY
REFER TO NFPA 70E

- K. Underground Electrical Lines: For exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 (150mm) to 8 (205mm) inches below grade. A single plastic line marker is permitted when the width of the common trench does not exceed 16 inches; provide a second plastic line marker to mark each edge of the trench when 16 inches of width is exceeded. Install line marker for underground wiring, both direct-buried cables and cables in raceway.

3.2 FEEDER AND BRANCH CIRCUIT DIRECTORIES

- A. Product:
 - 1. Adhesive labels and field markings
 - 2. Nameplates and signs
- B. Feeder Directories Branch: Provide each feeder, branch circuit, feeder modification, and branch circuit modification with a typed circuit directory label. Refer to technical equipment specification sections for additional requirements. Include the following with each label:
 - 1. Load Description: Lighting, receptacles, specific equipment, spare, space, or similar description.
 - 2. Location: Room name, number, location.
- C. Provide a factory or custom clear plastic sleeve for each branch panel directory and secure to inside panel cover.

3.3 LIGHTING CONTROL AND RECEPTACLE COVER PLATES

- A. Product:
 - 1. Adhesive labels and field markings
 - 2. Nameplates and signs
- B. Identification material to be a clear, 3/8-inch Kroy tape or Brother self-laminating vinyl label with black letters. Embossed Dymo-Tape labels are not acceptable. Permanently affix identification label to cover plates, centered above the receptacle openings.
- C. Provide identification on all switch and receptacle cover plates. Identification shall indicate source and circuit number serving the device (e.g. "C1A #24"). Identification for switch cover plates shall be installed on the inside cover.

3.4 CONDUIT AND EXPOSED CABLE LABELING

- A. Product:
 - 1. Adhesive labels and field markings

- B. Blank conduit ends or outlet boxes for future extension of system shall have permanent identification marker indicating purpose of conduit or box and where the raceway originated.

3.5 BOX LABELING

- A. Products:
 - 1. Adhesive labels and field markings
- B. Identify Junction, Pull and Connection Boxes: Labeling shall be 3/8-inch Kroy tape OR Brother self-laminating vinyl label, letters/numbers. In rooms that are painted out, provide labeling on inside of cover.
- C. All junction, pull, and connection boxes shall be identified as follows:
 - 1. For power and lighting circuits, indicate system voltage and identity of contained circuits ("120V, 1LA1-3,5,7").
 - 2. For other wiring, indicate system type and description of wiring ("FIRE ALARM NAC #1").

3.6 CONDUCTOR COLOR CODING

- A. Products:
 - 1. All wire and cables shall be color coded by the manufacturer.
- B. Color coding shall be applied at all panels, switches, junction boxes, pull boxes, etc., where the wires and cables are visible and terminations are made. The same color coding shall be used throughout the entire electrical system, therefore maintaining proper phasing throughout the entire project.
- C. Colored cable ties shall be applied in groups of three ties of specified color to each conductor at each terminal or splice point starting 3 inches from the termination and spaced at 3- inches centers. Tighten to a snug fit, and cut off excess length.
- D. Where more than one nominal voltage system exists in a building or facility, each ungrounded conductor of a multi-wire branch circuit, where accessible, shall be identified by phase and system.
- E. Conductors shall be color coded as follows:
 - 1. 120/240 Volt, 3-Wire:
 - a. A-Phase - Black
 - b. B-Phase - Red
 - c. Neutral - White
 - d. Ground Bond - Green
 - 2. 208Y/120 Volt, 4-Wire:
 - a. A-Phase - Black
 - b. B-Phase - Red
 - c. C-Phase - Blue

- d. Neutral - White
 - e. Ground Bond - Green
3. Grounding Conductors:
- a. Equipment grounding conductors, main/system/supply-side bonding jumpers: Green.
 - b. Isolated Equipment Ground Conductors: Green with colored distinctive yellow stripe along the entire length of the conductor. Isolated ground for feeders, use colored tape with alternating bands of green and yellow to provide a minimum of three bands of green and two bands of yellow.
4. Cabling for Remote Control, Signal, and Power Limited Circuits:
- a. Low Voltage Switching: Per manufacturer recommendations and code requirements.
 - b. Building Automation Systems and Control: Refer to the Temperature Control Contactor notes located on the mechanical cover sheet.
 - c. Nurse Call: Refer to Division 27.
 - d. Electronic Control: Per manufacturer recommendations and code requirements.
 - e. Audio/Visual Systems: Refer to Division 27.
 - f. Structured Cabling: Refer to Division 27.

3.7 CONTROL EQUIPMENT IDENTIFICATION

- A. Products:
 - 1. Nameplates and signs
- B. Provide identification on the front of all control equipment such as combination starters, starters, VFDs, contactors, motor control centers, etc.
- C. Identification shall be provided for all connections to equipment furnished by this Contractor, other contractors, or the Owner.
- D. Labeling shall include:
 - 1. Equipment type and contract documents designation of equipment being served.
 - 2. Location of equipment being served if it is not located within sight.
 - 3. Voltage and phase of circuit(s).
 - 4. Panel and circuit number(s) serving the equipment.
 - 5. Method of automatic control, if included ("AUTO CONTROL BY FMCS").

3.8 EQUIPMENT CONNECTION IDENTIFICATION

- A. Products:
 - 1. Nameplates and signs
- B. Provide identification for hard wired electrical connections to equipment such as disconnects switches, starters, etc. Plug and cord type connections do not require this specific label.

- C. Identification shall be provided for all connections to equipment furnished by this Contractor, other contractors, or the Owner. The following list of equipment is specifically being listed to receive an equipment connection label; this list does not limit the equipment that shall receive a label:
 - 1. Mechanical heating, ventilation, and air conditioning equipment; chillers, boilers, pumps, air handling ventilation units, condensing units, unit heaters, and similar equipment
 - 2. Plumbing equipment
 - 3. Industrial machinery

- D. Labeling shall include:
 - 1. Equipment type and contract documents designation of equipment being served
 - 2. Location of equipment being served if it is not located within sight.
 - 3. Voltage and rating of the equipment.
 - 4. Panel and circuit numbers(s) serving the equipment

3.9 POWER DISTRIBUTION EQUIPMENT IDENTIFICATION

- A. Products:
 - 1. Nameplates and signs

- B. Provide identification on the front of all power distribution equipment such as panelboards, switchboards, switchgear, motor control centers, generators, UPS, storage battery disconnects, transfer switches, etc. Labels shall be visible on the exterior of the gear, correspond to the one-line diagram nomenclature, and identify each cubicle of multi-section gear.
 - 1. Interior Equipment: The identification material shall be engraved plastic-laminated labels.
 - 2. Exterior Equipment: The identification material shall be engraved vinyl labels.
 - 3. Labeling shall include:
 - a. Equipment type and contract documents designation of equipment.
 - b. Voltage of the equipment.
 - c. Name of the upstream equipment and location of the upstream equipment if it is not located within sight.
 - d. Rating and type of the overcurrent protection device serving the equipment if it is not located within sight ("FED BY 400A/3P BREAKER").

- C. Nominal System Voltage Label:
 - 1. Where more than one nominal voltage system exists in a building or facility, the identification of color coding used in the panelboard or equipment shall be permanently posted on the interior of the door or cover.

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- D. Distribution panelboards and switchboards shall have each overcurrent protection device identified with name and location of the load being served ("AHU-1 LOCATED IN PENTHOUSE 1"). Provide a separate engraved plastic laminate label adjacent to each overcurrent protection device with feeder wire size, feeder wire quantity, conductor material and distance in feet. Provide label separate from load identification label and adjustable trip settings label.

1. Sample Labels for Feeders:

4#3/0 CU & 1#6 CU GND, 125FT
4#250KCM AL & 1#6 GND CU, 125FT
2 SETS 4#400KCM CU & 1#1 GND CU, 125FT

- E. Branch panelboards shall be provided with typed panel schedules upon completion of the project. Existing panelboards shall have their existing panel schedules typed, with all circuit changes, additions or deletions also typed on the panel schedules. A copy of all panel schedules for the project shall be turned over as part of the O&M Manuals. Refer to Section 260500 for other requirements.

END OF SECTION

SECTION 260800
COMMISSIONING OF ELECTRICAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Description
- B. Responsibilities
- C. Related Work
- D. Test Equipment

1.2 DESCRIPTION

- A. The purpose of this section is to specify Division 26 responsibilities in the commissioning process.
- B. The systems to be commissioned are listed in Section 019100.
- C. Commissioning requires the participation of the Division 26 Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Section 019100. Division 26 Contractor shall be familiar with all parts of Section 019100 and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

1.3 RESPONSIBILITIES

- A. Refer to Section 019100.

1.4 RELATED WORK

- A. Specific commissioning requirements are given in the following sections of these specifications. All the following sections apply to the Work of this section.
 - 1. Section 017823 - Operations and Maintenance
 - 2. Section 017900 - Demonstration and Training
 - 3. Section 019100 - Commissioning
 - 4. Section 210800 - Commissioning of Fire Suppression
 - 5. Section 220800 - Commissioning of Plumbing
 - 6. Section 230800 - Commissioning of HVAC
 - 7. Section 270800 - Commissioning of Communications
 - 8. Section 280800 - Commissioning of Electronic Safety and Security

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. The Contractor shall provide all test equipment necessary to fulfill the testing requirements of this Division. This equipment includes, but is not limited to, the following:
 - 1. Test equipment required for NETA Acceptance Testing.
 - 2. Light meter.
 - 3. Sound level meter.
 - 4. Digital multimeter capable of measuring voltage (AC/DC), current, and resistance.
 - 5. Power quality and energy analyzer capable of capturing waveform (3 phase) and data recording.
 - 6. Handheld thermal imaging camera.
- B. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the related specifications. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.
- C. Refer to Section 019100 for additional Division 26 requirements.

PART 3 - EXECUTION

- A. Refer to Section 019100.

END OF SECTION

SECTION 260913
ENERGY METERING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Energy Metering including individual meter for metering of HHS electrical usage.
- B. Individual Meters

1.2 RELATED SECTIONS AND WORK

- A. Refer to the Electrical Distribution System drawings for ratings, locations, and configurations.
- B. Section 262416 - Panelboards

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company with three (3) years of experience in power measurements and controls.

1.4 REFERENCES

- A. ANSI C12 - Code for Electrical Metering
- B. ANSI C57.13 - Requirements for Instrument Transformers

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 260500.
- B. Provide product catalog data sheets as shop drawings.
 - 1. Produce a product catalog data sheet for each system component shown or not shown but required for the operation of the system.
 - 2. Product data shall include individual meter capabilities, potential transformer PT, and current transformer CT ratings for all items for compliance with specifications.
- C. Submit system floor plan / riser diagram shop drawings.
 - 1. Provide complete layout of the Energy Meter and Management System EMMS including individual meters and cabling.
 - 2. Provide installation instructions for network wiring and cabling.

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1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 260500.
- B. Store and protect products under provisions of Section 260500.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit Operation, Maintenance, and Installation Manuals under provisions of Section 260500.
- B. Include submittal shop drawings information.
- C. Include revised record drawings of the installed system.
- D. Include manufacturer representative system setup and commissioning report.

1.8 WARRANTY

- A. Provide one (1) year warranty on all materials and labor from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric Square D
 - 1. PowerLogic ION7300 Series
- B. Eaton Power Xpert
 - 1. DPM; PXM1000/2000/3000 Series
- C. ABB
- D. Siemens
- E. Electro Industries / Gauge Tech

2.2 ENERGY METERING AND MONITORING DEVICE AND COMPONENT CHARACTERISTICS

- A. Provide control transformers, current transformers, and fused potential transformers sized as required.

B. DEM; Energy Meter:

1. The following instantaneous readings shall be monitored and displayed by the energy meter:
 - a. Frequency
 - b. Current, per phase RMS, 3-phase average RMS, apparent RMS, peak demand
 - c. Voltage, phase-to-phase and phase-to-neutral
 - d. Power factor, per phase and 3-phase total
 - e. Real power (kW), 3-phase total, peak demand, cumulative (kWH)
2. The current and voltage signals shall be digitally sampled at a rate high enough to provide true-RMS sensing. All setup parameters required by the energy meter shall be stored in nonvolatile memory and retained in the event of a control power interruption. The meter shall maintain in nonvolatile memory maximum and minimum values for each of the instantaneous values reported, as well as the time and date of the highest peak for all peak demand readings.
3. The energy meter shall be equipped with a display to provide local access to all metered quantities.
4. Meter shall be programmed to log and display kWH usage for each month.
5. Reset of the following electrical parameters shall also be allowed from the front of the meter:
 - a. Peak demand current
 - b. Peak demand power
 - c. Energy (KWH)
 - d. Reactive Energy (KVARH)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Distribution system integrated meters and components, including system display units, metering devices, shall be installed by the manufacturer, and wired and tested in the equipment as indicated on the drawings. All control power, Current Transformers CT, Potential Transformers PT, and data communications cabling and harnesses shall be factory wired within the equipment enclosure.
- B. Field Cabling and Termination Requirements. Provide factory installed terminal blocks for field wiring when required. The manufacturer installation drawings shall clearly identify all interconnection field wiring, cabling types, and associated requirements.
- C. Provide manufacturer recommended cabling and system interconnections to individual meters and other scheduled systems.
- D. All wiring, gateways, and programming required for system setup and integration with other systems shall be provided by the Electrical Contractor.

3.2 FACTORY REPRESENTATIVE PREINSTALLATION, STARTUP, AND COMMISSIONING

- A. Conduct a preinstallation meeting prior to the installation of any electrical power meters. Attendance is required by all affected installers (contractor), as well as the manufacturer's commissioning engineer.
- B. The Electrical Contractor shall have a factory service engineer present for the preinstallation, start-up, field calibration, and check-out of the Energy Meter. Factory service engineer shall be required to return to the site for recalibration or setup should the system not function as specified during the system commissioning. All costs shall be a part of this Contract.
- C. Preinstallation Meeting. Electrical contractor and factory service engineer shall co-conduct a preinstallation meeting with the electrical contractor and any other pertinent stakeholders prior to installing any metering equipment.
- D. Verify settings, parameters, and adjustments with other contractors prior to startup. Make all adjustments and settings to coordinate with controls and equipment.
- E. Test setup and communication of each individual metered point.
- F. Provide two-party review and verification of meter load category designations. Verify each metered point is contributing the appropriate sum, subtraction, or similar mathematical contribution to the appropriate load categories and total facility energy profile. Meter tags are provided with subscripts on the plans when applicable.
 - 1. HHS Panelboard
 - 2. A complete working demonstration of the EMMS shall represent the completion of the setup and commissioning process.

3.3 TRAINING

- A. The Electrical Contractor shall have a factory service engineer present for Owner training. Training shall not commence until the completion of the system startup and commissioning phase. Provide a minimum of one (1) day for training with the total duration and quantity of sessions being coordinated with the Owner personnel.
- B. Provide an overview and demonstration of the EMMS system. Provide hands-on exercises to enable personnel to assume operating responsibilities of the system after training completion.
 - 1. System Orientation. Identify meter, and major components of the EMMS locations by physical facility tour, system one line diagram, and virtual representation in the EMMS human machine interface.
- C. Provide documentation of training including date, time, training agenda, training attendance, instructor contact information, user questions during training, and documentation of instructor answers for each applicable question. Submit training documentation to Architect / Engineer / Owner.

END OF SECTION

SECTION 260934
LIGHTING CONTROL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Line and low voltage standalone lighting controls
- B. Automatic load control relay (ALCR20)
- C. Time switches

1.2 RELATED SECTIONS

- A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of comparable product solutions available by competitive manufacturers. The Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. The Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:
 - 1. 26 51 19 LED Lighting
 - 2. Electrical Drawings: Plans, luminaire schedules, lighting control sequence of operations, diagrams, and details.

1.3 RELATED WORK

- A. Section 019100 - Commissioning
- B. Section 230900 - Facility Management Control System (FMCS)
- C. Section 265100 - Lighting

1.4 QUALITY ASSURANCE

- A. Manufacturers shall be regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. All components and assemblies are to be factory pre-tested prior to delivery and installation.
- C. Comply with Electrical Code as applicable to electrical wiring work.

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- D. Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.
- E. Panels and accessory devices are to be UL listed under UL 916 Energy Management Equipment.
- F. All assemblies are to be in compliance with FCC emissions standards specified in Part 15 Subpart J for Class A applications.

1.5 REFERENCES

- A. FCC Rules and Regulations, Part 15, Subpart J - Radio Frequency Interference
- B. FS W S 896 Switch, Toggle
- C. NEMA WD 1 - General Color Requirements for Wiring Devices
- D. NEMA WD 7 - Occupancy Motion Sensors
- E. NFPA 70 - National Electrical Code (NEC)
- F. UL Standard 916 Energy Management Equipment
- G. UL 924 - Emergency Lighting and Power Equipment
- H. UL 1472 - Solid-State Dimming Controls

1.6 SUBMITTALS

- A. Submit product data under provisions of Section 260500.
- B. Submit a comprehensive package including devices, hardware, software, product specification, finishes, dimensions, installation instructions, warranty, system software requirements, and roles and responsibilities of all persons and groups involved in installation, execution, and commissioning.
- C. Provide floor plan showing location, orientation, and coverage area of each control device, sensor, and controller/interface. For areas requiring multiple sensor devices for appropriate coverage, submit specific manufacturer-approved sensor layout as an overlay directly on the project drawings, either in print or approved electronic form.
- D. Submit a list of devices and equipment that will be installed for each sequence of operation.
- E. Submit project specific control wiring diagrams showing all equipment, line voltage, and control wiring requirements for all components including, but not limited to, dimmers, relays, low voltage switches, occupancy sensors, control stations, dimmer panels, relay panels, and communication interfaces and programming instructions for each sequence of operation. Include network cable specification and end-of-line termination details, if required.
- F. Verify acceptance of communications connection to building automation system. Submit BACnet IP parameters.

1.7 PROJECT RECORD DOCUMENTS

- A. Submit project record documents under provisions of Section 260500.
- B. Accurately record location of all controls and devices. Include description of switching sequences and circuiting arrangements.

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit emergency, operation, and maintenance data under provisions of Section 260500. Data shall also include the following:
 - 1. Schedule for routine maintenance, inspection, and calibration of all lighting control devices and system components. Recommended schedule for inspection and recalibration of sensors.
 - 2. Complete narrative describing intended operation and sequence for each control scenario and system component, updated to reflect all changes resulting from commissioning of systems. Narrative shall indicate recommended settings for devices where applicable.
 - 3. Replacement part numbers for all system components.
- B. Identify installed location and labeling for each luminaire controlled by automated lighting controls.
- C. Submit software operating and maintenance manuals, program software backup on compact disc or compatible media with data files, device address list, and a printout of software application and graphic screens, where applicable.

1.9 SYSTEM DESCRIPTION

- A. Performance Statement: This specification section and the accompanying lighting design documents describe the minimum material quality, required features, and operational requirements of the lighting control system (LCS). These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the performance required of the system, as presented in these documents, the Contractor and system manufacturer/vendor are solely responsible for determining all equipment, wiring, and programming required for a complete and operational system.
- B. Provide an integrated lighting controls system consisting of panels, power supplies, controllers, sensors, relays, switches, devices, wiring, etc. necessary to perform the Lighting Control Sequence of Operation as defined on the plans and specifications. Contractor is responsible for confirming that all components and luminaires interoperate as a single system.
 - 1. Sequence of Operation: Describes the required operation and performance for lighting control in each space. Sequences of operation are indicated on the drawings.
 - 2. Drawings: The drawings include sequences of operation, locations of control interface devices, sensors, and control zones. Wiring and additional equipment to make a complete and functioning system has not been shown, but shall be submitted with the shop drawings.

- C. The following control types and features are acceptable. Acceptable control locations are shown on the drawings.
 - 1. Line Voltage Control: Control equipment consists of traditional line voltage wiring devices and equipment such as switches, dimmers and combination occupancy/vacancy sensor switches, etc.
 - 2. Distributed Control: Control equipment is in the space/zone being controlled; not reliant on centralized controllers.
 - a. All locations shall have the ability to be networked for remote control and monitoring, but network connections are not required.

1.10 COMMISSIONING

- A. Commissioning of a system or systems specified in this section is part of the construction process. Documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel, is required in cooperation with the Owner's Representative and the Commissioning Agent. Project closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to Division 1 for detailed commissioning requirements.
- B. The Contractor shall provide all services necessary for compliance with the IECC Section C408 Commissioning. The commissioning shall include, but not be limited to, a commissioning plan, preliminary commissioning report, construction documents, manuals, final commissioning report, and lighting system functional testing.
- C. This project will have selected building systems commissioned. The Contractor is responsible to execute commissioning. The commissioning process, equipment, and systems to be commissioned are defined in Division 1.
- D. The Contractor shall notify the Commissioning Agent, Architect/Engineer and Owner's Representative ten (10) working days prior to scheduled commissioning date.
- E. The commissioning process requires meeting attendance. Refer to Division 1 for meeting requirements.
- F. The system shall be functionally tested by a factory-authorized engineer and comply with the Sequence of Operation. All loads shall be tested live for continuity and freedom from defects, and all control wiring shall be tested for continuity and connections prior to energizing the system.

1.11 WARRANTY

- A. Manufacturer shall warrant products under normal use and service to be free from defects in materials and workmanship for a period of two (2) years from date of commissioning.
- B. Occupancy, vacancy, daylight sensors and controls shall have a five (5) year warranty from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LIGHTING CONTROLS

- A. All items of material having a similar function (e.g., switches, dimmers, sensors, contactors, relays, etc.) shall be of the same manufacturer, unless specifically stated otherwise on drawings or elsewhere in the specifications. Lighting control switches, systems, and components shall be listed.
- B. Color of lighting controls and sensors shall match the receptacle wiring devices specified in the space.
- C. The functions described in the lighting sequence of operation shall dictate the actual lighting control device required to accomplish the functions described for the space.

2.2 DEVICE COLOR

- A. All switch, lighting controls, and coverplate colors shall be the same as wiring devices, unless indicated otherwise.

2.3 COVERPLATES

- A. All switches and lighting controls shall be complete with coverplates that match material and color of the wiring device coverplates in the space.
- B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.
- C. Install nameplate identification as indicated in Section 260553.
- D. Plate-securing screws shall be metal with head color matching the wall plate finish.

2.4 WALL SWITCHES

- A. Refer to Electrical Symbols List for device type.
- B. Switch touch surfaces shall have an antimicrobial additive that suppresses the growth of harmful bacteria, mold, mildew, and fungi. Coverplate color shall match the switch color.
 - 1. Manufacturers:
 - a. Cooper 7621 CuVerro
 - b. Leviton A5621
- C. SW-1P; Single Pole Switch:
 - 1. Single throw, 120/277-volt, 20-amp maintained contact. Toggle handle, side and back wired.

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2. Manufacturers:
 - a. Hubbell HBL1221
 - b. Leviton 1221-2
 - c. Pass & Seymour PS20AC1
 - d. Cooper AH1221
 3. Single throw, 120/277-volt, 20-amp maintained contact. Rocker handle, side and back wired.
 4. Manufacturers:
 - a. Hubbell DS120
 - b. Leviton 5621
 - c. Pass & Seymour 2621
 - d. Cooper 7601.
- D. SW-3W; Three-way Switch:
1. 120/277 volt, 20 amp. Toggle handle, side and back wired.
 2. Manufacturers:
 - a. Hubbell 1223
 - b. Leviton 1223-2
 - c. Pass & Seymour PS20AC3
 - d. Cooper AH1223
 3. 120/277-volt, 20-amp maintained contact. Rocker handle, side and back wired.
 4. Manufacturers:
 - a. Hubbell DS320
 - b. Leviton 5623
 - c. Pass & Seymour 2623
 - d. Cooper 7623
- E. SW-4W; Four-way Switch:
1. 120/277 volt, 20 amp. Toggle handle, side and back wired.
 2. Manufacturers:
 - a. Hubbell 1224
 - b. Leviton 1224-2
 - c. Pass & Seymour PS20AC4
 - d. Cooper AH1224
- F. SW-COMB; Combination Single Pole Switch and GFCI Receptacle:
1. Single throw switch, 120-volt, 15-amp maintained contact. Toggle handle, side and back wired. NEMA 5-15R GFCI receptacle with test and reset buttons.
 2. Manufacturers:
 - a. Hubbell GFSP15
 - b. Leviton 7229
 - c. Pass & Seymour 1595-SWTTR
 - d. Cooper VGFS15

2.5 WALL DIMMERS

- A. UL listed with integral air-gap switch for on/off control.
- B. Integral EMI/RFI suppression.
- C. Non-viewable heat sink.
- D. Dimmer compatibility and wiring with the load being controlled shall be verified by Contractor prior to purchase and installation.
- E. Dimmer to match device color.
- F. SW-D-LED; LED Electronic Driver Dimmer:
 - 1. 120 -volt, decora style linear slider operator with positive off. Color to match adjacent devices. Luminaire manufacturer shall list compatible dimmer manufacturers and models. 0-10V dimmers shall comply with IEC 60629 Annex E.
 - 2. Manufacturers:
 - a. Compatible with provided LED driver.
- G. SW-D3-LED; LED Electronic Driver Three-Way Dimmer:
 - 1. 120-volt, decora style linear slider operator with positive off. Color to match adjacent devices. Luminaire manufacturer shall list compatible dimmer manufacturers and models. 0-10V dimmers shall comply with IEC 60929 Annex E.
 - 2. Manufacturers:
 - a. Compatible with provided LED driver.

2.6 INDOOR OCCUPANCY AND VACANCY SENSORS

- A. General Description: Wall- or ceiling-mounting, solid-state units with a separate power supply/relay unit.
 - 1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied, with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes. Vacancy sensors require a manual switch operation to turn lights on and off, with a time delay for turning lights off when unoccupied.
 - 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 - 3. Relay Unit: Dry contacts rated for 20 A ballast load at 120 and 277 VAC, for 13-amp tungsten at 120 VAC, and for 1 hp at 120 VAC. Power supply to sensor shall be 24 V dc, 150-mA, Class 2 power source as defined by Electrical Code.
 - 4. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure. Mount relay above accessible ceiling near entry door to room or area.
 - c. Time Delay and Sensitivity Adjustments: Recessed and concealed.

5. Indicator: LED to show when motion is being detected during testing and normal operation of the sensor.
 6. Bypass Switch: Override the on function in case of sensor failure.
 7. Power Supply and Child Packs: Provide as required for sensor quantity and switching scheme. Mount to standard 1/2" knockout on electrical box above accessible ceiling near entry door to room or area. Sensor power shall be from emergency circuit if emergency lighting is in the area.
 8. Detection Coverage (Room): Detect occupancy anywhere in an area based on hand motion.
 9. Detection Coverage (Corridor): Detect occupancy based on a half-step motion.
 10. Warranty: Five (5) year warranty.
- B. Dual-Technology Type: Detect occupancy by using a combination of PIR and ultrasonic or acoustic detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit.
1. SW-VS-D or SW-OC-D; 360 Degree Coverage Pattern:
 - a. Frequency greater than 40 KHz. Dual sensing verifications (requires both technologies to activate), either technology maintains on status. Integrated ambient light level sensor (2 to 200 FC range), adjustable sensitivity and time delay, integrated isolated relay contact. Sensor shall control all circuits in area, unless noted otherwise. Initial settings: ambient sensor 40 FC.
 - b. Manufacturers:
 - 1) Watt Stopper DT 300 Series
 - 2) Hubbell OMNI-DT2000 or ATD2000C
 - 3) Greengate OAC-DT
 - 4) Leviton OSC##-MOW
 - 5) Sensor Switch CM PDT 10
 2. SW-VS-D-W or SW-OC-D-W; Wall Mounted on Adjustable Swivel Mount:
 - a. Wall or ceiling sensor with adjustable settings to allow manual on/auto off or auto on/auto off. Integrated ambient light level sensor (2 to 100 FC range).
 - b. Manufacturers:
 - 1) Watt Stopper DT-200 Series
 - 2) Hubbell LODTRP
 - 3) Leviton OSM12--M series
 - 4) Sensor Switch WvPDT 16 Series
 3. SW-O; Wall Switch:
 - a. Wall switch with manual on/auto off. 120/277 VAC load rating of 0-800 W for ballast, LED or tungsten. 5-, 15-, 30-minute adjustable OFF delay. Coverage of minor motion in 12' x 15' pattern.
 - b. Manufacturers:
 - 1) Watt Stopper DW-100 Series
 - 2) Hubbell LHMTS, Leviton OSSMT series
 - 3) Sensor Switch WSX-PDT SA Series

4. SW-O2; Wall Switch:
 - a. Multi-relay wall switch with manual on/auto off for two separate loads. 120/277 VAC load relay rating of 0-800 W for ballast, LED or tungsten. 5-, 15-, 30-minute adjustable OFF delay. Coverage of minor motion in 12' x 15' pattern.
 - b. Manufacturers:
 - 1) Watt Stopper DW-200 Series
 - 2) Hubbell LHMTD
 - 3) Leviton OSSMD series
 - 4) Sensor Switch WSX-PDT 2P Series
 5. Sensitivity Adjustment: Separate for each sensing technology.
 6. Detection Coverage:
 - a. Task Areas: Detect occupancy anywhere in an area based on hand motion.
 - b. Circulation Areas: Detect occupancy anywhere in an area based upon half-step walking motion.
- C. Mask sensors where necessary to prevent nuisance switching from adjacent areas.
- D. PIR Type: Detect occupancy by sensing a combination of heat and movement in area of coverage.
1. SW-OC-P-HA; High Bay - Aisle Coverage Pattern:
 - a. 20' to 40' mounting height. Minimum 1.3:1 walking motion coverage pattern to height ratio. Adjustable sensitivity and time delay, integral isolated relay contact. Sensor shall control all luminaires in area. Initial settings: Time delay 10 minutes.
 - b. Manufacturers:
 - 1) Watt Stopper HB-300 Series
 - 2) Hubbell FHB 140 or HMHB series
 - 3) Leviton OSFHU
 - 4) Greengate OEF-P
 2. SW-OC-P-HB; High Bay - 360 Degree Coverage Pattern:
 - a. 20' to 40' mounting height. Minimum 1.3:1 walking motion coverage pattern to height ratio. Adjustable sensitivity and time delay, integral isolated relay contact. Sensor shall control all luminaires in area.
 - b. Manufacturers:
 - 1) Watt Stopper HB-300 Series
 - 2) Hubbell FHB 140 or HMHB series
 - 3) Leviton OSFHU
 - 4) Greengate OEF-P
 3. SW-O; Wall Switch Occupancy Sensor:
 - a. Passive infrared, zero crossing circuitry, adjustable sensitivity and time delay, no minimum load requirements, manual or auto on operation, Initial settings: 10 minutes.

- b. Manufacturers:
 - 1) Watt Stopper PW-100 Series
 - 2) Sensor Switch WSX
 - 3) Hubbell LHIRS1 or AP1277
 - 4) Leviton ODS15
 - 5) Greengate OSW-P-0451

- 4. SW-O2; Dual Wall Switch Occupancy Sensor:
 - a. Passive infrared, zero crossing circuitry. Switches control two separate circuits or relays. , adjustable sensitivity and time delay, no minimum load requirements, manual or auto on operation, Initial settings: 10 minutes.
 - b. Manufacturers:
 - 1) Watt Stopper PW-200 Series
 - 2) Sensor Switch WSX-2
 - 3) Hubbell LHIRD2 or AP127712
 - 4) Leviton ODS
 - 5) Greengate OSW-P-0451

- 5. SW-OC-P-P; Ceiling Mounted - 360 Degree Coverage Pattern:
 - a. Passive infrared, zero crossing circuitry, adjustable sensitivity and time delay, integral isolated relay contact. Sensor shall control all circuits in the area unless noted otherwise.
 - b. Manufacturers:
 - 1) Watt Stopper CI Series
 - 2) Sensor Switch CM-9
 - 3) Hubbell Automation Omni-IR
 - 4) Leviton OSC Series
 - 5) Greengate OMR-P Series

- 6. SW-OC-P-P2; Ceiling Mounted - 100 Degree Coverage Pattern:
 - a. Passive infrared, zero crossing circuitry, adjustable sensitivity and time delay, integral isolated relay contact. Sensor shall control all circuits in the area unless noted otherwise.
 - b. Manufacturers:
 - 1) Watt Stopper WPIR Series
 - 2) Sensor Switch CM-9
 - 3) Hubbell LOIRWV or ATD1600W

- 7. SW-OC-P-W; Wall Mounted - 100 Degree Coverage Pattern:
 - a. Passive infrared, zero crossing circuitry, adjustable sensitivity and time delay, integral isolated relay contact. Sensor shall control all circuits in the area unless noted otherwise.

- b. Manufacturers:
 - 1) Watt Stopper WPIR Series
 - 2) Sensor Switch CM-9
 - 3) Hubbell LOIRWV or ATD1600W
- 8. With daylight filter and lens to afford coverage applicable to space to be controlled.
- E. Ultrasonic Type: Ceiling mounting. Detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
 - 1. SW-OC-U; 360 Degree 20' x 20' Hand Motion Coverage Pattern:
 - a. Frequency greater than 32 KHz solid state, adjustable sensitivity and time delay, integral isolated 1-amp relay contact, temperature and humidity resistant receivers. Sensor shall control all circuits in area, unless noted otherwise.
 - b. Manufacturers:
 - 1) Watt Stopper WT-1100 series
 - 2) Hubbell OMNI-US or ATU series
 - 3) Leviton OSC series
 - 4) Greengate ODC-U series
 - 2. SW-OC-U2; 35' x 30' Hand Motion Coverage Pattern:
 - a. Frequency greater than 32 KHz solid state, adjustable sensitivity and time delay, integral isolated relay contact, temperature and humidity resistant receivers. Sensor shall control all circuits in area, unless noted otherwise.
 - b. Manufacturers:
 - 1) Watt Stopper WT-2200 series
 - 2) Hubbell OMNI-US or ATU series
 - 3) Leviton OSC series
 - 4) Greengate ODC-U series
 - 3. SW-OC-U-A; 360 Degree Two-Sided Corridor Coverage Pattern:
 - a. Frequency greater than 32 KHz solid state, adjustable sensitivity and time delay, integral isolated relay contact, temperature and humidity resistant receivers. Sensor shall control all circuits in area, unless noted otherwise.
 - b. Manufacturers:
 - 1) Watt Stopper WT-2250 Series
 - 2) Hubbell OMNI-US or ATU series
 - 3) Greengate ODC-U Series
 - 4. SW-OC-U-W; Wall Mounted:
 - a. Wall switch with adjustable settings to allow manual on/auto off or auto on/auto off.
 - b. Manufacturers:
 - 1) Watt Stopper UW-100 Series
 - 2) Hubbell AU1277I,

5. Crystal controlled with circuitry that causes no detection interference between adjacent sensors.

2.7 CONDUCTORS AND CABLES

A. Control Wiring:

1. Where installed with the line-voltage wiring, control wiring shall be copper conductors not smaller than No. 16 AWG with insulation voltage rating and temperature rating equal to that of the line-voltage wiring, complying with Division 26 Section 260513 "Wire and Cable."
2. Tap conductors to switches or relays: Stranded copper conductors of 16 AWG or solid 16 or 18 AWG with insulation rating equal to that of the line-voltage wiring.
3. Tap conductors to dimming ballasts: Solid copper conductors of 18 AWG with insulation voltage rating equal to that of the line-voltage wiring and insulation temperature rating not less than 90°C.
4. Network cabling as required by manufacturer.

B. Splices and Taps:

1. Tapping or wire trap connectors shall be used to splice all Class 1 and Class 2 control wiring. Twist-on, wire-nut type connectors are not allowed.

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION MEETING

- A. Schedule a pre-construction meeting with the controls representative, installing contractor, Architect/Engineer, and Owner to explain the proposed lighting control centralized, wireless, and distributed systems.

3.2 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify field dimensions and coordinate physical size of all equipment with the architectural requirements of the spaces into which they are to be installed. Allow space for adequate ventilation and circulation of air.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Beginning of installation means installer accepts existing conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings.
- B. All wiring shall be installed in conduit.

- C. All branch load circuits shall be live tested before connecting the loads to the lighting control panel.

3.4 SUPPORT SERVICES

A. System Startup:

- 1. Manufacturer shall provide factory authorized technician to confirm proper installation and operation of all system components.

B. Testing:

- 1. System shall be completely functional tested by a factory-authorized technician. All loads shall be tested live for continuity and freedom from defects, and all control wiring shall be tested for continuity and connections prior to energizing the system components.
- 2. Programming of initial zones, schedules, lighting levels, control station groups, and sensor settings shall be performed by a factory-authorized technician. Lighting Control Sequence of Operation shall serve as a basis for programming, However, all final decisions regarding groups and schedules shall be at the direction of the Owner. The following procedures shall be performed at a minimum:
 - a. Confirm occupancy sensor placement, sensitivity, and time delay settings to meet specified performance criteria.
 - b. Confirm daylight sensor placement, sensitivity, deadband, and delay settings to meet specified performance criteria.
 - c. Confirm that schedules and time controls are configured to meet specified performance criteria and Owner's operating requirements.
- 3. Verify occupancy/vacancy and daylight sensor operation is correct after furniture and equipment is installed in each area. Make adjustments to sensor settings and time delays to allow proper operation.
- 4. Verify occupancy/vacancy sensors are located to provide complete coverage for the area served with no nuisance switching.
 - a. Relocate sensors or provide additional sensors as necessary to provide adequate coverage.
 - b. Mask occupancy sensors where necessary to prevent nuisance switching from adjacent areas.

C. Training:

- 1. Manufacturer shall provide competent factory-authorized technician to train Owner personnel in the operation, maintenance and programming of the lighting control system. Submit training plan with notification seven (7) days prior to proposed training dates.
- 2. Training duration shall be no less than three (1) day.

D. Documentation:

- 1. Manufacturer shall provide system documentation including:
 - a. System one-line showing all panels, number and type of control stations and sensors, communication line, and network or BMS/BAS interface unit.
 - b. Drawings for each panel showing hardware configuration and numbering.

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- c. Panel wiring schedules.
- d. Typical diagrams for each component.

3.5 SYSTEM COMMISSIONING

- A. Contractors' tests shall be scheduled and documented in accordance with the commissioning requirements. Refer to Section 010900, General Commissioning, for further details.
- B. System verification testing is part of the commissioning process. Verification testing shall be performed by the Contractor and witnessed and documented by the Commissioning Agent. Refer to Section 010900, General Commissioning, for system verification tests and commissioning requirements.
- C. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's Representative. The instruction shall be scheduled in coordination with the Owner's Representative after submission and approval of formal training plans. Refer to Section 010900, General Commissioning, for Contractor training requirements.

END OF SECTION

SECTION 262000
SERVICE ENTRANCE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Arrangement with Utility Company for permanent electric service.
- B. Underground service entrance

1.2 RELATED SECTIONS AND WORK

- A. Refer to the One-Line Diagram for additional information.

1.3 SYSTEM DESCRIPTION

- A. System Voltage: 208Y/120 volts, three phase, four-wire, 60 Hertz.

PART 2 - PRODUCTS

2.1 METERING EQUIPMENT

- A. Meter: Furnished by the Utility Company.
- B. Meter Base: Furnished by the Contractor, as approved by the Utility Company. (Manufacturers: Milbank, Superior, Duncan, or Anchor).
- C. MC-1; Exterior Mounted Metering Cabinets: Furnished and installed by the Contractor to Utility Company's specifications. Conduit and conductors between metering cabinets and instrumentation shall be by the Contractor. Connections as required by the Utility Company.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Make arrangements with Utility Company to obtain permanent electric service to the Project.
- B. Primary distribution equipment and pad-mounted transformers shall be furnished and installed by the Utility Company.

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- C. Primary conductors shall be furnished, installed, and terminated by the Utility Company. Primary conduit shall be furnished and installed by the Contractor, as shown on the drawings, to the Utility Company's requirements.
- D. Underground: Install service entrance conduits in concrete envelope from Utility Company's pad mounted transformer to meter cabinet and building service entrance equipment. Utility Company will connect service conductors to transformer secondary lugs.
- E. Concrete Pad for Transformer: Furnished and installed by the Contractor to Utility Company's specifications.

END OF SECTION

SECTION 262416

PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Service and distribution panelboards: **DP-#**
- B. Lighting and appliance branch circuit panelboards: **Panel '###'**

1.2 RELATED SECTIONS AND WORK

- A. Refer to the Electrical Distribution Diagram and Electrical Schedules for size, rating, and configuration.
- B. Section 260913 - Energy Metering and Management System

1.3 REFERENCES

- A. NEMA AB 1 - Molded Case Circuit Breakers
- B. NEMA KS 1 - Enclosed Switches
- C. NEMA PB 1 - Panelboards
- D. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less
- E. NEMA PB 1.2 - Application Guide for Ground-fault Protective Devices for Equipment
- F. UL 67 - Panelboards

1.4 SUBMITTALS

- A. Submit shop drawings for equipment and component devices under provisions of Section 260500.
- B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker arrangement and sizes.
- C. Submit manufacturer's instructions under provisions of Section 260500.

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1.5 SPARE PARTS

- A. Keys: Furnish four (4) each to the Owner.

PART 2 - PRODUCTS

2.1 RATINGS

- A. Definitions:
 - 1. Series rated equipment shall be defined as equipment that can achieve a required UL AIC rating with an upstream device such as a main breaker or a combination of devices to meet or exceed a required UL AIC rating. All series rated equipment shall have a permanently attached nameplate indicating that device rating must be maintained. See Section 260553 for additional requirements.
 - 2. 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.
- B. The panelboards for this project shall be fully rated unless otherwise specifically noted in the Drawings or Specifications.

2.2 MAIN AND DISTRIBUTION PANELBOARDS

- A. General
 - 1. Manufacturers:
 - a. Square D QMB, I-Line
 - b. ABB ReliaGear neXT
 - c. Siemens F2, P4
 - d. Eaton PRL4, PRL5
- B. Panelboards: NEMA PB 1; type as shown on the drawings.
- C. Provide cabinet front with hinged trim on door to allow access to wiring gutters without removal of trim and flush lock. Door hardware shall provide swing clear operation (180-degree swing). Finish in manufacturer's standard gray enamel.
- D. Provide panelboards with copper bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.
- E. All spaces shown on the one-line diagram shall be fully prepared spaces for future breakers.
- F. Suitable for use as service entrance equipment. Provide line side (service style) barriers.

2.3 BRANCH CIRCUIT PANELBOARDS

- A. General
 - 1. Manufacturers:
 - a. Square D NQ, NF
 - b. ABB ReliaGear Series
 - c. Siemens P1
 - d. Eaton PRL1, PRL2
- B. Provide cabinet front with hinged trim to allow access to wiring gutters without removal of trim and flush lock all keyed alike. Hinged trim shall be secured with screws. Door hardware shall provide swing clear operation (180-degree swing). Finish in manufacturer's standard gray enamel.
- C. Provide panelboards with copper bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.
- D. All unlabeled circuits shown on the panelboard schedule shall be fully prepared spaces for future breakers.
- E. All multiple-section panelboards shall have the same dimensional back box and cabinet front size.
- F. Provide handle lock-on devices for all breakers serving exit sign and lighting circuits with emergency battery units. Provide handle lock-on devices and red handles for breakers serving fire alarm panels.

2.4 ACCESSORIES

- A. Provide REQUIRED accessories as described below. Provide SCHEDULED accessories when listed with plan schedules. Refer to plan schedules for additional requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards plumb as indicated on the drawings in conformance with NEMA PB 1.1.
- B. Height: 6 feet to handle of highest device.
- C. Provide filler plates for unused spaces in panelboards.
- D. Provide custom typed circuit directory for each branch circuit panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEIPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

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- E. Stub five (5) empty one-inch conduits to accessible location above ceiling out of each recessed panelboard and panelboards installed in electrical closets less than 36" deep.

3.2 FIELD QUALITY CONTROL

- A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION

SECTION 262723
INDOOR SERVICE POLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Indoor service poles

1.2 REFERENCES

- A. NEMA WD 1 - General Requirements for Wiring Devices

1.3 SUBMITTALS

- A. Submit product data under provisions of Section 260500.
- B. Indicate materials, finishes, receptacle and connector configuration, and attachment details.
- C. Submit manufacturer's installation instructions under provisions of Section 260500.

1.4 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 260500.
- B. Include adjustment information and recommended care for finishes.

PART 2 - PRODUCTS

2.1 INDOOR SERVICE POLES (PP-1)

- A. Indoor Service Pole: Free standing surface metal raceway section with fittings, with integral pre-wired convenience receptacles and separate raceway for tele/data cable. Verify length with ceiling height to extend above accessible ceilings.
- B. Material: Steel main body and coverplates.
- C. Finish: As selected by the Architect.
- D. Convenience Receptacles: NEMA WD1; Type 5-20R configuration, four per pole. Pre-wired receptacle with No. 12 AWG copper conductor to outlet box attached to pole top, above ceiling. Leave 6-inch leads.

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- E. Tele/Data Wiring Raceway: Adequate for six (6) Cat 6 data cables. Include full size opening at top of pole. Provide knockouts at 6" above floor for mounting two (2) decorative style covers.
- F. Top Clamp: Concealed above ceiling, minimum 6" above finished ceiling suitable for securing pole to inverted "T" grid suspension member. Include trim plate to enclose openings cut in ceiling panel.
- G. Foot: Suitable for positive anchoring to hard surface floor, unless otherwise indicated on the drawings.
- H. Manufacturers:
 - 1. Wiremold 25DTP series
 - 2. Hubbell HBLPP1 series
 - 3. Thomas & Betts PP1 series

2.2 INDOOR SERVICE POLES (PP-2)

- A. Indoor Service Pole: Free standing surface metal raceway section with fittings, with integral pre-wired furniture whip and separate raceway for tele/data cable. Verify length with ceiling height to extend above accessible ceilings.
- B. Material: Steel main body and coverplates.
- C. Finish: As selected by the Architect.
- D. Furniture Whip: Provide with 4-circuit furniture whip at 6" above floor. Pre-wired with No. 12 AWG copper conductors to box attached at pole top, above ceiling. Leave 6-inch leads.
- E. Tele/Data Wiring Raceway: Adequate for six (6) Cat 6 data cables. Include full size opening at top of pole. Provide knockouts at 6 inches above floor for mounting two (2) decorative style covers.
- F. Top Clamp: Concealed above ceiling, minimum 6" above finished ceiling suitable for securing pole to inverted "T" grid suspension member. Include trim plate to enclose openings cut in ceiling panel.
- G. Foot: Suitable for positive anchoring to hard surface floor, unless otherwise indicated on the drawings.
- H. Manufacturers:
 - 1. Wiremold 25DTP series
 - 2. Hubbell HBLPP1 series
 - 3. Thomas & Betts PP1 series

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that installation of ceiling suspension system and other work above finished ceiling are completed.

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3.2 INSTALLATION

- A. Neatly cut openings in ceiling panels.
- B. Attach foot and top clamp in accordance with manufacturer's instructions.
- C. Install trim plate to enclose ceiling panel opening.
- D. Install poles plumb.
- E. Adjust installation of service pole to suit final partition and furniture locations.
- F. Provide nameplate identification per Section 260553.
- G. Test receptacles for proper polarity, ground continuity, and compliance with requirements. Refer to Section 262726 for additional information.

END OF SECTION

SECTION 262726

WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Device plates and box covers
- B. Modular connectors
- C. Receptacles (REC-#)
- D. Floor boxes and floor box with service fitting (FB-#)

1.2 REFERENCES

- A. DSCC W-C-896F - General Specification for Electrical Power Connector
- B. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet
- C. NEMA WD 1 - General Color Requirements for Wiring Devices
- D. NEMA WD 6 - Wiring Devices - Dimensional Requirements
- E. NFPA 70 - National Electrical Code (NEC)
- F. UL 498 - Standard for Attachment Plugs and Receptacles
- G. UL 943 - Standard for Ground Fault Circuit Interrupters

1.3 COORDINATION

- A. Receptacles for Owner Furnished Equipment: Match plug configurations.
- B. Cord and Plug Sets: Match equipment requirements.
- C. Coordinate installation of receptacle assemblies in countertops, furniture with the Contractor providing the furniture. Contractor shall coordinate penetrations and conduit routing in furniture with drawings and other obstacles below the installation surface.

PART 2 - PRODUCTS

2.1 DEVICE COLOR

- A. All switch, receptacle, and outlet colors shall be white, unless indicated otherwise. If existing devices in a space are color other than white, new devices shall match color of existing devices.

2.2 COVERPLATES

- A. All switches, receptacles, and outlets shall be complete with the following:
 - 1. #302 stainless steel coverplates in finished spaces where walls are finished.
- B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.
- C. Install nameplate identification as indicated in Section 260553.
- D. Plate securing screws shall be metal with head color matching the wall plate finish.

2.3 MODULAR CONNECTORS

- A. Devices listed below are traditional wired devices. Contractor option to provide equivalent modular connector-type devices (Hubbell Snap Connect, Pass & Seymour Plug Tail, Leviton Lev-Lock, Copper ArrowLink) where applicable.

2.4 RECEPTACLES

- A. Refer to Electrical Symbols List for device type.
- B. REC-DUP: NEMA 5-20R Duplex Receptacle:
 - 1. Spec Grade: 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face and brass back strap.
 - a. Manufacturers:
 - 1) Hubbell 5352
 - 2) Leviton 5362-S
 - 3) Pass & Seymour 5362
 - 4) Cooper 5362

C. REC-DUP-GFI: NEMA 5-20R Ground Fault Duplex Receptacle:

1. Standard Grade: 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face, listed.
 - a. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
 - b. Manufacturers:
 - 1) Leviton GFNT2
 - 2) Pass & Seymour 2097
 - 3) Cooper SGF20

D. REC-DUP-WP: NEMA 5-20R Weatherproof Ground Fault Duplex Receptacle:

1. 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face, weather resistant WR listed. Provide extra-duty NEMA 3R rated while-in-use clear outlet box hood.
2. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
 - a. Manufacturers:
 - 1) Leviton GFWT2 with aluminum housing M5979
 - 2) Pass & Seymour 2097TRWR with aluminum housing WIUCAST1
 - 3) Cooper WRSGF20 with aluminum housing WIUMV-1

E. REC-SIM-630R: NEMA 6-30R Simplex Receptacle:

1. 250-volt, 30 amp, 2-pole, 3-wire grounding type with thermoplastic face.
 - a. Manufacturers:
 - 1) Hubbell HBL9330
 - 2) Leviton 5372
 - 3) Pass & Seymour 3801
 - 4) Cooper 5700N

F. REC-SIM-650R: NEMA 6-50R Simplex Receptacle:

1. 250-volt, 50 amp, 2-pole, 3-wire grounding type with thermoplastic face.
 - a. Manufacturers:
 - 1) Hubbell HBL9367
 - 2) Leviton 5374
 - 3) Pass & Seymour 3804
 - 4) Cooper 5709N

G. REC-QUAD: NEMA 5-20R Double Duplex Receptacle:

1. Consists of two duplex receptacles, double gang box, plaster ring and faceplate.
 - a. Manufacturers:
 - 1) Refer to Duplex Receptacle above.

- H. REC-QUAD-GFI: NEMA 5-20R Double Duplex GFI Receptacle:
 - 1. Consists of two duplex GFI receptacles, double gang box, plaster ring and faceplate.
 - a. Manufacturers:
 - 1) Refer to Duplex GFI Receptacle above.
 - I. Back wired devices shall be complete with eight holes that are screw activated with metal clamps for connection to #12 or #10 copper conductors.
 - J. Side wired devices shall have four binding screws that are undercut for positive wire retention.
 - K. Ground fault circuit interrupter (GFCI) receptacles shall be listed and comply with UL 943 requiring increased surge immunity, improved corrosion resistance, improved resistance to false tripping and diagnostic indication for miswiring if the line and load conductors are reversed during installation.

2.5 FLOOR BOXES

- A. Cover, Color, and Style: custom options selected by Architect]. Rectangular cover, 180 degree access, satin nickel color.
- B. Refer to Technology drawings for voice/data, Audio/Video outlet, and coordination requirements.
- C. Floor Boxes Housing Material Based on Cast-in-Place Floor Type:
 - 1. Slab on Grade: Cast Iron or listed for slab on grade with special kit, coating ,or equivalent; corrosion resistant.
- D. FB-1: Concealed Center Compartment:
 - 1. Floor Box, flush-mounted hinged cover, square/rectangular center service area with closed while-in-use cover and cable egress doors in cover, provide complete with appropriate outlet cover plates and hardware. For use with 4-inch minimum concrete pour floors, fully adjustable, UL 514 scrub water listed.
 - 2. Gang / Outlet Descriptions:
 - a. 125 Volt, 20 amp, NEMA 5-20R duplex receptacle with 3/4-inch conduit.
 - b. Voice/Data outlet with 1-inch conduit. Refer to Technology drawings for additional information.
 - c. Audio/Visual outlet with 1-inch conduit. Refer to Technology drawings for additional information.
 - d. Spare with 3/4-inch conduit with pull string.
 - 3. Manufacturers:
 - a. Hubbell CFB Series
 - b. Legrand Wiremold RFB Series
 - c. ABB Steel City 664/665/667 Series

4. Installation: Group route raceway conduits under slab on grade or in ceiling space below to nearest wall or as shown on plans.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install convenience receptacles at elevations indicated in the General Installation Notes on the contract drawings.
- B. Install specific-use receptacles at heights shown on the contract drawings. Install devices level, plumb, and square with building lines. Coordinate installation of adjacent devices of separate systems with common mounting heights, including lighting, power, systems, technology, and temperature control device rough-ins.
- C. Ground Fault Protection: Provide ground fault protection for all branch circuit breakers serving 120/208 receptacles and electrical outlets rated 50 amps or less single-phase and 100 amps or less three-phase in the following locations, as shown on drawings, or required by adopted code:
 1. Bathrooms, locker rooms, shower rooms
 2. Kitchens' all 120-volt through 250-volt receptacles
 3. Rooftops
 4. Interior/Exterior locations subject to damp/wet conditions
 5. When located within 6 feet of sinks, bathtubs, and shower stalls
 6. Plug-and-cord receptacles when the utilization appliance is located within 6 feet of a sink edge.
 7. Garages, accessory buildings, service bays
 8. Specific Appliances: Auto vacuum machines, water drink/bottle fill coolers, pressure staying machines, tire inflation machines, vending machines, sump pumps, dishwashers, electric ranges, ovens, clothes dryers, microwave ovens
- D. Install receptacles vertically with ground slot up or where indicated on the drawings, horizontally with ground slot to the left.
- E. Install decorative plates on switch, receptacle, and blank outlets in finished areas, using jumbo size plates for outlets installed in masonry walls.
- F. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.
- G. Install devices and wall plates flush and level.
- H. Install nameplate identification to receptacle cover plates indicated. Identification shall identify panel name and circuit number. Refer to Specification Section 260553 - Electrical Identification.
- I. Test receptacles and modular wiring connectors for proper polarity, ground continuity and compliance with requirements.

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J. Floor Box Installation:

1. Set boxes level and flush with finish flooring material.
2. Use cast iron floor boxes for installations in slab on grade. Trim shall match floor covering to be used.
3. Provide a minimum horizontal offset of 24 inches between boxes.
4. Provide saw-cutting and patching of existing concrete floors as necessary for floor box installations within existing floors.

END OF SECTION

SECTION 262816
DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fusible switches
- B. Non-fusible switches
- C. Enclosures

1.2 RELATED SECTIONS AND WORK

- A. Refer to the Disconnect and Starter Schedule for rating and configuration.

1.3 REFERENCES

- A. NEMA KS 1 - Enclosed Switches

1.4 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE AND NON-FUSIBLE SWITCHES

- A. Acceptable Manufacturers:
 - 1. Square D 3110 Series
 - 2. Eaton DH Series
 - 3. ABB TH Series
 - 4. Siemens HNF / HF Series
- B. FDS-#; Fusible Switch Assemblies: NEMA KS 1; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position without a tool. Handle lockable in OFF position. Fuse Clips: Class 'R' fuse clips only, unless indicated otherwise on the drawings.

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- C. DS-#; Non-fusible Switch Assemblies: NEMA KS 1; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position without a tool. Handle lockable in OFF position.
- D. Enclosures: Type as indicated on the disconnect schedule.
- E. Accessories: Provide the following accessories. Refer to Disconnect Schedule for additional requirements for each application.
 - 1. Lockable
 - 2. Provide finger safe barriers for exposed line-side terminations and energized components when the switch is in the open position.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install disconnect switches where indicated on the drawings.
- B. Install fuses in fusible disconnect switches.
- C. Field coordinate installation with other contractors and equipment to maintain code required working space requirements.
- D. Provide adhesive label on inside door of each switch indicating UL fuse class and size for replacement.

3.2 ADJUSTING

- A. Set field-adjustable circuit breaker trip ranges.

END OF SECTION

SECTION 263600
TRANSFER SWITCH

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Portable generator connection cabinet (GCC-1)
- B. Manual transfer switch MTS-1

1.2 RELATED SECTIONS AND WORK

- A. Refer to the Transfer Switch Schedule for rating and configuration.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in automatic transfer equipment with three (3) years documented experience.

1.4 REFERENCES

- A. NEMA ICS 1 - General Standards for Industrial Control and Systems
- B. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers, and Assemblies
- C. NEMA ICS 6 - Enclosures for Industrial Controls and Systems
- D. NEMA ICS 10 - Guide to Application of Low-Voltage Automatic Transfer Switch Equipment
- E. UL 1008 - Standard for Automatic Transfer Switches
- F. NFPA 110 - Standard for Emergency and Standby Power Systems

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 260500.
- B. Submit product data for transfer switches showing overall dimensions, electrical connections, electrical ratings, and environmental requirements.
- C. Submit manufacturer's installation instructions under provisions of Section 260500.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 260500.
- B. Include instructions for operating equipment.
- C. Include instructions for operating equipment under emergency conditions when engine generator is running.
- D. Identify operating limits which may result in hazardous or unsafe conditions.
- E. Document ratings of equipment and each major component.
- F. Include routine preventive maintenance and lubrication schedule.
- G. List special tools, maintenance materials, and replacement parts.

1.7 REGULATORY REQUIREMENTS

- A. Conform to applicable code for emergency and standby electrical systems.

PART 2 - PRODUCTS

2.1 PORTABLE GENERATOR (GCC-1)

- A. Acceptable Manufacturers:
 - 1. Foxfab FFCC Series
 - 2. Berthold Electric Co
 - 3. Power Temp Systems Inc
 - 4. ESL Power Systems Triple Switch Series
 - 5. Trystar
- B. Pad mount, powder coat painted NEMA 3R housing with lockable door, 1000 amps, 600 volt. Color-coded cam-lock connectors. Submit product data and dimensioned drawings. Color selection by Architect.
 - 1. Portable Generator Cam Lock Receptacle: Male plug, female cable
- C. Accessories: Provide the following required accessories.
 - 1. Generator Start Signals: Provide parallel generator start cabling from the transfer switches to the portable generator cabinet. Provide quick connect type connections for the generator start signals.
 - 2. Indicators:
 - a. Generator "ON" indicator
 - b. Utility "ON" indicator
 - c. Phase Monitor: A-B-C phase rotation monitor indicator.

- d. Cabinet Heater: Provide cabinet heater with thermostat/humidistat sized per manufacturer recommendations to prevent condensation inside cabinet. EC to provide branch circuit wiring per approved shop drawings.

D. Provide engraved plastic label including:

1. System voltage
2. Maximum amps
3. Short Circuit Current Rating SCCR
4. Phase rotation direction
5. Phase, ungrounded conductor, and grounding identification

2.2 MANUAL TRANSFER SWITCH

A. Acceptable Manufacturers:

1. ASCO 300 Series
2. Russelectric RMT Series
3. ABB Zenith ZTG Series
4. Cummins OTPC Series
5. Generac W Series
6. Kohler KCS Series

B. Description: NEMA ICS2; manual transfer switch.

C. Configuration: Manually-operated, three-position center-off transfer switch.

D. Engine start switch.

2.3 SERVICE CONDITIONS

A. Service Conditions: NEMA ICS 1. Suitable for use as service entrance equipment. Provide line side (service style) barriers.

2.4 RATINGS

A. Refer to the electrical diagrams for the Withstand and Close Ratings WCR available interrupting capacity (AIC) at the transfer switch. The transfer switch shall be series rated with the equipment feeding the transfer switch. The series rating shall be the larger of the two Short Circuit Current Ratings SCCR values when the SCCR rating of the equipment feeding the normal and emergency sides of the transfer switch is not equal.

B. Series rating with upstream devices shall be allowed per UL-1008.

2.5 ENCLOSURE

A. Enclosure: NEMA ICS 6; Type 1.

2.6 ACCESSORIES

- A. Provide 2 N.O. and 2 N.C. isolated contacts to indicate:
 - 1. Normal source available.
 - 2. Emergency source available.
 - 3. Exercise mode in operation.

- B. Metering Capabilities: The following metered readings shall be available at the local display.
 - 1. Current, per phase RMS and neutral
 - 2. Current unbalance %
 - 3. Voltage, phase-to-phase and phase-to-neutral
 - 4. Voltage unbalance %
 - 5. Real power (KW), per phase and 3-phase total
 - 6. Apparent power (KVA), per phase and 3-phase total
 - 7. Power factor, 3-phase total & per phase
 - 8. Demand, (KWH, KVA)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify field measurements are as instructed by the manufacturer.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 264300
SURGE PROTECTION DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes materials and installation requirements for factory and field wired low voltage surge protection devices (SPD) for the protection of all AC electrical circuits. SPD equipment to be installed at designated service entrance equipment.

1.2 QUALITY ASSURANCE

- A. The specified unit shall be designed, manufactured, tested and installed in compliance with the above references. The unit shall be "Listed by Underwriters Laboratories" to UL 1449.
- B. Each unit shall be designed and manufactured by a qualified manufacturer of power conditioning equipment. The qualified manufacturer must have been engaged in the design and manufacturer of such products for a minimum of five years.

1.3 REFERENCES

- A. ANSI/IEEE C62.33 - IEEE Guide on Testing of MOV components
- B. ANSI/IEEE C62.35 - IEEE Guide on Testing of SAD components
- C. ANSI/IEEE C62.41 - IEEE Recommended Practice on Surge Voltage in Low Voltage AC Power Circuits
- D. ANSI/UL 1449 Latest Edition - UL Standard for Safety for Surge Protective Devices
- E. IEC 664 - International Engineering Consortium, Standard for Clamping Voltage
- F. NFPA 70 - National Electrical Code (NEC)
- G. UL 67 - Listed for Internal Panelboard Transient Voltage Surge Suppressors
- H. UL 96A - Devices listed as approved for secondary surge arrestors (VZCA)
- I. UL 248-1 - Fusing
- J. UL 1283 - Electromagnetic Interference Filters, Fifth Edition

1.4 SUBMITTALS

- A. Shop Drawings: Should include device dimensions, mounting requirements including wire size and over-current protection device rating, nameplate nomenclature, electrical ratings, short circuit current rating, and test results as indicated below under "Testing, Warranty and Life Expectancy" as provided by an independent test lab or a UL certified test lab for the category(ies) of suppression device(s) specified using the appropriate IEEE test wave. Product data sheets with installation instructions for each size and type of device are required. Shop drawings submitted without the testing data as required by section this section will be rejected.
- B. Fuse information: Provide fuse information if required for operation. Include size, manufacturer, time-current chart responses to UL 1449 testing requirements, maximum surge protection capability per mode and phase as limited by the fuse, and verification of repetitive surge protection device operation without system degeneration greater than 10%.

1.5 TESTING, WARRANTY AND LIFE EXPECTANCY

- A. Minimum Repetitive Surge Current Capacity:
 - 1. Service entrance suppressor units should be tested repetitively at an independent lab to verify repetitive capacity.
 - 2. Minimum Repetitive Surge Current Capacity Test:
 - a. An initial UL 1449 surge defined as 1.2 x 50 μ s, 6000V open circuit voltage waveform and an 8 x 20 μ s, 500A and 3kA short circuit current waveform shall be applied to benchmark the unit's suppression voltage.
 - b. A repetitive number of ANSI/IEEE C62.41.2-2002 (Category C3) surges, defined as a 1.2 x 50 μ s 10kV or 20kV open circuit voltage waveform and an 8 x 20 μ s 10,000A short circuit current waveform, shall then be applied at one-minute intervals.
 - c. To complete the test, another UL 1449 surge shall be applied to verify the unit's survival.
 - 3. Survival is achieved if the suppression voltage (VPR) does not vary by more than 10%.
 - 4. Proof of such testing shall be the test log generated by the surge generator.
- B. Provide UL 1449 classification white sheet pages indicating the VPR (voltage protection rating) for each SPD unit submitted for this product using the 6kV/3kA combination wave surge.
- C. Warranty: Ten (10) years. Includes workmanship, installation and programming.
- D. No scheduled parts replacement or preventative maintenance shall be required.

PART 2 - PRODUCTS

2.1 DESCRIPTION

- A. General: The unit shall provide transient voltage suppression, surge current diversion and high-frequency noise attenuation, when connected in parallel to the facilities distribution system. The unit MCOV shall not be less than 115% of the nominal system voltage. Operating frequency shall be for a 60 Hz system. The unit shall provide protection in all normal modes for "wye" and "delta" systems.

- B. Short Circuit Current Rating: Provide factory label for SCCR rating. The short circuit current rating shall be the larger of the listed value on the drawings or as required by the equipment protected.

2.2 RATINGS

- A. SPD-1; Service Entrance Suppressors:

1. For 120/208]-volt, 3 phase, 4 wire, type 2, category C3 unit.
 - a. Surge current capacity: 80,000/160,000 amps per protection mode/phase
 - b. Nominal Discharge Current: 20 kA.
 - c. Mounting: Refer to the drawings.
 - d. Voltage Protection Rating: Refer to requirements below.
 - e. Components: Minimum component size of 20mm thermally protected metal oxide varistors (MOV).
 - f. Disconnect: Surge-rated disconnect with 200,000 SCCR.
2. Manufacturers:
 - a. Square D Surgelogic EMA Series
 - b. Siemens TPS4 Series
 - c. Eaton SPD Series
 - d. Current Technology Current Guard Plus
 - e. ASCO Power Technologies 400 Series
 - f. LEA International LSS Series

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine equipment for size and type of surge protection device to be used to ensure physical compatibility.
- B. Inspect surge protection device for any signs of physical damage due to shipping or handling before installing surge protection device.

3.2 INSTALLATION

- A. Mounting Location:
 1. The unit shall be installed as close as practical to the panel secondary lugs in accordance with applicable national/Local Electrical Codes and the manufacturer's recommended installation instructions. Connect the unit to the panel using a conduit nipple. Flush mount the unit in the front of the switchboard. Mount unit directly across from the breaker or disconnect serving it.
 2. Integral surge protection devices mount between the main and branch circuit breakers.
 3. If internal surge protection device is specified, device shall be installed in a barrier compartment isolated from other components.

B. Connections:

1. Conductors from the protected bus to the unit shall not be any longer than necessary avoiding unnecessary bends. The conductor leads shall be twisted together and as short as possible. Connection shall be with mechanical lugs for each phase, neutral, and ground if applicable. Contractor shall provide wire and circuit breakers sized per the approved manufacturer's requirements. Maximum lead length from protected bus to surge protection device shall be per manufacturer's requirements, but no greater than 5'-0".
2. The surge protection unit shall be isolatable from the electrical distribution system via 3 pole circuit breaker mounted in the switchboard/panelboard. Single phase 120-volt units shall be hardwired without a disconnecting means.
3. Neutral and ground shall not be bonded together at secondary panelboard locations.

C. General:

1. Check unit for proper operation of protection and indication under start-up.
2. Check unit to ensure all MOVs for each mode of protection are operational. Verify integral fuse links are operational and have not melted.
3. Surge suppression devices shall not be installed ahead of the main service disconnect(s).
4. Install fuses in all fuse holders and fused disconnects internal to the surge protection unit. Use fuses recommended by the manufacturer to satisfy repetitive UL 1449 operation of the surge suppression unit. External fusing of the surge protection device is not allowed.
5. Coordinate location of surge protection device to allow adequate clearances for maintenance.
6. Manufacturer service phone number shall be posted on the front of the surge protection device.

END OF SECTION

SECTION 265119

LED LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Interior luminaires and accessories
- B. Light-emitting diode (LED) luminaire systems
- C. LED emergency lighting units
- D. Emergency exit signs
- E. Emergency inverter for LED light engines (individual luminaires - integral)

1.2 RELATED SECTIONS

- A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of comparable product solutions available by competitive manufacturers. The Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. The Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:
 - 1. 26 09 34 Lighting Control Systems
 - a. Automatic load control relay (ALCR) (individual luminaire - integral) (ALCR3)
 - 2. Electrical drawings: Plans, luminaire schedules, lighting control sequence of operations, diagrams, and details.

1.3 REFERENCES

- A. ANSI C78.377 - Specifications for the Chromaticity of Solid State Lighting Products
- B. ANSI C82.16 - Light-Emitting Diode Drivers - Method of Measurement
- C. ANSI C82.77 - Standard for Harmonic Emission Limits and Related Power Quality Requirements for Lighting Equipment
- D. NFPA 70E - National Electrical Safety Code
- E. NEMA SSL1 - Electronic Drivers for LED Devices, Arrays or System

- F. UL 8750 - Light Emitting Diode (LED) Equipment for use in Lighting Products
- G. LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products
- H. LM-80 - Measuring Luminous Flux and Color Maintenance of LED
- I. FS W-L-305 - Light Set, General Illumination (Emergency or Auxiliary)
- J. UL 924 - Standard for Emergency Lighting and Power Equipment

1.4 SUBMITTALS

- A. Submit product data under provisions of Section 260500.
- B. Basic Requirements of Submittal:
 - 1. Submit product data sheets for luminaires, LED light engines, drivers and poles. Include complete product model number with all options as specified. Submittal shall be arranged with luminaires listed in ascending order, and with each luminaire's, LED light engine, driver, or pole information following luminaire's product data. Failure to organize submittal in this manner will result in the submittal being rejected.
 - 2. Submit lens product data, dimensions and weights if not included in product data sheet submittal.
 - 3. Include outline drawings, support points, weights, and accessory information for each luminaire.
 - 4. Submit manufacturer origin of LED chipset and driver.
- C. LED Lighting - Control Compatibility Submittal:
 - 1. Submit lighting control capability data for each LED luminaire. The submittal shall clearly identify device data proposed by the Contractor and approved by the luminaire manufacturer for dimming, switching, addressable, wireless, and similar control characteristics.
- D. Submit Design Lights Consortium (DLC) information for each luminaire type.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site. Store and protect under provisions of Section 260500.
- B. Protect luminaire finishes, lenses, and trims from damage during storage and installation. Do not remove protective films until construction cleanup within each area is complete.

1.6 WARRANTY

- A. The warranty period begins at the date of Substantial Completion.
- B. LED Light Engines and Drivers:
 - 1. LED Drivers and Dimming Drivers: Five (5) years

2. Light Emitting Diode (LED) Light Engines: Five (5) years
- C. Emergency Lighting Units and Exit Signs:
 1. Emergency Lighting Units: Three (3) year, non-prorated
 2. Exit Signs: Three (3) year, non-prorated
 3. Emergency Unit and Exit Sign Battery: Sealed lead acid or lead calcium cell, requiring no maintenance or replacement for ten (10) years under normal conditions.
- D. Emergency Drivers:
 1. Emergency LED Driver: Three (3) years
- E. Emergency Inverter for LED Light Engines:
 1. Emergency Inverter and Battery: Sealed nickel cadmium five (5) year, non-prorated.
- F. Automatic Load Control Relay (ALCR): Five (5) year

1.7 REGULATORY REQUIREMENTS

- A. Conform to NFPA 101 for installation requirements.

PART 2 - PRODUCTS

2.1 INTERIOR LUMINAIRES AND ACCESSORIES - GENERAL

- A. Lensed Troffers: Provide hinged frames with latches and 0.125-inch thick virgin acrylic lenses. Prismatic lenses shall have depth of no less than 0.080", KSH12 or equal. Other lenses as scheduled.
- B. Recessed Luminaires: Confirm ceiling and wall type and furnish trim and accessories necessary to permit proper installation in each system. Where fire-rated ceiling or wall assemblies are specified, furnish and install listed enclosures around luminaires that maintain the system rating.
- C. Luminaires: Louvers shall be anodized low iridescent specular aluminum with mitered corners and interlocking construction.
- D. Suspended Luminaires: Coordinate power feed and suspension canopies with ceiling type and architectural RCP for proper fit and location. Ensure finished installations are plumb and level at elevations specified. Verify suspension length prior to submittal.
- E. Painted reflector surfaces shall have a minimum reflectance of 90%.
- F. All painted components shall be painted after fabrication.

2.2 LIGHT EMITTING DIODE (LED) LUMINAIRE SYSTEMS

- A. Light emitting diodes used in interior applications shall have a minimum color rendering index (CRI) of 80. Light emitting diodes used in exterior applications shall have a minimum color rendering index (CRI) of 70. Color temperature of the luminaires shall be as noted on the luminaire schedule. Provide light source color consistency by utilizing a binning tolerance within a maximum 3-step McAdam ellipse unless noted otherwise.
- B. Refer to the luminaire schedule for color temperature and minimum color rendering index CRI requirements. Provide light source color consistency by utilizing a binning tolerance within a maximum 3-step McAdam ellipse unless noted otherwise.
- C. LED chip arrays specified as color changing shall have chip colors as noted on the luminaire schedule.
- D. Rated life shall be minimum of 50,000 hours at L70.
- E. LED chips shall be wired so that failure of one chip does not prohibit operation of the remainder of the chip array.
- F. Luminaire delivered lumens is defined as the absolute lumens per the manufacturers LM-79-08 test report.
- G. LED luminaires shall be designed for ease of component replacement including modular replaceable boards or Zhaga sockets. Luminaires that are factory sealed and do not have field replaceable parts shall provide a 10-year warranty.
- H. LED light engine shall have a maximum LLD of 0.85 at 50,000 hours at 25°C ambient.

2.3 LED EMERGENCY LIGHTING UNITS

- A. Self-Powered Emergency Lighting Units: One-piece, self-contained unit with sealed, maintenance-free nickel cadmium battery, automatic charger and electronic circuitry. Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
- B. Battery: Maintenance free lead calcium type, with 90 minute capacity to supply the connected lamp load.
- C. Charger: Dual-rate solid state current limiting charger, capable of maintaining the battery in a full-charge state during normal conditions, and capable of recharging discharged battery to full charged within 168 hours. Low voltage disconnect to prevent deep discharge of battery.
- D. LED Lamp Wattage: As scheduled on luminaire schedule.
- E. Remote Lamps: Match LED lamps on unit.
- F. Indicators: Provide lamps to indicate AC ON and RECHARGING.
- G. Provide test switch to transfer unit from normal supply to battery supply.
- H. Electrical Connection: Knockout for conduit connection.

- I. Unit Voltage: Refer to luminaire schedule volts, AC.
- J. Self-Diagnostics and Testing:
 - 1. Unit shall be self-diagnostic with continuous monitoring of charger performance and battery voltage. Any malfunction of battery, charger, transfer circuit, or emergency lamps shall be detected and visually indicated.
 - 2. Unit shall be programmed to exercise the battery and test emergency operation by performing a five-minute discharge/diagnostic cycle every six months. A manual test switch shall allow a five-minute discharge/diagnostic test at any time.

2.4 EMERGENCY EXIT SIGNS

- A. Exit Signs: Stencil face, 6-inch high letters, directional arrows as indicated, universal mounting type as indicated on the drawings.
- B. Self-Powered Exit Signs: Stencil face, 6-inch high letters, directional arrows as indicated, universal mounting type as indicated on the drawings. One-piece, self-contained unit with sealed, maintenance-free nickel cadmium battery, test switch, AC ON pilot light, automatic charger, and electronic circuitry. Power failure relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
- C. Directional Indicators: The directional indicator for exit signage shall be of a chevron type meeting all requirements of NFPA 101.
- D. Self-Diagnostics and Testing:
 - 1. Unit shall be self-diagnostic with continuous monitoring of charger performance and battery voltage. Any malfunction of battery, charger, transfer circuit, or emergency lamps shall be detected and visually indicated.
 - 2. Unit shall be programmed to exercise the battery and test emergency operation by performing a five-minute discharge/diagnostic cycle every six months. A manual test switch shall allow a five minute discharge/diagnostic test at any time.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Securely fasten luminaires to the listed and labeled ceiling framing member by mechanical means such as bolts, screws, rivets or listed clips identified for use with the type of ceiling framing members. The architectural ceiling framing system may be used in lieu of independent support with prior written approval by the ceiling system manufacturer and Authority Having Jurisdiction (AHJ). Luminaires and wiring installed in fire-rated ceiling assemblies shall be independently supported for all applications.
- B. Do not fasten luminaire supports to piping, ductwork, mechanical equipment, or conduit, unless otherwise noted. Support wires shall be tightly wrapped (minimum of three turns within 3 inches of the connection) and sharply bend to prevent vertical movement.

- C. Support suspended or pendant mounted luminaires independent of ceiling grid with adjustable stainless steel aircraft cables or per luminaire schedule mounting requirements. Suspension assembly and anchors shall be capable of supporting 300 pounds dead load at each suspension point.
- D. Support wire used to independently support luminaires, raceways, and wiring systems shall be distinguishable from ceiling support systems by color (field paint), tagging or equivalent means.
- E. Install lamps in lamp holders of luminaires.
- F. Adjust aimable luminaires to obtain lighting levels on objects and areas as directed to obtain desired lighting levels.
- G. Industrial Pendant Luminaires: Use hangers rated 500 pounds minimum or provide safety chain between driver and structure. Provide safety chain between reflector and driver.

3.2 CONSTRUCTION USE OF PROJECT LUMINAIRES

- A. The Contractor shall provide temporary construction lighting per the requirements of Division 1.
- B. The project luminaires shown on the construction documents shall not be used for temporary construction purposes without providing a plan for Owner approval that addresses energy and luminaire operating hours.

3.3 AUTOMATIC LOAD CONTROL RELAYS

- A. Factory or field installation per manufacturer requirements.
- B. Remote Test Switch: Provide connection to remote test switch.
- C. Fire Alarm Override: Provide connection to addressable fire alarm relay.

3.4 RELAMPING

- A. Replace failed LED light engine modules or arrays at completion of work.

3.5 ADJUSTING AND CLEANING

- A. Align luminaires and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires.

3.6 OWNER TRAINING

- A. Test emergency lighting equipment for 60 minutes to determine proper operation, prior to Substantial Completion, with the Owner's Representative.
- B. Provide electronic copy of periodic test log form to Owner's Representative. Explain and instruct Owner's Representative of requirements for testing and maintenance. Refer to latest adopted NFPA 101 for testing and logging requirements.

December 20, 2024

3.7 LUMINAIRE SCHEDULE

- A. As shown on the drawings.

END OF SECTION

SECTION 270500

BASIC COMMUNICATIONS SYSTEMS REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Basic Communications Systems Requirements specifically applicable to Division 27 sections, in addition to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

- A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Communications Systems.
- B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make the portion of the Communications Work a finished and working system.
- C. Separate contracts will be awarded for the following work.
- D. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- E. Separate contracts will be awarded for the following work. The division of work listed below is for the contractors' convenience and lists a normal breakdown of the work. Please refer to the Construction Manager's scope statements for complete scope of work description.
- F. Description of Systems include, but are not limited to, the following:
 - 1. Complete Structured Cabling System including, but not limited to:
 - a. Horizontal cabling and terminations.
 - b. Information outlets (IOes) including faceplates, jacks and labeling.
 - c. Telecommunication Room equipment including patch panels, cabinets, and termination blocks.
 - d. Cabling pathways.
 - e. Grounding and Bonding
 - f. Testing
 - 2. Complete Data Communications Equipment Systems.
 - 3. Complete Voice Communications Equipment Systems.
 - 4. Removal/demolition work and/or relocation and reuse of existing systems and equipment.
 - 5. Low Voltage Communications Wiring (less than +120VAC) as specified and required for proper system control and communications.

6. All associated electrical backboxes, conduit, miscellaneous cabling, and power supplies required for proper system installation and operation as defined in the "Suggested Matrix of Scope Responsibility".
7. Firestopping of penetrations as described in Division 7.

1.3 WORK SEQUENCE

- A. All construction work that will produce excessive noise levels and interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during non-occupied hours. The Owner shall reserve the right to set policy as to when restricted construction hours will be required.

1.4 DIVISION OF WORK BETWEEN ELECTRICAL AND COMMUNICATIONS CONTRACTORS

- A. Division of work is the responsibility of the Prime Contractor. Any scope of work described in the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described in the contract documents. The following division of responsibility is a guideline based on typical industry practice.
- B. Definitions:
 1. "Electrical Contractor" as referred to herein refers to the Contractors listed in Division 26 of this Specification.
 2. "Electrical Contractor" shall also refer to the Contractor listed in Division 27 of this specification when the "Suggested Matrix of Scope Responsibility" indicates the work shall be provided by the EC. Refer to the Contract Documents for the "Suggested Matrix of Scope Responsibility".
 3. "Technology Contractor" as referred to herein refers to the Contractors listed in Division 27 of this Specification.
 4. Low Voltage Technology Wiring: The wiring (less than 120VAC) associated with the Technology Systems, used for analog and/or digital signals between equipment.
 5. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation and mounting of the telecommunications/technology outlet. Rough-in shall include conduit from the information outlet backbox to above the lay-in ceiling. Where surface mounted backboxes are required, conduit shall be routed to above the lay-in ceiling or the bottom of the exposed structural joists.
- C. General:
 1. The purpose of these specifications is to outline typical Electrical and Technology Contractor's work responsibilities as related to technology systems including telecommunications rough-in, audio/visual systems rough-in, conduit, power wiring, and low voltage communications and technology wiring. The prime contractor is responsible for all divisions of work.

2. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals are approved. Therefore, only known wiring, conduits, raceways, and electrical power as related to such items, is shown on the technology drawings. Other wiring, conduits, raceways, junction boxes, and electrical power not shown on the technology drawings but required for the successful operation of the systems shall be the responsibility of the Technology Contractor and included in the Contractor's bid.
3. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of technology systems, the final installation shall not begin until a coordination meeting between the Electrical Contractor and the Technology Contractor has convened to determine the exact location and requirements of the installation.
4. Where the Electrical Contractor is required to install cable tray that will contain low voltage technology wiring, the installation shall not begin until the Technology Contractor has completed a coordination review of the cable tray shop drawing.
5. This Contractor shall establish electrical and technology utility elevations prior to fabrication and installation. The Technology Contractor shall cooperate with the Electrical Contractor and the determined elevations in accordance with the guidelines below. This Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:
 - a. Lighting Fixtures
 - b. Gravity Flow Piping, including Steam and Condensate
 - c. Sheet Metal
 - d. Electrical Busduct
 - e. Cable Trays, including 12" access space
 - f. Sprinkler Piping and other Piping
 - g. Conduit and Wireway
 - h. Open Cabling

D. Electrical Contractor's Responsibility:

1. Assumes all responsibility for all required conduit and power connections when shown on the "Suggested Matrix of Scope Responsibility" to be provided by the Electrical Contractor.
2. Responsible for Communications Systems grounding and bonding.
3. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Technology Contractor's Responsibility:

1. Assumes all responsibility for the low voltage technology wiring of all systems, including cable support where open cable is specified.
2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being provided by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility."
3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).
4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of technology equipment which is required to be bonded to the technology bonding system.

5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.5 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
 - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - d. Maintenance clearances and code-required dedicated space shall be included.
 - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.
 - a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.
3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.

2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.

6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
 - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
 - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain signoff of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.6 QUALITY ASSURANCE

A. Telecommunications Structured Cabling System Standards:

1. All work and equipment shall conform to the most current ratified version of the following published standards unless otherwise indicated that draft standards are to be followed:
 - a. ANSI/NECA/BICSI 568 - Standard for Installing Commercial Building Telecommunications Cabling
 - b. ANSI/TIA-568-C.0 - Generic Telecommunications Cabling for Customer Premises
 - 1) C.1 - Commercial Building Telecommunications Standard
 - 2) C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standard
 - 3) C.3 - Optical Fiber Cabling Components Standard
 - 4) C.4 - Broadband Coaxial Cabling and Components Standard
 - c. ANSI/TIA-569-C - Telecommunications Pathways and Spaces
 - d. ANSI/TIA-606-B - Administration Standard for Commercial Telecommunications Infrastructure
 - e. ANSI/TIA-607-B - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
 - f. NFPA 70 (NEC) - National Electrical Code (Current Edition)

- B. Refer to individual sections for additional Quality Assurance requirements.
- C. Qualifications:
 - 1. Only products of reputable manufacturers as determined by the Architect/Engineer will be acceptable.
 - 2. The installing Contractor shall be certified by the manufacturer of the structured cabling system. Certification of Contractor shall have been in place for a minimum of one (1) year prior to bidding this project. Documentation of certification is required at the time of bid. Shop drawings will not be approved until proof of certification is submitted. Refer to the end of this specification section for certification documentation requirements.
 - 3. Each Contractor and their subcontractors shall employ only workers who are skilled in their respective trades and fully trained. All workers involved in the termination of cabling shall be individually certified by the manufacturer.
 - 4. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size.
 - 5. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and copper structured cabling systems and have personnel adequately trained in the use of such tools and equipment.
 - 6. The Contractor shall have certified BICSI installation technicians or CNet CNIT (Certified Network Infrastructure Technician) on staff to perform the following tasks on the project:
 - a. Act as the field superintendent or job foreman with the responsibility of monitoring the daily work of each technician.
 - b. Oversee all testing and termination of cabling.
 - 7. The Contractor shall have certified BICSI Installer 2 or CNet CNCI (Certified Network Cabling Installer) on staff to perform the following tasks:
 - a. Installation and termination of copper cable.
 - 8. A resume of qualification shall be submitted with the Contractor's bid indicating the following:
 - a. Documentation of certification of This Contractor by the proposed structured cabling system manufacturer as required at the end of this specification section.
 - b. A list of recently completed projects of similar type and size with contact names and telephone numbers for each.
- D. Compliance with Codes, Laws, Ordinances:
 - 1. Conform to all requirements of the City of <Des Moines> Codes, Laws, Ordinances and other regulations having jurisdiction.
 - 2. In the event there are no local codes having jurisdiction over this job, the current issue of the National Electrical Code shall be followed.
 - 3. If there is a discrepancy between the codes and regulations having jurisdiction over this installation, and these specifications, Architect/Engineer shall determine the method or equipment used.

4. If the Contractor notes, at the time of bidding, any parts of the drawings and specifications which are not in accordance with the applicable codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time to follow this procedure, he shall submit with the proposal, a separate price required to make the system shown on the drawings comply with the codes and regulations.
5. Verify the installation environment prior to purchasing or installing any cable. Cable installed in a plenum environment shall be appropriately rated. Bring all discrepancies between the contract documents and installation conditions to the attention of the Architect/Engineer prior to purchase or installation.
6. All changes to the system made after the letting of the contract, in order to comply with the applicable codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.

E. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all applicable laws, regulations, ordinances, and other rules of the State or Political Subdivision wherein the work is done, or as required by any duly constituted public authority.
3. Pay all applicable charges for such permits or licenses that may be required.
4. Pay all applicable fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections due to codes, permits, licenses or as otherwise may be required by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized independent agency/consultant.
7. Pay any charges by the service provider related to the service or change in service to the project.
8. All equipment and materials shall be as approved or listed by the following (unless approval or listing is not applicable to an item by all acceptable manufacturers):
 - a. Factory Mutual
 - b. Underwriters' Laboratories, Inc.

F. Service Provider Requirements:

1. Secure from the telecommunications service provider all applicable requirements.
2. Comply with all service provider requirements.
3. The Owner shall make application for and pay for new telecommunications service equipment and installation. The Contractor shall coordinate schedule and requirements with the Owner and service provider.

G. Examination of Drawings:

1. The drawings for the technology systems work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and the exact routing of cabling to best fit the layout of the job. Scaling of the drawings will not be sufficient or accurate for determining this layout. Where a specific route is required, such route will be indicated on the drawings.

3. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
4. If an item is either shown on the drawings, called for in the specifications or required for proper operation of the system, it shall be considered sufficient for including same in this contract.
5. The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.
6. Where words "provide", "install", or "furnish" are used on the drawings or in the specifications, it shall be taken to mean, to furnish, install and terminate completely ready for operation, the items mentioned.

H. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
4. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
5. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
6. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
7. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

I. Field Measurements:

1. Before ordering any materials, this Contractor shall verify all pertinent dimensions at the job site and be responsible for their accuracy.
2. Field conditions that will result in telecommunications drops that exceed the length limitations identified in the contract documents shall be brought to the attention of the Architect/Engineer prior to installation. The cost of reworking cabling that is too long, that was not brought to the written attention of the Architect/Engineer will be borne entirely by the Contractor.
3. This Contractor shall provide the Architect/Engineer with written documentation of any cabling drops that will not be able to use the cable tray (where cable tray is available) due to the resulting cabling lengths. This documentation shall be submitted prior to installation and installation shall not commence until approved by the Architect/Engineer.

1.7 WEB-BASED PROJECT SOFTWARE

- A. The General Contractor shall provide a web-based project software site for the purpose of hosting and managing project communication and documentation until completion of the warranty phase.
- B. The web-based project software shall include, at a minimum, the following features: construction schedule, submittals, RFIs, ASIs, construction change directives, change orders, drawing management, specification management, payment applications, contract modifications, meeting minutes, construction progress photos.
- C. Provide web-based project software user licenses for use by the Architect/Engineer. Access will be provided from the start of the project through the completion of the warranty phase.
- D. At project completion, provide digital archive of entire project in format that is readable by common desktop software applications in format acceptable to Architect/Engineer. Provide data in locked format to prevent further changes.

1.8 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.
- B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.
- C. Change order work shall not proceed until authorized.

1.9 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to prevent damage to fixtures, equipment and materials.
- B. Store materials on the site to prevent damage.
- C. Keep fixtures, equipment and materials clean, dry and free from deleterious conditions.

1.10 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.11 WARRANTY

- A. At a minimum, provide a one (1) year warranty for all equipment, materials, and workmanship. Individual specifications sections within Division 27 may require additional warranty requirements for specific equipment or systems.
- B. The warranty period for the entire installation described in this Division of the specifications shall commence on the date of substantial completion unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner or their representative.
- C. Warranty requirements shall extend to correction, without cost to the final user, of all work and/or equipment found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from such defects or nonconformance with contract documents exclusive of repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.12 INSURANCE

- A. Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.13 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the first named manufacturer constitutes the basis for job design and establishes the equipment quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meets all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Architect/Engineer shall make the final determination of whether a product is equivalent.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor bears full responsibility for the unnamed manufacturers equipment adequately meeting the intent of design. The Architect/Engineer may reject manufacturer at time of shop drawing submittal. The Contractor assumes all costs incurred by other trades on the project as a result of changes necessary to accommodate the offered material, equipment or installation method.

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- D. Should this Contractor be unable to secure approval from the Architect/Engineer for other unnamed manufacturers as outlined above, this Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder. Should a voluntary alternate material be accepted, This Contractor shall assume all costs that may be incurred as a result of using the offered material, article or equipment necessitating extra expense on This Contractor or on the part of other Contractors whose work is affected.

PART 2 - PRODUCTS

2.1 CABLE JACKET RATING

2.2 Refer to individual sections.

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Installation of all conduit and cabling shall comply with Sections 26 05 33 and 26 05 13. Additional conduit requirements described within this Division shall be supplemental to the requirement described in Section 260533. Should conflicts exist between the two Divisions the more stringent (more expensive material and labor) condition shall prevail until bidding addendum or construction clarification or RFI can be submitted and responded to. In no case shall the Contractor carry the least stringent condition in the pricing.
- B. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.
- C. The Contractor shall be responsible for identifying and reporting to the Architect/Engineer any existing conditions including but not limited to damage to walls, flooring, ceiling and furnishings prior to start of work. All damage to interior spaces caused by this Contractor shall be repaired at this Contractor's expense to pre-existing conditions, including final colors and finishes.

- D. All cables and devices installed in damp or wet locations, including any underground or underslab location, shall be listed as suitable for use in such environments. Follow manufacturer's recommended installation practices for installing cables and devices in damp or wet locations. Any cable or device that fails as a result of being installed in a damp or wet location shall be replaced at the Contractor's expense.

3.3 FIELD QUALITY CONTROL

A. General:

1. Refer to specific Division 27 sections for further requirements.
2. The Contractor shall conduct all tests required and applicable to the work both during and after construction of the work.
3. The necessary instruments and materials required to conduct or make the tests shall be supplied by the Contractor who shall also supply competent personnel for making the tests who has been schooled in the proper testing techniques.
4. In the event the results obtained in the tests are not satisfactory, This Contractor shall make such adjustments, replacements and changes as are necessary and shall then repeat the test or tests which disclose faulty or defective work or equipment, and shall make such additional tests as the Architect/Engineer or code enforcing agency deems necessary.
5. All communications cable tests that fail, including those due to excessive cabling lengths, shall be remedied by the Contractor without cost to the project.

B. Protection of cable from foreign materials:

1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited, to overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.
2. Application of foreign materials of any kind on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.

3.4 PROJECT CLOSEOUT

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:

1. The Architect/Engineer will not perform a final jobsite observation until the project is ready. This is not dictated by schedule, but rather by completeness of the project.
2. Refer to the end of this specification section for a "STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION."
3. The Contractor shall sign this form and return it to the Architect/Engineer so that the final observation can commence.

C. Before final payment will be authorized, this Contractor must have completed the following:

1. Submitted operation and maintenance manuals to the Architect/Engineer for review.
2. Submitted bound copies of approved shop drawings.
3. Record documents including edited drawings and specifications accurately reflecting field conditions, **inclusive** of all project revisions, change orders, and modifications.
4. Submitted a report stating the instructions given to the Owner's representative complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representative as having received the instructions.
5. Submitted testing reports for all systems requiring final testing as described herein.
6. Submitted start-up reports on all equipment requiring a factory installation inspection and/or start.
7. Provide spare parts, maintenance, and extra project site materials in quantities specified in individual specification sections. Deliver to project site; submit receipt to Architect/Engineer prior to final payment being approved.
8. Provide System Assurance Warranty certificate for the telecommunications system.

3.5 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.

7. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVE

- A. Adequately instruct the Owner's designated representative or representatives in the maintenance, care, and operation of the complete systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representative or representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- D. The Architect/Engineer shall be notified of the time and place for the verbal instructions to be given to the Owner's representative so that their representative can be present if desirable.
- E. Refer to the individual specification sections for minimum hours of instruction time for each system.
- F. Operating Instructions:
 1. The Contractor is responsible for all instructions to the Owner and/or Owner's operating staff on the Communications Systems.
 2. If the Contractor does not have Engineers and/or Technicians on staff who can adequately provide the required instructions on system operation, performance, troubleshooting, care and maintenance, they shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 SYSTEM STARTING AND ADJUSTING

- A. The Communications Systems included in the construction documents are to be complete and operating systems. The Architect/Engineer will make periodic job site observations during the construction period. The system start-up, testing, configuration, and satisfactory system performance is the responsibility of the Contractor. This shall include all calibration and adjustments of electrical equipment controls, equipment settings, software configuration, troubleshooting and verification of software, and final adjustments that may be required.
- B. All operating conditions and control sequences shall be simulated and tested during the start-up period.

- C. The Contractor, subcontractors, and equipment suppliers are expected to have skilled technicians to ensure that the system performs as designed. If the Architect/Engineer is requested to visit the job site for the purpose of trouble shooting, assisting in the satisfactory start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period through no fault of the design; the Contractor shall reimburse the Owner on a time and material basis for services rendered at the Architect/Engineer's standard hourly rates in effect at the time the services are requested. The Contractor shall be responsible for making payment to the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.8 RECORD DOCUMENTS

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.
- B. Mark specifications to indicate approved substitutions, change orders, and actual equipment and materials used.
- C. This Contractor shall maintain at the job site, a separate and complete set of technology drawings which shall be clearly and permanently marked and noted in complete detail any changes made to the location and arrangement of equipment or made to the Technology Systems and wiring as a result of building construction conditions or as a result of instructions from the Architect or Engineer. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should This Contractor fail to complete Record Documents as required by this contract, This Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.
- D. Record actual routing of all conduits sized 2" or larger.
- E. The above record of changes shall be made available for the Architect and Engineer's examination during any regular work time.
- F. Upon completion of the job, and before final payment is made, This Contractor shall give the marked-up drawings to the Architect/Engineer.

3.9 ADJUST AND CLEAN

- A. Contractor shall thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.
- B. Contractor shall clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from equipment.
- C. Contractor shall remove all rubbish, debris, etc., accumulated during the Contractor's operations from the premises.

STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION

To assist the contractor in a timely close-out of the project, it is crucial that the final jobsite observation is not conducted prior to the project being ready. The contractor is required to review the completion status of the project at the time the observation is scheduled. This review, and the subsequent submittal of this form to the Architect/Engineer, shall indicate the contractor's agreement that the area of the project being requested for final observation is ready as defined below. The following list represents the degree of completeness required prior to requesting a final observation:

1. All cabling pathways (cable tray, ladder rack, conduit sleeves, etc.) are installed and all cabling has been pulled through them.
2. All mechanical firestop products are installed and all other penetrations have been sealed.
3. All telecommunications jacks are installed in the faceplates.
4. All telecommunications cabling is pulled and at least 90% of all jacks have been terminated at the jack and at the telecom room.
5. Telecommunications testing is in progress and at least 50% of testing has been completed.
6. Telecommunications labeling has been provided on at least 50% of each type of component requiring a label.
7. All telecommunications related grounding is complete.
8. All Audio/Visual components, cabling and control systems are installed, programmed and operational.
9. All overhead or integrated paging systems, including speakers, back boxes, cabling, and power supplies, and all headend equipment is installed, programmed and operational.
10. All CCTV cameras, mounts, cabling and all headend equipment are installed, programmed and operational.
11. All access control system equipment, including card readers, conduits, cabling, electronic locks, controllers and all headend equipment, is installed, programmed and operational.

Prime Contractor: _____ By: _____

Requested Observation Date _____ Today's Date: _____

Contractor shall sign this readiness statement and transmit to Architect/Engineer at least 10 days prior to the requested date of observation.

It is understood that if the Architect/Engineer finds that the project is not complete as defined above and that the final jobsite observation cannot be completed on the requested date, the Architect/Engineer will return to the site at a later date. All additional visits to the site for the purposes of completing the final observation will be billed T&M to the Contractor at our standard hourly rates, including travel expenses or the contractor's retainage may be deducted for the same amount.

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TELECOMMUNICATIONS - PROOF OF CERTIFICATION

There are specific Contractor qualification requirements for this project as defined in Section 270500, which may include Manufacturer Certification and RCDD or CNIDP credentials. This Proof of Certification document, and the supporting documentation require herein, is required to be submitted at the time of bid to show compliance with the requirements of 27 05 00.

Statement of Compliance:

The named Contractor's base bid is a structured cabling solution from the connectivity manufacturer: _____ . Named Contractor is trained and certified, under the named manufacturer's formal certification program to provide and install all materials and work required by this project. Further, said Contractor is authorized, by the named manufacturer, to offer all product, labor and system assurance warranties required for this project by these contract documents.

The certification of this named manufacturer is valid, current and in effect as of the bid day of this project, the _____ day of _____, 20_____.

The named Contractor is not employing any other sub-contractor on the telecommunications portion of this project that does not also meet this certification requirement.

Contractor Company Name: _____

Authorized Representative: (print) _____

Date: _____

Manufacturer Certification Number (if any): _____

If this project requires RCDD certification, complete the following:

RCDD or CNIDP Name: _____

RCDD #: _____ Expiration: _____

Submit the following with the bid:

This form.

Proof of Manufacturer Certification indicated above.

Proof of RCDD or CNIDP status.

END OF SECTION

SECTION 270526
COMMUNICATIONS BONDING

PART 1 - GENERAL

1.1 RELATED WORK

- A. Section 260533 - Conduit and Boxes
- B. Section 260526 - Grounding and Bonding
- C. Section 270500 - Basic Communications Systems Requirements
- D. Section 270528 - Interior Communication Pathways
- E. Section 270553 - Identification and Administration

1.2 QUALITY ASSURANCE

- A. Refer to Section 270500 for relevant standards.
- B. Communications bonding system component, device, equipment, and material manufacturer(s) shall have a minimum of five (5) years documented experience in the manufacture of communications bonding products.
- C. The entire installation shall comply with all applicable electrical codes, safety codes, and standards. All applicable components, devices, equipment, and material shall be listed by Underwriters' Laboratories, Inc.

1.3 REFERENCES

- A. ANSI/IEEE 1100 - Recommended Practice for Power and Grounding Sensitive Electronic Equipment in Industrial and Commercial Power Systems
- B. ANSI/TIA 568-C - Commercial Building Telecommunications Cabling Standard
- C. ANSI/TIA 569-A - Commercial Building Standard for Telecommunications Pathways and Spaces
- D. ANSI/TIA 606 - Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- E. ANSI/TIA 758 - Customer Owned Outside Plant
- F. ANSI/TIA-607-D - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

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- G. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements
- H. IEEE 837 - IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding
- I. NFPA 70 - National Electrical Code
- J. NFPA 780 - Standard for the Installation of Lightning Protection Systems
- K. UL 96 - Lightning Protection Components
- L. UL 96A - Installation Requirements for Lightning Protection Systems
- M. UL 467 - Grounding and Bonding Equipment

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site under the provisions of Section 270500.
- B. Store and protect products under the provisions of Section 270500.
- C. Contractor shall exercise care to prevent corrosion of any products prior to installation. Corroded products shall not be acceptable for use on this project.

1.5 SYSTEM DESCRIPTION

- A. This section describes the requirements for the furnishing, installation, adjusting, and testing of a complete turnkey communications bonding system, including connection to the electrical ground grid.
- B. Performance Statement: This specification section and the accompanying drawings are performance based, describing the minimum material quality, required features, operational requirements, and performance of the system. These documents do not convey every wire that must be installed, every equipment connection that must be made, or every feature and function that must be configured. Based on the equipment constraints described and the performance required of the system as presented in these documents, the Contractor is solely responsible for determining all components, devices, equipment, wiring, connections, and terminations required for a complete and operational system that provides the required performance.
- C. This document describes the major components of the system. All additional hardware, subassemblies, supporting equipment, and other miscellaneous equipment required for complete, proper system installation and operation shall be provided by the Contractor.
- D. Basic System Requirements:
 - 1. A complete communications bonding infrastructure is required for this project. Refer to the drawings and the requirements of ANSI-J-STD-607-D and NFPA 70 for complete information.

2. The bonding system shall include, but not be limited to, the following major components:
 - a. Telecommunications Bonding Conductor (TBC)
 - b. Primary Bonding Busbar (PBB)
 - c. Telecommunications Bonding Backbone (TBB)
 - d. Secondary Bonding Busbar(s) (SBB)
 - e. Rack mount Telecommunications Grounding Busbar(s)
 - f. Bonding Conductor(s) (BC)
 - g. Bonding Connectors
 - h. Bonding system labeling and administration as defined in Section 270553.

1.6 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 270500.
- B. Provide final system block diagram showing any deviations from approved shop drawing submittal.
- C. Provide floor plans that document the following:
 1. Actual locations of system components, devices, and equipment.
 2. Actual conductor routing.
 3. Actual system component, device, equipment, and conductor labels.
- D. Provide statement that system checkout test, as outlined in the approved shop drawing submittal, is complete and test results were satisfactory.
- E. Complete all operation and maintenance manuals as described below.

Length Linear ft (m)	Size (AWG)
Less than 13 (4)	6
14 - 20 (4 - 6)	4
21 - 26 (6 - 8)	3
27 - 33 (8 - 10)	2
34 - 41 (10 - 13)	1
42 - 52 (13 - 16)	1/0
53 - 66 (16 - 20)	2/0
67 - 84 (20 - 26)	3/0
85 - 105 (26 - 32)	4/0
106 - 125 (32 - 38)	250 kcmil
126 - 150 (38 - 46)	300 kcmil
151 - 175 (46 - 53)	350 kcmil
176 - 250 (53 - 76)	500 kcmil
251 - 300 (76 - 91)	600 kcmil
Greater than 301 (91)	750 kcmil

PART 2 - EXECUTION

2.1 INSTALLATION

- A. General Bonding Requirements:
 - 1. The communications bonding system shall be a complete system. Contractor shall furnish and install all necessary miscellaneous components, devices, equipment, material, and hardware, including, but not limited to, lock washers, paint-piercing washers, hex nuts, compression lugs, insulators, mounting screws, lugs, etc., to provide a complete system.
 - 2. Comply with the manufacturer's instructions and recommendations for installation of all products.
- B. Main Cross Connect and Service Entrance Room Bonding Requirements:
 - 1. Locate the PBB in the service entrance room unless otherwise noted on the drawings.
 - 2. The location of the PBB shall be the shortest practical distance from the telecommunications primary lightning protection devices.
 - 3. Bond the telecommunications primary protectors to the PBB. Maintain a minimum 1 foot separation of the bonding conductor from all DC power cables, switchboard cable, and high frequency cable.
 - 4. In service entrance rooms where the entrance pathway contains an isolation gap, the pathway on the facility side of the gap shall be bonded to the PBB.
- C. Where the service entrance cable contains a shield, the shield(s) shall be bonded to the PBB using manufacturer-approved hardware.
- D. Metallic Interior Communication Pathway Bonding Requirements:
 - 1. All metallic interior continuous communication cable pathways, including, but not limited to, conduit, conduit sleeves, fire-rated cable pathway devices, cable tray, basket tray, and ladder rack, shall be bonded to the communications bonding system.

2.2 ADJUSTING

- A. Adjust work under provisions of Section 270500.
- B. Contractor shall make any and all adjustments to the communications bonding system necessary to ensure that the installed system meets all requirements listed herein. Modifications necessary to comply with listed requirements or to provide specified performance shall be completed by the Contractor at no additional cost to the Owner.

2.3 TESTING

- A. Measure and document resistance to ground at PBB, each SBB, each RBB, and each electrical distribution panel bonded to the PBB or a SBB.
1. Measurements shall be made not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage, and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the fall-of-potential method according to IEEE 81.
 2. The preferred measured resistance to ground for the grounding electrode system is 10 ohms or less. Refer to Division 26 for exact project requirements.
 3. Under no circumstances shall any point in the communications bonding system have a lower resistance to ground than that of nearby electrical distribution system components that it is bonded to.

END OF SECTION

SECTION 270528

INTERIOR COMMUNICATION PATHWAYS

PART 1 - GENERAL

1.1 RELATED WORK

- A. Section 260533 - Conduit and Boxes
- B. Section 270500 - Basic Communications Systems Requirements
- C. Section 270526 - Communications Bonding

1.2 QUALITY ASSURANCE

- A. Refer to Section 270500 for requirements.

1.3 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code

1.4 DRAWINGS

- A. The drawings, which constitute a part of these specifications, indicate the general route of the wire mesh support systems, conduit, sleeves, etc. Data presented on these drawings is as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification of all dimensions, routing, etc., is required.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 CABLE HOOK SUPPORT SYSTEM

- A. In areas where cabling is not supported by cable tray, ladder rack, enclosed wireway or installed in conduit, such cabling shall be supported by an approved cable hook support system.
- B. Refer to manufacturer's requirements for allowable fill capacity for selected cable hook. In no case shall a 40% fill capacity be exceeded.

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- C. Cable hooks shall be securely mounted per manufacturer's instructions. In no case shall the side-to-side travel of any cable hook exceed 6".
- D. Cable hooks shall be selected based on the contractor's cable routing. Hooks shall be capable of supporting a minimum of 30 pounds with a safety factor of 3.
- E. J-hook support spans shall be based on the smaller of the manufacturer's load ratings and code requirements. In no case shall horizontal spans exceed 5 feet and vertical spans exceed 4 feet.
- F. The resting and supporting of cabling on structural members shall not meet the requirements for cabling support specified herein.
- G. The use of tie-wraps or hook and loop type fasteners is specifically prohibited as a substitute for cable hooks specified herein.

3.2 CONDUIT AND CABLE ROUTING

- A. Refer to Section 260533 for additional requirements.
- B. All conduits shall be reamed and shall be installed with a nylon bushing.
- C. Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of less than 2", maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter 2" or greater, maintain a bend radius of at least 10 times the internal diameter.
- D. No conduit or sleeve containing more than two (2) cables shall exceed 40% fill ratio, regardless of length.
- E. Any conduit exceeding 90' in length or containing more than two (2) 90-degree bends shall contain a pull box sized per ANSI/TIA/EIA 569 requirements.
 - 1. A separate pull box is required for each 90' (or greater) length section.
 - 2. A separate pull box is required after any two (2) consecutive 90-degree bends.
 - 3. Pull box shall be located in an area that maintains accessibility of box, including the ability to remove box lid without removal or relocation of any other materials.
- F. Any conduit with bends totaling 90 degrees or more shall have the fill capacity derated by 15% for each 90 degrees of cumulative bend.
- G. Cables installed in any conduits that do not meet the above requirements shall be replaced at the Contractor's expense, after the conduit condition has been remedied.

3.3 ATTACHMENT TO METAL DECKING

- A. Where supports for cable trays and cable hook systems attach to metal roof decking, excluding concrete on metal decking, do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center. This 25-lb. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

END OF SECTION

SECTION 270553
IDENTIFICATION FOR COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes the identification requirements relating to the structured cabling system and its termination components and related subsystems.
- B. Identification and labeling.
- C. Administration of structured cabling system, utilizing identifiers, records, record linkages and presentation.
 - 1. Identifier: Information that links a specific element of the telecommunications infrastructure with its corresponding record.
 - 2. Records: A collection of detailed information related to a specific element of the telecommunications infrastructure.
 - 3. Record Linkage: A connection between a record and an identifier or between records.

1.2 RELATED WORK

- A. Section 270500 - Basic Communications Systems Requirements

1.3 SUBMITTALS

- A. Under the provisions of Section 270500 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Documentation of labeling scheme.
 - 2. Complete documentation of nomenclature for all Administration components.

PART 2 - PRODUCTS

2.1 ADMINISTRATION

- A. Administrative requirements include identifiers, records, record linkages and labeling for the purposes of administering building cabling, pathways and spaces and grounding/bonding within a facility.

- B. The administrative system shall be developed in Microsoft Word format or other electronics program approved by the Architect/Engineer. Should the Contractor elect to provide documentation of the administrative system in a proprietary format, the owner shall be provided with a retail licensed version of the software by the Contractor allowing the full editing and reading the documentation.
- C. Refer to the Administrative System Outline below for minimum requirements.
- D. Identifiers:
 - 1. Identifiers shall be marked at the equipment to be administered.
 - 2. Identifiers shall be unique for each type of equipment. For example, in no case shall the identifier for a cable be the same as the identifier for a pathway.
- E. Records:
 - 1. Provides descriptive information about the identified equipment.
- F. Linkages:
 - 1. To be used to describe the connection between an identifier and a record. In addition, a linkage is used to point from one record to another record.
- G. Presentation of Administrative System:
 - 1. Provide reports cataloging the records for all equipment.
 - 2. Sample reports shall be provided to show explanations of the meaning of all information in the record.
 - 3. Provide reports showing the labeling scheme for all components of the Administrative system.
- H. Administrative System Outline:
 - 1. The format of the outline is as follows:
 - a. Subsystem:
 - 1) Required identifiers.
 - 2) Linked records.
 - 2. Pathways:
 - a. Pathway identifier, type, fill, loading.
 - b. Cable records, space records, pathway records, grounding records.
 - 3. Spaces:
 - a. Space identifier, space type.
 - b. Pathway records, cable records, grounding records.

4. Cable:
 - a. Cable identifier, cable type, total pair count, damaged pair count, unterminated pair count.
 - b. Termination records, splice records, pathway records, grounding records.
5. Cabling Termination Hardware:
 - a. Termination identifier, hardware type, damaged position numbers.
 - b. Termination position records, space records, grounding records.
6. Termination Position:
 - a. Termination position identifier, termination type.
 - b. Cable records, termination hardware records, space records.
7. Primary Bonding Busbar:
 - a. PBB identifier, busbar type, grounding conductor identifier.
 - b. Bonding conductor records, space records.
8. Secondary Bonding Busbar:
 - a. SBB identifier, busbar type.
 - b. Bonding conductor records, space records.
9. Bonding Conductors:
 - a. Bonding conductor identifier, conductor type, busbar identifier.
 - b. Grounding busbar records, pathway records.

2.2 LABELING

- A. Adhesive labels shall meet the requirements of UL 969 (Ref D-16) for legibility, defacement and adhesion. Exposure requirements of UL 969 for indoor and outdoor (as applicable) use shall be met.
- B. Insert labels shall meet the requirements of UL 969 for legibility, defacement and general exposure.
- C. Labeling shall be consistent for all common elements in the project. This consistency shall include label size, color, typeface and attachment method.
- D. Labels incorporating bar codes shall be either Code 39 conforming to USS-39 or Code 128 conforming to USS-128.
 1. All Code 39 bar codes shall have a ratio between 2.5:1 and 3.0:1. Provide a minimum "quiet zone" of 0.25" on each side of the bar code.
 2. A descriptive label for reading by personnel shall be provided with any bar code. Bar codes by themselves are not acceptable.

- E. Color Code: Observe the following requirements for color coding:
1. Labels on each end of a cable shall be the same color for each termination.
 2. Labels for cross-connects shall be two different colors at each termination fields, representative of the color of that field.
 3. Orange (Pantone 15C) shall be used for the demarcation point.
 4. Green (Pantone 353C) shall be used for the termination point of network connection on the facility side of the demarc.
 5. Purple (Pantone 264C) shall be used to identify the termination of cables from common equipment (PBX, computers, LANS, etc.)
 6. White shall be used to identify the first-level backbone termination in the main cross-connect.
 7. Gray (Pantone 422C) shall be used to identify the second-level backbone termination in the main cross-connect.
 8. Blue (Pantone 291C) shall be used to identify the termination of station cabling at the telecommunications closet and/or equipment room end of the cable.
 9. Brown (Pantone 465C) shall be used to identify the termination of the interbuilding backbone cable terminations.
 10. Yellow (Pantone 101C) shall be used to identify the termination of auxiliary circuits, alarms, maintenance, security, etc.
 11. Red (Pantone 184C) shall be used to identify the termination of key telephone systems.
 12. In facilities that do not contain a main cross-connect, the color white may be used to identify second-level backbone terminations.
- F. Tag all CAT 3, CAT 5E, CAT 6, and optical fiber cables at both the Communications Equipment Room and the information outlets using the following alphanumeric labeling system:
1. (Room Number) - (Outlet Number) - (Jack Number) - (Use).
 2. "Outlet Number" shall start with 1 in each room, with additional outlets in each room numbered sequentially.
 3. "Jack Number" shall start with 1 for the upper left jack in each outlet, increasing sequentially from left to right and top to bottom across the outlet face.
 4. "Use" shall be designated by the following:
 - a. "V" for voice (RJ-45)
 - b. "D" for data (RJ-45)
 - c. "C" for video (coax)
 - d. "M" for multimedia retrieval (coax)
 - e. "S" for speaker (RCA)
 5. Example #1: "106-1-1-V" indicates the top left voice jack in outlet #1 in Room 106.
 6. Example #2: "109-3-4-D" indicates the bottom right data jack (assuming a 4-port faceplate) in outlet #3 in Room 109.

2.3 DOCUMENTATION/AS-BUILTS/RECORDS

- A. General:
1. Upon completion of the installation, the Contractor shall submit as-builts per the requirements of Section 270500 and Division 1. Documentation shall include the items detailed in the subsections below.

2. All documentation, including hard copy and electronic forms shall become the property of the Owner.

B. Record Drawings:

1. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons and drawing conventions used shall be consistent throughout all documentation provided.

PART 3 - EXECUTION

3.1 IDENTIFICATION AND LABELING

A. Cable Labeling:

1. Horizontal cables shall be labeled at each end.
 - a. Cables that differ only by performance class shall have a suitable marking or label to indicate the higher performance class. For example, station cabling utilizing the blue color may include blue with a white stripe to indicate the higher performance class station cabling.
2. Backbone cables shall be labeled at each end.
 - a. Provide additional cable labeling at each manhole and pull box.
 - b. Cables that are routed through multiple pathway segments shall contain reference to all pathway segments in the pathway linkage field.
 - c. Cables that differ only by performance class shall have a suitable marking or label to indicate the higher performance class. For example, station cabling utilizing the blue color, may include blue with a white stripe to indicate the higher performance class station cabling.

B. Information Outlet Labeling: Tag all voice and data jacks as defined herein.

C. Termination Hardware Labeling:

1. An identifier shall be provided at each termination hardware location or its label.

D. Grounding/Bonding Labeling:

1. The PBB shall be labeled "PBB." There shall be only one PBB in the facility.
2. Label all TBB conductors connecting to the PBB with a unique label, located at both ends of the TBB.
3. Each SBB shall be labeled with a unique label.
4. All TBB conductors connecting to the SBB shall be labeled uniquely at each end of the cable.

3.2 ADMINISTRATION

- A. Provide administrative documentation of cabling, termination hardware, termination positions, splices and grounding as described above.
- B. Identifiers:
 - 1. Cable Identifiers: Provide a unique identifier for each cable serving as a link to the cable record. The identifier shall be marked on the cable or on the cable label.
 - 2. Termination Hardware Identifiers:
 - a. Provide a unique identifier for each termination hardware unit, serving as a linkage the unit record.
 - 3. Termination Position Identifiers:
 - a. A unique identifier shall be provided to each termination position to serve as a link to the termination position record.
 - b. An identifier shall be marked on each position label. Each termination position shall be marked with the termination position identifier.
 - 4. Grounding/Bonding Identifiers:
 - a. The PBB shall be marked "PBB". Only one PBB shall be located in a facility.
 - b. Provide a unique identifier for each TBB attached to the PBB.
 - c. A unique identifier shall be provided for each SBB in a facility.
 - d. Provide a unique identifier for each TBB attached to the SBB.
- C. Records:
 - 1. Cable Records: Provide cable identifier, cable type, conductor quantity, damaged conductor quantity, unterminated conductor quantity, available conductor quantity.
 - a. The cable type field shall include the manufacturer and manufacturer's catalog designations, including ratings.
 - 2. Termination Hardware Records: Provide hardware identifier, hardware type, damaged position numbers, available position numbers.
 - a. Provide linkages to termination position records, space records, and grounding records.
 - 3. Termination Position Records: Provide termination position identifier, cable conductor numbers.
 - a. Provide linkages to cable records, termination position records, termination hardware records and space records.
 - 4. Grounding/Bonding Records:
 - a. PBB Record: Provide PBB identifier, busbar type, grounding conductor identifier.
 - 1) Provide linkage to bonding conductor records and space records.

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- b. TBB Records: Provide TBB identifier, conductor type, and busbar identifier.
 - 1) Provide linkage to busbar and pathway records.
- c. SBB Records: Provide SBB identifier, busbar type.
 - 1) Provide linkage to bonding conductor records and space records.

END OF SECTION

SECTION 271500
HORIZONTAL CABLING REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes the products and execution requirements relating to furnishing and installing horizontal communications cabling and termination components and related subsystems as part of a cabling plant. The cabling plant consists of copper cabling.

1.2 RELATED WORK

- A. Section 270500 - Basic Communications Systems Requirements
- B. Section 271720 - Structured Cabling System Warranty

1.3 QUALITY ASSURANCE

- A. Refer to Section 270500 for relevant standards and plenum or non-plenum cable requirements.
- B. The channel shall be required to meet the performance requirements indicated herein. The manufacturer shall warranty the performance of their system to the required performance (and not just to the Standard, should the required performance exceed the Standard).
- C. Specific components of the channel shall be required, at a minimum, to meet the Standard component requirements for that particular component.
- D. The installing contractor must be certified by the manufacturer of the structured cabling system.

1.4 SUBMITTALS

- A. Under the provisions of Section 270500 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLE

A. CAT 6 Cable:

1. The horizontal cable requirements must be met, as well as the following channel requirements.
2. CAT 6 cable shall terminate on rack-mounted modular patch panels in their respective communication equipment room as indicated on the drawings.
3. Performance tests shall be conducted using swept frequency testing through 250 MHz for the channel. All numbers given are for a 4-connection channel. Discrete frequency testing results at 250 MHz is not acceptable.
4. Performance data shall be characterized as "Guaranteed Headroom" and shall be guaranteed by the manufacturer to perform at guaranteed margins over ANSI/TIA/EIA-568-C.2. Performance data that is not warranted by the manufacturer will not be considered.
5. The structured cabling and connectivity must be provided by the same company. For the purpose of this specification that shall mean that the cabling and connectivity must be marketed, branded, supported, warranted, and distributed by the same company. Specifically, ally or partnerships between cabling manufacturers and connectivity manufacturers do not meet this requirement unless otherwise listed below. Specifically, products made by others through an OEM relationship are acceptable if the products are marketed, branded, supported, warranted, and distributed by the same company.
6. The 4-connector channel performance margins listed in the below criteria shall be guaranteed minimum margins above ANSI/TIA/EIA-568-C.2 with electrical parameters between 1-250 MHz.
 - a. Insertion Loss: 5%
 - b. NEXT: 3.0 dB
 - c. PS NEXT: 5.0 dB
 - d. ACR-F (ELFEXT): 4.0 dB
 - e. PS ACR-F (PS ELFEXT): 5.0 dB
 - f. Return Loss: 2 dB
7. The jacket color for CAT 6 cable shall be white orange for data applications.
8. Basis of Design:
 - a. PANDUIT
9. Manufacturer:
 - a. PANDUIT

B. CAT 6A Cable:

1. The horizontal cable requirements must be met, as well as the following channel requirements.
2. CAT 6A cable shall terminate on rack-mounted modular patch panels in their respective communication equipment room as indicated on the drawings.
3. Cable shall exceed transmission requirements listed in ANSI/TIA/EIA-568-C.2. Performance tests shall be conducted using swept frequency testing through 500 MHz for the channel. All numbers given are for a 4-connection channel.

4. Performance tests shall be conducted using swept frequency testing through 500 MHz for the channel. All numbers given are for a 4-connection channel. Discrete frequency testing results at 500 MHz is not acceptable.
5. Performance data shall be provided by third-party independent testing laboratories only. Testing data shall be submitted on the third-party testing laboratory letterhead. Test data will only be accepted if it displays testing as a channel. Electrical characteristics of the performance of the cable itself will not satisfy this requirement.
6. The structured cabling and connectivity may be provided by the same company. For the purpose of this specification that shall mean that the cabling and connectivity must be marketed, branded, supported, warranted, and distributed by the same company. Specifically, ally or partnerships between cabling manufacturers and connectivity manufacturers do not meet this requirement unless otherwise listed below. Specifically, products made by others through an OEM relationship are acceptable if the products are marketed, branded, supported, warranted, and distributed by the same company.
7. The 4-connector channel performance margins listed in the below criteria shall be guaranteed minimum margins above ANSI/TIA/EIA-568-C.2 with electrical parameters between 1-500 MHz.
 - a. Insertion Loss: 3%
 - b. NEXT: 2 dB
 - c. PS NEXT: 3 dB
 - d. PSA NEXT: 3 dB
 - e. PSA NEXT (Average):
 - f. ACR-F: 2 dB
 - g. PS ACR-F: 3 dB
 - h. PSA ACR-F: 3 dB
 - i. PSA ACR-F (Average): 3 dB
 - j. Return Loss: 2dB
8. The jacket color for CAT 6A cable shall be white. Blue Insert for data applications.
9. Basis of Design:
 - a. PANDUIT
10. Manufacturer:
 - a. PANDUIT

2.2 FACEPLATES/JACKS

A. CAT 6 Jacks:

1. CAT 6 horizontal cable shall each be terminated at their designated work area location on RJ-45 modular jacks. These modular jack assemblies shall snap into a modular mounting frame. The combined modular jack assembly is referred to as an information outlet.
2. The same orientation and positioning of modular jacks shall be utilized throughout the installation. Prior to installation, the Contractor shall submit the proposed configuration for each information outlet type for review by the Architect/Engineer.
3. Information outlet faceplates shall incorporate recessed designation strips at the top and bottom of the frame for identifying labels. Designation strips shall be fitted with clear plastic covers.

4. Where standalone CAT 6 only modular jacks are identified, the information outlet faceplate shall be configured as to allow for the addition of one (1) additional modular jack (CAT 3, CAT 5E, or CAT 6) to be installed to supplement each such modular jack as defined by this project. The installation of these supplemental modular jacks is NOT part of this project.
5. Any unused modular jack positions on an information outlet faceplate shall be fitted with a removable blank inserted into the opening.
6. All modular jacks will be fitted with a dust cover. Modular jacks shall incorporate a dust cover that fits over and/or into the modular jack opening. The dust cover shall be designed to remain with the modular jack assembly when the modular jack is in use. No damage to the modular jack pinning shall result from insertion or removal of these covers. Dust covers that result in deformation of the modular jack pinning, will not be accepted.
7. The information outlet faceplate shall be constructed of high impact plastic (except where noted otherwise). The information outlet faceplate color shall:
8. Different faceplate and frame designs for locations, which include optical fiber cabling relative to those, that terminate only copper cabling are acceptable. Information outlets that incorporate optical fiber shall be compliant with the above requirements plus:
 - a. Be a low-profile assembly.
 - b. Position the optical fiber couplings to face downward or at a downward angle to prevent contamination.
 - c. Incorporate a shroud that protects the optical fiber couplings from impact damage.
9. All information outlets and the associated modular jacks shall be of the same manufacturer throughout the project.
10. The CAT 6 modular jacks shall be non-keyed TIA-568B8-pin modular jacks.
11. The interface between the modular jack and the horizontal cable shall be a 110-type termination block or insulation displacement type contact. Termination components shall be designed to maintain the horizontal cable's pair twists as closely as possible to the point of mechanical termination.
12. CAT 6 modular jacks shall be pinned per TIA-568B.
13. CAT 6 termination hardware shall, as a minimum, meet all the mechanical and electrical performance requirements of the following standards:
 - a. ANSI/TIA/EIA-568-A-5
 - b. ANSI/TIA/EIA-568A
 - c. ISO/IEC 11801
 - d. FCC PART 68 SUBPART F
14. The color for CAT 6 jacks shall be blue for data applications. Alternately, a color-coded bezel or icon may be used to identify the CAT 6 modular jack.

B. Cat 6A Jacks:

1. CAT 6A horizontal cable shall each be terminated at its designated work area location on RJ-45 modular jacks. These modular jack assemblies shall snap into a modular mounting frame. The combined modular jack assembly is referred to as an information outlet.
2. The same orientation and positioning of modular jacks shall be utilized throughout the installation. Prior to installation, the Contractor shall submit the proposed configuration for each information outlet type for review by the Architect/Engineer.
3. Information outlet faceplates shall incorporate recessed designation strips at the top and bottom of the frame for identifying labels. Designation strips shall be fitted with clear plastic covers.

4. Where standalone CAT 6A only modular jacks are identified, the information outlet faceplate shall be configured as to allow for the addition of one (1) additional modular jack (CAT 3, CAT 5E, or CAT 6) to be installed to supplement each such modular jack as defined by this project. The installation of these supplemental modular jacks is NOT part of this project.
5. Any unused modular jack positions on an information outlet faceplate shall be fitted with a removable blank inserted into the opening.

PART 3 - EXECUTION

3.1 CABLE INSTALLATION REQUIREMENTS

A. Horizontal Cabling:

1. The maximum horizontal cable drop length for Data UTP shall not exceed 295 feet in order to meet data communications performance specifications. This length is measured from the termination panel in the wiring closet to the outlet and must include any slack required for the installation and termination. The Contractor is responsible for installing horizontal cabling in a fashion so as to avoid unnecessarily long runs. Any area that cannot be reached within the above constraints should be identified and reported to the Architect/Engineer prior to installation. Changes to the contract documents shall be approved by the Architect/Engineer.
2. All cable shall be free of tension at both ends. In cases where the cable must bear some stress, Kellum grips may be used to spread the strain over a longer length of cable.
3. Manufacturer's minimum bend radius specifications shall be observed in all instances.
4. Horizontal cabling installed as open cabling shall be supported at a maximum of 5' between supports. Refer to the specifications for required cable supports.
5. Horizontal cabling installed as open cable or in cable tray shall be bundled at not less than 10' intervals with hook-and-loop tie wraps. The use of plastic cable ties is strictly prohibited.
6. The maximum conduit fill for horizontal cabling shall not exceed 40% regardless of conduit length.
7. Cable sheaths shall be protected from damage from sharp edges. Where a cable passes over a sharp edge, a bushing or grommet shall be used to protect the cable.

B. A coil of 3 feet in each cable shall be placed in the ceiling at the last support (e.g., J-hook, bridle ring, etc.) before the cables enter a fishable wall, conduit, surface raceway or box. At any location where cables are installed into movable partition walls or modular furniture via a service pole, approximately 15-feet of slack shall be left in each horizontal cable under 250 feet in length to allow for change in the office layout without re-cabling. These "service loops" shall be secured at the last cable support before the cable leaves the ceiling and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.

1. To reduce or eliminate EMI, the following minimum separation distances from 480V power lines shall be adhered to:
 - a. Twelve (12) inches from power lines of less than 5-kVa.
 - b. Eighteen (18) inches from high-voltage lighting (including fluorescent).
 - c. Thirty-nine (39) inches from power lines of 5-kVa or greater.
 - d. Thirty-nine (39) inches from transformers and motors.

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2. Information outlets shown on floor plans with the subscript "W" are intended to be used for wall mounted telephones. Back boxes for wall mounted telephones shall not be located within 12" vertically, or horizontally, from any light switches, power receptacles, nurse call devices, thermostats, or any other architectural element that would otherwise prevent the installation of a wall mounted telephone on the mating lugs.

END OF SECTION

SECTION 271710

TESTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes the testing requirements relating to the structured cabling system and its termination components and related subsystems.

1.2 RELATED WORK

- A. Section 270500 - Basic Communications Systems Requirements

PART 2 - PRODUCTS

2.1 TESTING COPPER

- A. General Requirements:
 - 1. Should it be found by the Architect/Engineer that the materials or any portion thereof furnished and installed under this Contract fail to comply with the specifications and drawings with respect or regard to the quality, amount, or value of materials, appliances, or labor used in the work, it shall be rejected and replaced by the Contractor and all work disturbed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.
 - a. CAT 6 Cable:
 - 1) Testing shall be from the modular jack at the information outlet to the modular patch panel in the communication equipment room.
 - 2) Horizontal cable shall be free of shorts within the pairs, and be verified for continuity, pair validity and polarity, and conductor position on the modular jack (e.g., wire map). Any defective, split, or mis-positioned pairs must be identified and corrected.
 - 3) CAT 6 horizontal cable shall be tested to 250 MHz as defined by TIA/EIA-568-C.2. Measurements shall be of the "Permanent Link", including patch cords, cabling and modular jacks at the information outlet and modular patch panel. Parameters to be tested must include:
 - a) Wire Map
 - b) Length
 - c) NEXT Loss (Pair-to-Pair)
 - d) NEXT (Power Sum)
 - e) ELFEXT (Pair-to-Pair)
 - f) ELFEXT (Power Sum)
 - g) Return Loss

- h) Attenuation
 - i) Propagation Delay
 - j) Delay Skew
- 4) The maximum length of horizontal cable shall not exceed 295 feet, which allows 33 feet for technology equipment and modular patch cords.
 - 5) To establish testing baselines, cable samples of known length and of the cable type and lot installed shall be tested. The cable may be terminated with an eight-position CAT 6 modular connector (8-pin) to facilitate testing. Nominal Velocity of Propagation (NVP) and nominal attenuation values shall be calculated based on this test and be utilized during the testing of the installed cable plant. This requirement can be waived if NVP and nominal attenuation data is available from the cable manufacturer for the exact cable type under test.
 - 6) CAT 6 horizontal cable testing shall be performed using a test instrument designed for testing to 250 MHz or higher. Test records shall verify, "PASS" on each cable and display the specified parameters, comparing test values with standards based "templates" integral to the unit. Test records that report a PASS*, FAIL*, or FAIL result for any of the parameters will not be accepted.
 - 7) In the event results of the tests are not satisfactory, the Contractor shall make adjustments, replacements, and changes as necessary and shall then repeat the test or tests that disclosed faulty or defective material, equipment, or installation methods, and shall make additional tests as the Architect/Engineer deems necessary at no additional expense to the project or user agency.

b. CAT 6A Cable:

- 1) Testing shall be from the modular jack at the information outlet to the modular patch panel in the communication equipment room.
- 2) Horizontal cable shall be free of shorts within the pairs and be verified for continuity, pair validity and polarity, and conductor position on the modular jack (e.g., wire map). Any defective, split, or mis-positioned pairs must be identified and corrected.
- 3) CAT 6A horizontal cable shall be tested to 500 MHz as defined by TIA/EIA-568-C.2. Measurements shall be of the "Permanent Link", including [patch cords,] cabling and modular jacks at the information outlet and modular patch panel. Parameters to be tested must include:
 - a) Wire Map
 - b) Length
 - c) NEXT Loss (Pair-to-Pair)
 - d) NEXT (Power Sum)
 - e) ELFEXT (Pair-to-Pair)
 - f) ELFEXT (Power Sum)
 - g) Return Loss
 - h) Attenuation
 - i) Propagation Delay
 - j) Delay Skew
- 4) The maximum length of horizontal cable shall not exceed 295 feet, which allows 33 feet for technology equipment and modular patch cords.

- 5) To establish testing baselines, cable samples of known length and of the cable type and lot installed shall be tested. The cable may be terminated with an eight-position CAT 6A modular connector (8-pin) to facilitate testing. Nominal Velocity of Propagation (NVP) and nominal attenuation values shall be calculated based on this test and be used during the testing of the installed cable plant. This requirement can be waived if NVP and nominal attenuation data is available from the cable manufacturer for the exact cable type under test.
- 6) CAT 6A horizontal cable testing shall be performed using a test instrument designed for testing to 500 MHz or higher. Test records shall verify "PASS" on each cable and display the specified parameters, comparing test values with standards based "templates" integral to the unit. Test records that report a PASS*, FAIL*, or FAIL result for any of the parameters will not be accepted.
- 7) In the event results of the tests are not satisfactory, the Contractor shall make adjustments, replacements, and changes as necessary and shall then repeat the test or tests that disclosed faulty or defective material, equipment, or installation methods, and shall make additional tests as the Architect/Engineer deems necessary at no additional expense to the project or user agency.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 323113.53

HIGH-SECURITY 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. High-security chain-link fences.
 - 2. Horizontal-slide, motor-operated gates.
 - 3. Swing, manually-operated gates.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
 - 2. Review sequence of operation for each type of gate operator.
 - 3. Review coordination of interlocked equipment specified in this Section and elsewhere.
 - 4. Review required testing, inspecting, and certifying procedures.

1.4 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Fence and gate posts, rails, and fittings.
 - b. Chain-link fabric, reinforcements, and attachments.
 - c. Accessories: Barbed wire.
 - d. Gate operator, including operating instructions and motor characteristics.
 - 2. Include product test reports.
- B. Shop Drawings: For each type of fence and gate assembly.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include accessories, hardware, gate operation, and operational clearances.
 - 3. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
 - 4. Wiring Diagrams: For power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For gate operators to include in emergency, operation, and maintenance manuals.
- B. Gate Operator Operation and Maintenance Data, including:
 - 1. Documentation of maintenance and repair service availability for emergency conditions.
 - 2. Quarterly maintenance for one year following Substantial Completion of the Project.
 - 3. Contractor shall provide owner with (2) copies of standard factory prepared operation, installation and maintenance manuals. Manuals shall include typical wiring diagrams.
 - 4. Contractor shall provide owner with (2) copies of any risers, layouts, and special wiring diagrams showing any changes to standard drawings, if required on project.
- C. Gate Operator Periodic Maintenance:
 - 1. The manufacturer recommends periodic maintenance at one (1), three (3) and 12-month intervals as described in the installation and maintenance manual.
 - 2. External reversing devices should be checked at least once a month.
- D. Fence and Gate Special Warranty: Manufacturer agrees to repair or replace components of high-security chain-link fences and gates that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to comply with performance requirements.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - c. Faulty operation of gate operators and controls.
 - 2. Warranty Period: Five years from date of Substantial Completion.
- E. Gate Operator Warranty: Five (5) year manufacturer's standard warranty.

1.6 REFERENCES

- A. Underwriters Laboratories (UL): UL 325 - Standard for Safety for Door, Drapery, Gate, Louver, and Window Operators and Systems.
- B. Underwriters Laboratories (UL): UL 991 - Standard for Tests for Safety Related Controls Employing Solid-State Devices.
- C. American Society Testing Materials (ASTM): ASTM F2200 - Standard Specification for Automated Vehicular Gate Construction.
- D. National Electrical Manufacturers Association (NEMA): NEMA ICS 6 - Industrial Control Systems: Enclosures.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing fence grounding; member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

- B. Emergency Access Requirements: According to requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.
- C. Gate Operator Installer Qualifications: Installation performed by factory authorized dealer contractor specifically trained in gate operator systems of the type found within this section.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 Specifications to design chain-link fence and gate frameworks.
- B. Structural Performance: Chain-link fence and gate frameworks shall withstand the design wind loads and stresses for fence height(s) and under exposure conditions indicated according to ASCE/SEI 7:
 - 1. Design Wind Load: As indicated on Drawings.
 - a. Minimum Post Size: Determine according to ASTM F 1043 for post spacing not to exceed 10 feet for Material Group IA, ASTM F 1043, Schedule 40 steel pipe.
 - b. Minimum Post Size and Maximum Spacing: Provide line posts of size and spacing indicated, but not less than sizes and spacings determined according to CLFMI WLG 2445, based on mesh size and pattern specified.
- C. Deflection Limits: Fence deflections shall be within the following limits:
 - 1. Fabric Tension: Maximum 2.5 inches when tested by applying a 30-lbf force at midpoint between rails and horizontally between posts for every eighth lower panel along the fence line. Measure fabric movement from the relaxed position at the point where the force is applied.
 - 2. Fence Post Rigidity: Maximum 3/4 inch when a 50-lbf force is applied at mid-height of every eighth post along the fence line. Measure post movement from the relaxed position at the point where the force is applied.
- D. Lightning Protection System: Maximum resistance-to-ground value of 25 ohms at each grounding location along fence under normal dry conditions.

2.2 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in height measured between top and bottom of outer edge of selvage according to "CLFMI Product Manual" and requirements indicated below:
 - 1. Fabric Height: 8'-0". Mesh up to 7'-0", top foot of fence-three strands barb wire with angled post.
 - a. Steel Wire for Fabric: Wire diameter of 0.148 inch.
 - 1) Mesh Size: 2 inches.

2. Coat selvage ends of metallic-coated fabric before the weaving process with manufacturer's standard clear protective coating.
3. Selvage: Twisted and barbed top and bottom.

2.3 SECURITY FENCE FRAMEWORK

- A. Posts and Rails: ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts.
 1. Fence Height: 84 inches.
 2. Heavy-Industrial-Strength Material: Group IA, round steel pipe, Schedule 40. Provide Group IC, round steel pipe, electric-resistance-welded pipe at gate.
 - a. Line Post: 2.375 inches in diameter.
 - b. End, Corner, and Pull Posts: 2.875 inches in diameter.
 3. Rail Members: Intermediate and top rails according to ASTM F 1043 for Heavy Industrial. See Drawings.
 4. Metallic Coating for Steel Framework:
 - a. External, Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil-thick, zinc-pigmented coating.

2.4 HORIZONTAL-SLIDE GATES

- A. General: ASTM F 1184 for gate posts and single cantilever sliding gate types. Provide automated vehicular gates according to ASTM F 2200.
 1. Classification: Type I Overhead Slide.
 - a. Gate Leaf Width: As indicated on plans-close off drive.
 - b. Framework Member Sizes and Strength: Based on gate fabric height of more than 96 inches.
 2. Classification: Type II Cantilever Slide, Class 1 with external roller assemblies.
 - a. Gate Frame Width and Height: 25' wide or less by 96".
- B. Pipe and Tubing:
 1. Zinc-Coated Steel: Protective coating and finish to match fence framework.
- C. Frame Corner Construction: Welded and 3/8-inch-diameter, adjustable truss rods for panels 60 inches or wider.
- D. Extended Gate Posts and Frame Members: Angled gate posts and frame end members above top of chain-link fabric at both ends of gate frame 12 inches as required to attach barbed wire assemblies.
- E. Overhead Track Assembly: Manufacturer's standard track, with overhead framework supports, bracing, and accessories, engineered to support size, weight, width, operation, and design of gate and roller assemblies.
- F. Hardware:
 1. Hangers, Roller Assemblies, and Stops: Fabricated from galvanized steel.

2.5 SWING GATES

- A. General: ASTM F 900 for gate posts and double swing gate types.
 - 1. Gate Leaf Width: As indicated on drawings.
 - 2. Framework Member sizes and strength: Based on gate fabric height of 96 inches.
- B. Pipe and Tubing:
 - 1. Zinc-Coated Steel: Protective coating and finish to match fence framework.
 - 2. Gate Posts: Round tubular steel.
 - 3. Gate Frames and Bracing: Round tubular steel.
- C. Frame Corner Construction: Welded and 3/8 inch diameter, adjustable truss rods for panels 60 inches or wider.
- D. Extended Gate Posts and Frame Members: Fabricate gate posts and frame end members to extend 12 inches (300 mm) above top of chain-link fabric at both ends of gate frame as required to attach barbed wire assemblies.
- E. Hardware:
 - 1. Hinges: 180-degree inward/outward-see drawings.
 - 2. Latch: Permitting operation from one side of gate with provision for padlocking accessible from both sides of gate.
 - 3. Lock: Manufacturer's standard internal device.
 - 4. Padlock and chain.

2.6 FITTINGS

- A. Provide fittings according to ASTM F 626.
- B. Post Caps: Provide for each post.
 - 1. Provide line post caps with loops to receive tension wire or top rail and barbed wire arms.
- 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 intermediate rails to posts.
- E. Tension and Brace Bands, Tension Bars, and Truss Rod Assemblies: According to ASTM F 2611.
- F. Barbed Wire Arms: Pressed steel or cast iron with clips, slots, or other means for attaching strands of barbed wire, integral with post cap, for each post unless otherwise indicated, and as follows:
 - 1. Provide line posts with arms that accommodate top rail or tension wire.
 - 2. Provide corner arms at fence corner posts unless extended posts are indicated.
 - 3. Single-Arm Type: Type I, slanted arm.
 - 4. Use bolts or rivets for connection to posts.
- G. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
 - 1. High-Security Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:

- a. Metallic-Coated Steel: 0.148-inch-diameter wire; zinc coating.
- H. Power-Driven Fabric Fasteners: As recommended in writing by manufacturer.
- I. Finish:
 - 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. of zinc.

2.7 BARBED WIRE

- A. Steel Barbed Wire: ASTM A 121, High Security Grade, three-strand barbed wire; 0.099-inch-diameter line wire with 0.080-inch-diameter, four-point round barbs spaced not more than 4 inches o.c.
 - 1. Aluminum Coating: Type A.
 - 2. Three rows at top of fence.

2.8 SLIDING GATE OPERATORS

- A. Basis of Design Manufacturer: DoorKing, Inc.; 120 S. Glasgow Ave; Inglewood, CA 90301; Toll-Free Tel: (800) 826-7493; Tel: (310) 645-0023; Fax: (310) 641-1586; Email: ghendrix@doorking.com; Web: doorking.com.
 - 1. Substitutions: Allowed in accordance with Division 01 Specifications.
- B. Microprocessor based solid-state control board interacting with card readers, RF transmitters, access control systems, ticket machines, other activating devices as required, external devices (photo-eyes, contact edges) for entrapment protection and vehicle (loop) sensing systems. Control board shall include built-in close timer (1-25 seconds), built-in ports for two (2) plug-in loop detectors, partial open input, programming switches to set various operating modes, inherent magnetic pulse obstruction sensing reverse system. System shall employ Fail-Safe operation upon primary (AC) power outage.
 - 1. Compliance: Compliant to UL 325, UL 991, and CSA C22.2 No. 247 and listed by Intertek Testing Laboratories NA, Inc. (ETL), a Nationally Recognized Testing Laboratory.
 - a. This model is intended for use in Class I, II, III and IV vehicular slide gate applications.
 - 2. Maximum Gate Length:
 - a. 30-feet with 1/2 HP motor.
 - b. 45-feet with 1 HP motor.
 - 3. Maximum Gate Weight:
 - a. 1000 Lbs. with 1/2 HP motor.
 - b. 1500 Lbs. with 1 HP motor.
 - 4. Operator speed: approximately 11-inches per second.
 - 5. Enclosure:
 - a. 12-gage, 0.108-inch G90 hot-dipped galvanized steel, finished with polyester powder coat, exterior grade semi-gloss texture gray.
 - b. Polypropylene, 0.157" texture gray, conforms to UL746C, UV (f1) and V0 flame rating.
 - 6. Configuration: Left- or right-hand mount; front, center or rear mounting configurations.
 - 7. Mounting: Pad or post mount.
 - 8. Electrical Power Requirements: 115/208/230/460/575 VAC.
 - a. 208/230/460/575 VAC requires DoorKing High Voltage Kit.
 - 9. Motor: Continuous Duty Motor.
 - a. 1/2 HP.

- b. 1 HP.
- 10. Dead Bolt Lock: Solenoid dead bolt engages if an attempt is made to force the gate open.
- 11. Fail-Safe Operation: Upon loss of primary (AC) power, the system shall automatically be transferred to a fail-safe mode allowing the gate to be pushed open without the use of special knowledge, keys, or other releasing mechanisms.
- 12. Primary Reduction: Adjustable clutch, single cog belt drive train.
- 13. Pulling Medium: #40 roller chain.
- 14. Magnetic Limit Switches: Automatic setting with no mechanical switches to set, wear out or break.
- 15. Operating Switches: Built-in power (on-off), reset and operating switches.
- 16. Convenience Outlets: Two (2) 115 VAC for accessory transformers.
- 17. Entrapment Protection.
 - a. Photo-electric eye (non-contact sensor).
 - b. Sensing edge (contact sensor).
- 18. Accessories: Provide the optional accessories listed below.
 - a. Base Plate - for post mount applications.
 - b. Chain tray kit - to support roller chains on long gates.
 - c. Fail-Secure Lock Kit - requires a key lock to open the gate upon primary (AC) power loss.
 - d. Plug-in loop detectors.
 - e. Electric reversing edge - reverses direction of gate on contact with an obstruction.
 - f. Provide security interface to card access system.

2.9 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with 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.

2.10 GROUNDING MATERIALS

- A. Comply with requirements in Section 26 and see Electrical Drawings.
- B. Connectors and Grounding Rods: Listed and labeled for complying with UL 467.
 - 1. Connectors for Below-Grade Use: Exothermic welded type.
 - 2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for a certified 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 or Civil Engineer.
- 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 CHAIN-LINK FENCE INSTALLATION

- A. Install chain-link fencing according to ASTM F 567 and more stringent requirements specified.
 - 1. Install fencing on established boundary lines inside property line.
- B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and held 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: Place top of concrete 2 inches below grade or as indicated on Drawings to allow covering with surface material.
 - b. Posts Set into Sleeves in Concrete: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.
 - c. Posts Set into Holes in Concrete: Form or core drill holes not less than 5 inches deep and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.
- D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more, at any abrupt change in grade, and at intervals not greater than 500 feet. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.
- E. Line Posts: Space line posts uniformly at 96 inches o.c.

- F. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
 - 1. Locate horizontal braces at mid-height of fabric 72 inches or higher, on fences with top rail, and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- G. Barbed Wire Arms: Bolt or rivet to top of post. Angle single arms away from approach side of fence.
- H. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sagging. 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 at the following locations:
 - 1. Extended along bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.
- I. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- J. Chain-Link Fabric: Apply fabric on the approach side of fence, inside of enclosing framework. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
 - 1. Overlapping Fabric: Overlap ends of fence fabric at or between posts or rails; overlap 6 inches and secure with wire ties or steel strap method.
 - 2. Bottom Clearance: Leave 1-1/2 inches between finish grade or surface and bottom selvage unless otherwise indicated.
- K. 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.
- L. Tie Wires: Power-fastened or manually fastened ties configured to wrap a full 360 degrees around rail or post and a minimum of one complete diamond of fabric. Twist ends one and one-half machine twists or three full manual twists and cut off protruding ends to preclude untwisting by hand.
 - 1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.
- M. Power-Fastening of Fabric: Fasten 0.192- or 0.148-inch wire fabric with 2- or 1-inch mesh size. Fasten fabric to line posts 12 inches o.c. and to braces 24 inches o.c.
- N. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.
- O. Barbed Wire: Install barbed wire uniformly spaced, angled toward security side of fence. Pull wire taut, install securely to extension arms, and secure to end post or terminal arms.

3.4 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.

3.5 GATE-OPERATOR INSTALLATION

- A. It is preferred, but not required, that this product be installed by a qualified technician who is certified by either the Accreditation and Certification Institute (ACI) or the Institute of Door Dealer Education and Accreditation (IDEA).
- B. Model 9150 shall be mounted, firmly secured, plumb and level, as required.
- C. Wiring shall be uniform and in accordance with national electric codes and manufacturer's instructions.
- D. All splices shall be in easily accessible junction boxes or on terminal boards.
- E. All cable runs in all junction boxes shall be tagged and identified.
- F. Coordinate all work with other effected trades and contractors.

3.6 SYSTEM INITIALIZING AND PROGRAMMING

- A. Turn system on and adjust to meet requirements of specifications and on-site conditions.
- B. System shall function as specified.

3.7 SYSTEM TEST PROCEDURES

- A. System shall be completely tested to assure that all components and accessories are hooked-up and in working order.
- B. System shall be pre-tested by contractor and certified to function in accordance with plans and specifications.
- C. System shall be tested in presence of owner's representative.

3.8 OWNER INSTRUCTIONS

- A. Installation contractor shall conduct up to (1) hour of instruction in use and operation of the system to designated owner representatives, within (30) days of acceptance.
- B. Installation contractor shall conduct up to (1) hour of technical training, in troubleshooting and service of the system, to designated owner representatives within (90) days of system acceptance.

3.9 GROUNDING AND BONDING

- A. Comply with requirements in Section 26.
- B. Fence and Gate Grounding:
 - 1. Ground for fence and fence posts shall be a separate system from ground for gate and gate posts.
 - 2. Install ground rods and connections at maximum intervals of 100 feet.
 - 3. Ground fence on each side of gates and other fence openings.
 - a. Bond metal gates to gate posts.
 - b. 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.
- C. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a ground rod located a maximum distance of 150 feet on each side of crossing.
- D. Fences Enclosing Electrical Power Distribution Equipment: Ground according to IEEE C2 unless otherwise indicated.
- E. 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 the conductor to each fence component at grounding location.
 - 1. Make grounding connections to each barbed wire strand with wire-to-wire connectors designed for this purpose.
- F. Connections:
 - 1. Make connections with clean, bare metal at points of contact.
 - 2. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 3. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 - 4. Make above-grade ground connections with mechanical fasteners.
 - 5. Make below-grade ground connections with exothermic welds.
 - 6. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests.
- B. Perform the following tests:
 - 1. Fabric Testing: Test fabric tension according to "Deflection Limits" Paragraph in "Performance Requirements" Article.
 - 2. Fence Post Rigidity Testing: Test line posts for rigidity according to "Deflection Limits" Paragraph in "Performance Requirements" Article.
 - 3. Grounding Tests: Comply with requirements in Section 26.
- C. Prepare test reports.

3.11 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.
- B. Automatic Gate Operator: Energize circuits to electrical equipment and devices, start units, and verify proper motor rotation and unit operation.
 - 1. Hydraulic Operator: Purge operating system, adjust pressure and fluid levels, and check for leaks.
 - 2. Test and adjust operator, controls, alarms, and safety devices. Replace damaged and malfunctioning controls and equipment.
 - 3. Lubricate operator and related components.
- C. Lubricate hardware and other moving parts.

3.12 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain high-security chain-link fences and gates.

END OF SECTION