PROJECT MANUAL

S-55 HVAC AND LIGHTING UPGRADES
CAMP DODGE, JOHNSTON, IOWA

Project No. 19083734
Contract No. C4425S277

AUGUST 16, 2024

ISG Project No.: 24-30667

IOWA ARMY NATIONAL GUARD

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S-55 HVAC AND LIGHTING UPGRADES
CAMP DODGE, JOHNSTON, IOWA

For The
IOWA ARMY NATIONAL GUARD

Project No. 19083734
Contract No. C4425S277

AUGUST 16, 2024

THE ARMORY BOARD
DEPARTMENT OF PUBLIC DEFENSE (MILITARY DIVISION)

THE ADJUTANT GENERAL
Major General STEPHEN E. OSBORN
CHAIRMAN OF THE ARMORY BOARD

ISSUED BY:

STATE COMPTROLLER OFFICE:

Zach Gillen, Contracting Officer
Camp Dodge, Building 3465 (W-41)
7105 NW 70th Avenue
Johnston, IA 50131-1824
Phone: (515) 252-4522

CONSTRUCTION & FACILITIES MANAGEMENT OFFICE:

Michael Brothers, Design Branch Chief
Camp Dodge, Building 3535 (B-61)
7105 NW 70th Avenue
Johnston, IA 50131-1824
Phone: (515) 252-4225

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DOCUMENT 00 01 02

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DOCUMENT 00 01 05

CERTIFICATIONS

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

Erica Schaefer 08-16-2024

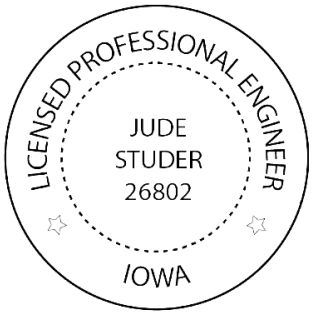
Erica M. Schaefer, AIA Date

License No.: 07376 Date Issued: 03-22-2017

My License Renewal Date is June 30, 2026

Sections covered by this seal:

Division 00, 01, 03 - 14.



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

08-16-2024

Jude Studer, PE Date

License No.: 26802 Date Issued: 06-04-2021

My License Renewal Date is December 31, 2024

Sections covered by this seal:

Division 00, 01, 03 - 06.

	I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly Licensed Engineer under the laws of the State of Iowa. 08-16-2024 Adam W. Puls, P.E. Date License No.: 23206 License Issued: 01-04-2016 My License Renewal Date is December 31, 2025 Sections covered by this seal: Division 00, 01, and 21 - 23.

	I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly Licensed Engineer under the laws of the State of Iowa. 08-16-2024 Joseph Hahn, P.E. Date License No.: 26928 Date Issued: 08-13-2021 My License Renewal Date is December 31, 2024 Sections covered by this seal: Division 00, 01, 26 - 28.

END OF DOCUMENT 00 01 05

DOCUMENT 00 01 10

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Legend:

IAARNG: Iowa Army National Guard
ISG: ISG, Inc.

Legend:

IAARNG: Iowa Army National Guard
ISG: ISG, Inc.

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING

DIVISION 26 - ELECTRICAL

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

Legend:

IAARNG: Iowa Army National Guard
ISG: ISG, Inc.

DIVISION 31 – EARTHWORK

DIVISION 32 – EXTERIOR IMPROVEMENTS

END OF DOCUMENT 00 01 10

Legend:

IAARNG: Iowa Army National Guard
ISG: ISG, Inc.

DOCUMENT 00 11 00

ADVERTISEMENT FOR BIDS

PROJECT TITLE:
S-55 HVAC AND LIGHTING UPGRADES

BID DATE: SEPTEMBER 17, 2024

PROJECT LOCATION:
CAMP DODGE, JOHNSTON, IOWA

PROJECT NO.: 19083734
CONTRACT NO.: C4425S277

The Iowa Department of Public Defense, on behalf of the Iowa National Guard (IANG), will be receiving sealed bids until **1:00 P.M.** local time in Conference Room 106 of **BUILDING 3535 (B-61)**, **CAMP DODGE**, 7105 NW 70TH AVENUE, JOHNSTON, IOWA 50131-1824 for the proposed S-55 HVAC AND LIGHTING UPGRADES, CAMP DODGE, JOHNSTON, IOWA. The general scope of work includes, but is not limited to:

Base Bid: HVAC equipment replacement and Latrine fixture update. Equipment replacement consists of replacement of Air Handling Units (3), Makeup Air Units (2), VAV Boxes, Exhaust Fans, Fire/Smoke Dampers and Controls. The Latrine fixture update consists of upgrading the water closet/urinal flush valves. Additional items are included as a part of an add alternate and include paint throughout the building, ceiling repair, latrine partition and counter replacements, and replacement of latrine lavatories.

Alternate Bid No.1: Finish Upgrades

Bids received will be opened and read aloud at the time and place stated. Late bids will not be considered. Bids must be hand-delivered (bids received via mail, delivery service, oral, telephonic, facsimile or other electronically transmitted bids will not be accepted). Interested parties are invited to attend.

Bids shall be submitted on the Bid Form and shall be accompanied by a Bid Security as set forth in the Instructions to Bidders in the amount of five percent (5%) of the total bid amount. Each bid shall be accompanied by a bid bond executed by corporations authorized to contract as surety in Iowa, cashier's check or a certified check drawn upon a solvent bank chartered under the laws of the United States of America, made payable to Iowa Department of Public Defense; as a guarantee that the accepted bidder shall enter into a contract with the State of Iowa and file an approved surety company Performance and Payment Bond for the faithful performance thereof. Upon failure to comply, said check or bid bond shall become forfeited as liquidated damages.

Any construction contractor performing work in Iowa (including out-of-state contractors) must comply with Chapter 91C of Iowa Code

Bidders must comply with all affirmative action/equal employment opportunity provisions of the State of Iowa and the Federal Government. The Iowa Department of Public Defense, Iowa Army National Guard, seeks to provide opportunities for Targeted Small Businesses in accordance with the provisions of Chapter 73 of the Code of Iowa. A listing of certified Targeted Small Businesses can be obtained by visiting the Iowa Department of Economic Development website at https://iowaeda.microsoftcrmportals.com/tsb-search/

The Iowa Department of Public Defense 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 and the IANG.

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

Bidding Documents may be obtained from Beeline and Blue (2507 Ingersoll Avenue, Des Moines, Iowa 50312, (515) 244-1611 or 1-800-347-1610) and will be loaned to qualified contract bidders upon receipt of Master Builders of Iowa non-cash deposit card or a check in the amount of fifty dollars ($50.00) deposit per set payable to “Iowa Department of Public Defense”. Deposit will be refunded to bidders upon return of their complete set of Bidding Documents, including any addenda, properly bound and in good condition to Beeline and Blue within 14 calendar days after opening of bids. Cash deposits will not be accepted.

Bidding Documents may also be viewed online or downloaded at www.beelineandblue.com. Click on “EPLANROOM” and then “PUBLIC JOBS”. Register and log in, then select the project name or enter the project name in the search window.

The Plan Holders List may be viewed online at www.beelineandblue.com. Navigate to the project as outlined above and click on the “PLAN HOLDERS” tab.

For questions regarding the website, please call (515) 244-1611 or 1-800-347-1610.

A set of the Bidding Documents is also available for review at the Construction and Facilities Management Office, Bldg 3535 (B-61), Camp Dodge.

Award of this contract is dependent on receiving requested Federal and/or State funding. If such funding is not received within the sixty (60) day bid guarantee after the date of receiving bids, all rights and obligations under this agreement are considered null and void.

A Pre-Bid Conference will be held at **10:00 A.M.** local time**, THURSDAY, SEPTEMBER 5, 2024,** in Conference Room 106 of **BUILDING 3535 (B-61)** Camp Dodge, 7105 NW 70th Avenue, Johnston, Iowa to review the Plans and Project Manual and to answer questions on this project. All interested parties are invited to attend.

For further information regarding this project please call Michael Brothers at (515) 252-4225 or Zach Gillen at (515) 252-4522.

END OF DOCUMENT 00 11 00

DOCUMENT 00 21 00

INSTRUCTIONS TO BIDDERS

TABLE OF ARTICLES

ARTICLE 1 - DEFINITIONS

1.1 The following definitions add to the list of definitions included in the General Conditions of the Contract and shall be used in conjunction with them as a part of the Bidding Documents.

1.2 Bidding Documents include The Bidding Requirements and the proposed Contract Documents:

1.3 The Bidding Requirements consists of:

.1 Advertisement For Bids.
.2 Instructions to Bidders.
.3 Form of Bid
.4 Supplements to Form of Bid:

.(1) Supplement A: Bid Bond .....(Submit With Form of Bid)
.(2) Supplement D: Targeted Small Business Form .....(Submit With Form of Bid)
.(3) Supplement F: Substitution Request Form (Bidding Phase).
.(4) Supplement G: Proposed Subcontractor Form.
.(5) Supplement H: Wage Rate Requirements Statement
.(6) Supplement J: 889 Representation Form

1.4 The Proposed Contract Documents consists of:

.1 Form of Agreement between the Owner and Contractor.
.2 Conditions of the Contract (General, Supplementary, and other Conditions).
.3 Drawings.
.4 Specifications.
.5 Addenda issued prior to execution of the Contract.
.6 Modifications issued after execution of the Contract.
.7 Other documents listed in the Agreement.

1.5 Definitions set forth in the General Conditions of the Contract for Construction or in other Contract Documents are applicable to the Bidding Documents.

1.6 Addenda are a written or graphic instruments issued by the Architect prior to the execution of the Contract which modify or interpret the Bidding Documents by additions, deletions, clarifications, or corrections.

1.7 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

1.8 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work as described in the Bidding Documents.

1.9 An Allowance is a specified monetary sum, specified quantity or time not otherwise defined by the specifications or drawings, but which the contractor is required to include in the bid price.

1.10 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment or services or a portion of the Work as described in the Bidding Documents.

1.11 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

1.12 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

1.13 A Sub-bidder is a person or entity who submits a Bid to a Bidder for materials, equipment or labor for a portion of the Work.

ARTICLE 2 - RECEIPT AND OPENING OF BIDS

2.1 The Iowa Department of Public Defense (Military Division), Iowa Army National Guard, hereinafter called the Owner, will receive Bids in Conference Room 106 of Building **3535 (B-61)**, Camp Dodge, 7105 NW 70th Avenue, Johnston, Iowa 50131-1824, until the established bid date and time (see Section 00 41 00 - Form of Bid). The Owner will then publicly open and read all properly submitted Bids.

2.2 The Owner will secure, unopened, all Bids received prior to the established bid date and time. The Owner's representative whose duty it is to open Bids will decide when the specified time has arrived and will not consider any Bid received thereafter.

2.3 The Owner will reject and return unopened any Bid received after the time specified for the receipt of Bids.

2.4 Oral, telephonic, telegraphic, facsimile or other electronically transmitted bids will not be considered.

2.5 Mailed or Delivery Service Bids will not be considered.

2.6 Each Bidder shall be solely responsible for the delivery of their Bid to the Owner at the place and before the time specified in Paragraph 2.1 above.

2.7 Photo identification will be required to gain entrance at the front gate of Camp Dodge.

2.8 The Owner acknowledges the responsibility of the Iowa Public Bidding Requirements in advertising and receiving bids for this project.

ARTICLE 3 - BIDDING DOCUMENTS

3.1 Bidders may obtain complete sets of the Bidding Documents from the issuing entity designated in the Advertisement for Bid for the deposit sums stated therein. Deposits will be refunded as designated in the Advertisement for Bid.

3.2 Bidders and Sub-bidders shall use complete sets of Bidding Documents in preparing Bids; neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

3.3 The Owner and Architect may make copies of the Bidding Documents available on the above terms for the Purpose of obtaining Bids on the Work. No license or grant of use is conferred by issuance of copies of the Bidding Documents.

ARTICLE 4 - PREPARATION OF BIDS

4.1 Prepare Bids on an exact copy of the "Form of Bid" included in these documents. Fill in all applicable blank spaces, typewritten or in ink. The amount must be in both words and figures. If words and figures do not agree, the amount as written in words shall govern.

4.2 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change".

4.3 The person signing the Bid must initial all erasures or corrections.

4.4 Bids must indicate the full name of the Bidder, must be signed in the firm or corporate name of the Bidder, and must bear the longhand signature of a principal duly authorized to execute contracts for the Bidder. Bids signed by an agent of the Bidder must be accompanied by evidence of the agent's authority to execute contracts for the Bidder. Type or print below the signature the name of each person signing the Bid.

ARTICLE 5 - SUBMITTAL OF BIDS

5.1 Enclose in its own sealed envelope the "Form of Bid for Construction Contract" separate from the other required Supplements to the Form of Bid identified below and label with the name of the Bidder and the following designation:

SEALED BID for:
S-55 HVAC AND LIGHTING UPGRADES
CAMP DODGE, JOHNSTON, IOWA
Contract Number C4425S277
Iowa Army National Guard

5.2 Enclose in a second sealed envelope along with the separately sealed "Form of Bid for Construction Contract" the following Supplements to the Form of Bid:

1. Supplement A: The Bid Security (Contractor provided document).
2. Supplement D: Targeted Small Business Form (use provided form).

Label this second sealed envelope with the name and address of the Bidder and the following designation:

BID DOCUMENTS for:
S-55 HVAC AND LIGHTING UPGRADES
CAMP DODGE, JOHNSTON, IOWA
Contract Number C4425S277
Iowa Army National Guard

5.3 **HAND CARRIED BIDS:** Deliver to address indicated in Article 2.1 above.

ARTICLE 6 - MODIFICATION OF BIDS

6.1 No modification of submitted Bids in any way or form will be permitted.

ARTICLE 7 - WITHDRAWAL OF BIDS

7.2 Any Bid may be withdrawn and resubmitted prior to the time set for the receipt of Bids provided that they are then fully in conformance with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

7.3 No bid may be withdrawn for a period of sixty (60) calendar days after the time set for the receipt of Bids.

ARTICLE 8 - IOWA TARGETED SMALL BUSINESS REQUIREMENTS

8.1 PROGRAM DESCRIPTION AND REQUIREMENTS:

8.1.1 On construction contracts bid competitively for which a participation goal is indicated, each Bidder who is not a Targeted Small Business and who will be using a Certified Targeted Small Business Subcontractor or supplier must:

.1 Submit with the Form of Bid: Supplement D: Targeted Small Business Form provided herein.

.2 Comply with all relevant provisions of the Iowa Civil Rights Act, Chapter 601A; Executive Order #11, 1984, and #15, 1973, as appended by Executive Order #34, dated July 22, 1988; Federal Executive Order #11245, 1965, as amended by Federal Executive Order #11375, 1967; the Equal Employment Opportunity Act of 1972; and Iowa Code Section 19B.7.

.3 Comply with all provisions of the State of Iowa relevant to fair employment practices, and furnish all information and submit all reports requested by these provisions.

.4 Continue to use the Iowa Targeted Small Business certification guidelines as set out in 481-Chapter 25 of the Iowa Administrative Code for the purpose of identifying Targeted Small Businesses for participation in the award of general and subcontracts.

8.1.2 The mandatory set-aside requirements and bid preferences required by Iowa Code Sections 73.16 to 73.21 are not currently in effect. Use the following guidelines to encourage Targeted Small Business participation.

8.1.3 DEFINITIONS:

.1 Actively manage means exercising the power to make policy decisions affecting the business.

.2 Minority person means an individual who is black, Hispanic, Pacific Island native, American Indian, or Alaskan Native.

.3 Operated means actively involved in the day-to-day management of the business.

.4 Small Business means any enterprise which is located in this State, which is operated for profit under a single management, and which has either fewer than twenty employees or an annual gross income of less than three million dollars computed as an average of the three previous years.

8.2 The Department of Public Defense (Military Division), Iowa Army National Guard (IAARNG), seeks to provide opportunities for Targeted Small Businesses in the awarding of contracts. The IAARNG may award contracts to Targeted Small Businesses under the terms of the Iowa Small Business Procurement Act of 1986 and the Iowa Administrative Code. The IAARNG is also authorized to establish certified Targeted Small Business participation requirements for construction contracts.

8.3 When entering into this contract with the IAARNG, the General Contractor will take documented steps to encourage participation from Targeted Small Businesses for the purpose of subcontracting or supplying of materials. This project has a Targeted Small Business participation goal of ten percent (10%).

8.4 If a prime contractor fails to meet the Targeted Small Business participation goal indicated, the prime contractor shall still be required to submit with the Form of Bid (on the Targeted Small Business Form provided herein) the names of Targeted Small Businesses contacted.

8.5 If the Bidder intends to subcontract with a certified Targeted Small Business in the absence of a stated Targeted Small Business participation goal, the Bidder should inform the State Comptroller Office of this intent by submitting a Targeted Small Business Form so that they may receive credit for this participation.

ARTICLE 9 - BID SECURITY FOR TARGETED SMALL BUSINESS BIDDERS

9.1 On projects where Bid amount exceeds $25,000.00, the instructions in Article 10, Bid Security for Non-Targeted Small Business Bidders, apply.

9.2 On Bids of $25,000.00 or less, Certified Targeted Small Businesses, as part of the Bid Documents, may either provide a Bid Bond or a bond waiver from the Department of Economic Development.

ARTICLE 10 - BID SECURITY FOR NON-TARGETED SMALL BUSINESS BIDDERS

10.1 Secure Bids with a cashier's check, certified check, or a Bid Bond in an amount of at least five percent (5%) of the Bid. The Owner will automatically disqualify Bids secured by other means.

10.2 Make certified checks and cashier's checks payable to "IOWA DEPARTMENT OF PUBLIC DEFENSE".

10.3 Submit Bid Bonds in the form prescribed in these documents. Bid Bonds must be executed solely by corporations authorized to contract a surety in Iowa and, in addition to all other provisions, clearly designate an Iowa resident agent as attorney-in-fact. Attorneys-in-fact who sign surety bonds must file with each bond a certified and effectively dated copy of their power of attorney.

10.4 Bid security acts as the measure of liquidated damages which the Owner will sustain by failure, neglect, or refusal of Bidder to deliver a signed contract stipulating performance of the Work in unqualified compliance with Contract Documents within ten (10) days after notification of award of contract is given.

10.5 The Owner will return Bid security when submitted in the form of either a cashier's check or a certified check by any Bidder except the three lowest Bidders within forty-eight (48) hours after opening.

10.6 The Owner will all return retained Bid securities (cashier's check, or certified check) within forty-eight (48) hours of executing a contract, performance and payment bond with the successful Bidder. If the award process involves more than the bid holding time established in the Bidding Documents, those Bidders whose securities are retained shall have the right to negotiate with the Owner on the matter.

ARTICLE 11 - QUALIFICATION OF BIDDERS

11.1 Bidders must be registered with the Iowa Labor Commissioner. The Bidders must include an Iowa registration number as provided for on the Form of Bid.

11.2 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.

11.3 Non-resident corporations certify by submittal of a Bid that the corporation shall comply with Chapter 73 of the Iowa Code.

11.4 The Owner may make such investigations as deemed necessary to determine the ability of the Bidder to perform the Work, and the Bidder must furnish to the Owner all such information and data for these purposes as the Owner may request. The Owner reserves the right to reject any Bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the Owner that such Bidder is properly qualified to carry out the obligations of the Contract and to complete the Work described herein.

11.5 The Owner gives preference to Iowa domestic labor in the constructing or building of any public improvement. By virtue of statutory authority, preference is given to products and provisions produced or grown within the State of Iowa.

11.6 Bidders and all Subcontractors shall be prepared to represent post-bid whether they do or do not use prohibited telecommunications equipment or services in accordance with Section 889 Part B of the FY 2019 National Defense Authorization Act (NDAA). Refer to Article 22 – Post-Bid Information

ARTICLE 12 - SUBCONTRACTORS

12.1 In accordance with Iowa law, the successful Bidder must furnish in writing to the Owner a list of the names of subcontractors who will work on the project as described in Article 22.

12.2 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 contractor's registration number, and (2) be acceptable to the Owner.

ARTICLE 13 - BIDDERS REPRESENTATION

13.1 Each Bidder by submitting a Bid represents that:

13.1.1 The Bidder has read and completely understands the Bidding Requirements and Contract Documents.

13.1.2 The Bidder has visited the site, become familiar with the local conditions under which the Work is to be performed, including availability and cost of labor and materials, and has carefully correlated personal observations with the requirements of the Contract Documents.

.1 A tour of the site will be conducted following the Pre-Bid Conference identified in the Advertisement for Bids. Bidders shall arrange for other site visits in advance by contacting David Shea at **(515) 250-6107**.

13.1.3 The Bid is based upon the materials, equipment and systems required by the Bidding Documents without exception.

13.1.4 The Bidder has familiarized himself/herself with Federal, State, and Local laws, ordinances, rules, and regulations affecting performance of the Work.

13.1.5 The Bidder agrees that the Contract Time will begin upon receipt of a Notice to Proceed from the Owner, and will achieve Substantial Completion of all the Work within the Contract Time stated on the Bid Form, excepting for delays covered in Article 8 of the General Conditions of the Contract.

13.1.6 The Bidder has given preference to use of Iowa domestic labor and products and provisions produced or grown within the State of Iowa.

13.2 Failure of the selected Bidder to fulfill the provisions of this Article in no way relieve the obligation of the Bidder to furnish all materials and labor necessary to carry out the provisions of the Contract, nor shall such failure constitute grounds for extra compensation over the price stated in the accepted Bid.

ARTICLE 14 - SUBSTITUTIONS

14.1 The materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

14.2 No substitution will be considered during the bidding period unless written request has been submitted to the Architect for approval, on the form provided herein, at least 5 days prior to the bid date. Each such request must include the name of the material, product or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, cuts, performance and test data, and any other data or information necessary for a complete evaluation. The burden of proof of the merit of the proposed substitution is upon the proposer.

14.3 Request for approval of a substitution will not be considered if Substitution Request Form provided herein is not completely filled out.

14.4 If the Architect approves any proposed substitution, such approval is not official until set forth in an addendum. Do not include any substitutions not confirmed by written addenda.

14.5 Substitutions after the Contract Award may be considered only as provided for in the Conditions of the Contract and Division 1 of the Project Manual.

ARTICLE 15 - ADDENDA AND INTERPRETATIONS

15.1 Bidders must carefully examine and compare the Bidding Documents, examine the site and local conditions and at once report any ambiguity, inconsistency, or error discovered. Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make written request to the Architect for interpretation or correction. Such requests must reach the Architect at least seven (7) days prior to the bid date.

15.2 The Architect will issue any and all interpretations, corrections, revisions, and amendments to all holders of Bidding Documents in the form of written addenda. Addenda will be transmitted at least forty-eight (48) hours prior to the time set for the receipt of Bids to all who are known by the issuing office to have received a complete set of Bidding Documents. Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose. Each Bidder is responsible to ascertain prior to submitting a Bid that the Bidder has received all Addenda issued. All addenda issued shall become part of the Contract Documents and Bidders must acknowledge them in the Form of Bid.

15.3 Only those interpretations, corrections, revisions, and amendments confirmed by written addenda are binding. Bidders are cautioned to refrain from including in their Bid any interpretations, corrections, revisions, or amendments which are not confirmed by written addenda.

15.4 Any question relating to the technical specifications may be directed to the individuals identified on Document 00 01 02 – Project Design Team.

ARTICLE 16 - BID PREFERENCE

16.1 All Bidders must certify their state or foreign country of residence by completing the official address section of the Form of Bid.

16.2 Under Iowa law, as described in the Iowa Administrative Code, resident Bidders on public improvements are allowed a preference equal to the preference given or required by the state or foreign country in which the nonresident Bidder is a resident. “Resident Bidder” means a person or firm authorized to transact business in this State, and having a place of business at which it is and has conducted business for at least six months prior to the first advertisement for the public improvement and, in the case of a corporation, at least fifty percent (50%) of the common stock is owned by residents of this State.

ARTICLE 17 - METHOD OF AWARD

17.1 It is the intent of the Owner to award a Contract to the lowest qualified Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. The Owner may reject any or all Bids, waive any irregularities, informalities, or technicalities in any Bid, and accept any Bid in whole or in part which it deems to be in the Owner’s best interests.

17.2 All requested Alternates shall be bid. The Owner reserves the right to accept Alternates in any order or combination, and to determine the low Bidder on the basis of the sum of the Base Bid and Alternate(s) accepted.

17.3 Generally, all Bids received by the Owner which require allocation of appropriated Government funding are subject to the acceptance of the issuing department for the State of Iowa. Each prime Bidder, subcontractor, and material supplier on this project agrees to guarantee their Bid for a period of sixty (60) calendar days after the time set for the receipt of Bids.

17.4 Award of this contract is dependent on receiving requested Federal and/or State funding. If such funding is not received within the sixty (60) day Bid guarantee after the date of receiving Bids, all rights and obligations to enter into a contract are considered null and void.

17.5 The Owner sending a "Notice of Award" to the selected Bidder constitutes award of the Contract.

ARTICLE 18 - EXECUTION OF CONTRACT

18.1 Selected Bidder must, within ten (10) calendar days after receiving Notice of Award, enter into a written contract with the Owner on the Form of Agreement prescribed in these documents.

18.2 The Contract, when duly executed, represents the entire agreement between parties.

18.3 Simultaneously with the delivery of the executed Contract, the Contractor must furnish a performance and payment surety bond in the amount of 100% of the Contract Sum as security for faithful performance of the Contract and for the payment of all persons performing labor and furnishing materials for the work, or evidence of eligibility for waiver of the bond requirements. The bond shall be on the form prescribed in these documents (Submit one copy only). The surety on such bond shall be by a corporation duly authorized to do business in the State of Iowa, and said bond shall be signed or countersigned by an Iowa Resident Agent. Attorneys-in-fact who sign surety bonds must file with each bond a certified and effectively dated copy of their power of attorney.

18.4 Completed Contract and Contract Performance and Payment Bond must be dated the same and executed as per State contracting instruction procedures.

18.5 The Owner will maintain a contract administration system ensuring that contractors perform in accordance with the terms, conditions, and specification of their Contract Document.

ARTICLE 19 - IOWA STATE BUILDING CODE

19.1 All construction under this Contract must conform to the requirements of the Iowa State Building Code. Adhere to the provisions of the Iowa State Building Code which takes precedence over local governmental bodies' regulations. Perform work not regulated by the Iowa State Building Code in accordance with other applicable local regulations.

ARTICLE 20 - TAXES

20.1 This project is TAX EXEMPT. Refer to Article 3.6 of the General Conditions (as modified by the Supplementary Conditions) and Article 22.3 of the Instructions To Bidders.

ARTICLE 21 - PREBID CONFERENCE

21.1 The Owner requests Bidders to attend a pre-bid conference on the date, time, and location specified in the Advertisement for Bids.

ARTICLE 22 - POST-BID INFORMATION

22.1 Prior to consideration for Award of Contract, the Apparent Low Bidder shall submit for the general contractor and ALL subcontractors a completed:

22.1.1 Supplement J: 889 Representation Form.

.1 Failure of the bidding entity to successfully meet the requirements of Section 889 Part B of the 2019 NDAA, either through non-use of the prohibited equipment or meeting the mitigation requirements as outlined in Supplement J, will result in the bid being rejected. Failure to meet these requirements by a proposed subcontractor will result in their rejection and trigger the actions outlined in Section 22.2.1 below.

22.2 The Awarded Bidder shall, within forty eight (48) hours of notification of selection for the award of a Contract for the Work, submit:

22.2.1 Supplement G - Proposed Subcontractor Form:

.1 Include the following:

(1). A designation of the Work to be performed by the Bidder with his/her own forces.
(2). A list of names of the subcontractors or other persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work including but not limited to Mechanical Work, Electrical Work, Masonry Work, and Telecommunication Work (as applicable).
(3). The list must include Iowa Contractor's registration numbers for all Subcontractors.

.2 The Bidder will be required to establish to the satisfaction of the Architect and the Owner the reliability and responsibility of the proposed subcontractors or other persons or entities to furnish and perform the Work described in the Bidding Documents.

.3 Prior to the execution of the Contract, the Architect will notify the Bidder in writing if either the Owner or the Architect, after due investigation, has reasonable objection to any subcontractor, person or entity on such list. If the Owner or Architect has a reasonable objection to any subcontractor, person or entity on such list, the Bidder may, at the Bidder's option:

(1). Withdraw the Bid.
(2). Submit an acceptable substitute subcontractor, person or entity with an adjustment in the Base Bid or Alternate Bid to cover the difference in cost occasioned by such substitution. The Owner may, accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification under this subparagraph, bid security will not be forfeited, notwithstanding anything to the contrary in Paragraph "Bid Security" of this Section.

.4 Subcontractors and other persons and entities proposed by the Bidder and to whom the Owner and the Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and the Architect.

22.3 The Awarded Bidder shall, within one week following the Pre-Construction meeting and prior to purchasing any materials for the Work, submit a completed 'Sales Tax Exempt Application Form'. The Owner will email an electronic copy of the form to the General Contractor shortly after the Pre-Construction Meeting.

END OF DOCUMENT 00 21 00

DOCUMENT 00 41 00

FORM OF BID
for
CONSTRUCTION CONTRACT

I. PROJECT TITLE:
S-55 HVAC AND LIGHTING UPGRADES

PROJECT LOCATION:
CAMP DODGE, JOHNSTON, IOWA

BID DATE: SEPTEMBER 17, 2024
AT: 1:00 p.m. Local time

PROJECT NO.: 19083734

CONTRACT NO.: C4425S277

TO: Iowa Army National Guard
State Comptroller Office
Attn: Contracting Officer
(Reference Section 00 21 00 for Submittal of Bids)

II. ACKNOWLEDGEMENT

A. The undersigned Bidder, in response to your Advertisement for Bids for construction of the above project, having examined the Drawings, Specifications, and other Bidding Documents and the site of the proposed work, and being familiar with all of the conditions surrounding the construction of the proposed project including the availability of materials and labor, hereby proposes to furnish all labor, materials, and supplies, and to construct the project in accordance with the proposed Contract Documents within the time set forth therein and at the prices stated below. These prices are to cover all expenses incurred in performing the work required under the proposed Contract Documents of which this bid is a part.

B. Accompanying this proposal are the following required documents:

1) Supplement A: The Bid Security.....(Contractor provided document).
2) Supplement D: Targeted Small Business Form .....(use provided form).

C. Bidder acknowledges receipt of the following Addenda which are a part of the Bidding Documents:

Numbers _____ , _____ , _____ , _____ , _____ , _____.

III. LUMP SUM PROPOSAL

A. **BASE BID:** Bidder agrees to perform all of the work described in the proposed Contract Documents and shown on the Drawings for the Sum of:

_____

_____ Dollars ($ _____)

B. **ALTERNATE No. 1:** Bidder agrees to perform all of the work described in the proposed Contract Documents and shown on the Drawings. ADD / DEDUCT the Sum of:

_____

_____ Dollars ($ _____)

C. **UNIT PRICES:** If the required quantities of the items listed below are increased or decreased by Change Order, the adjustment unit prices set forth below shall apply to such increased or decreased quantities:

Unit Price No. 1: SEALING OF DUCTWORK:

_____ Dollars / LF) ($_____ / LF)

D. **Amounts will be shown in both words and figures. In case of discrepancy, the amount in words will govern.**

IV. SCHEDULE

A. It is estimated that work can commence by..…….. _____ (mm/dd/yyyy).

and be completed by……_____ (mm/dd/yyyy).

(Note: Not a bid award determining factor.)

V. SUBMISSION CONDITIONS

A. In submitting this bid, it is understood that the Owner reserves the right to accept Alternates in any order or combination and to determine the low Bidder on the basis of the sum of the Base Bid and Alternate(s) accepted.

B. Bidder hereby certifies: (a) that his bid is genuine and is not made in the interest of or on behalf of any undisclosed person, firm, or corporation; (b) that Bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid; (c) that Bidder has not solicited or induced any person, firm, or corporation to refrain from bidding; (d) that Bidder has not sought by collusion to obtain any advantage over any other bidder or over Owner.

VI. CONTRACTOR SIGNATURE

A. Respectfully Submitted:

Firm Name: _____ Telephone No.: _____

Official Address: _____ FAX No.: _____

_____ EMAIL: _____

Mailing Address: _____
(if different from above)

_____

Signed By: _____

Printed Name: _____

_____
(Title)

Date: _____

Federal ID No.: _____

Iowa Contractor Registration No.:_____

END OF DOCUMENT 00 41 00

DOCUMENT 00 43 13

SUPPLEMENT A:
BID BOND

(To be submitted with the Form of Bid if securing Bid with a Bid Bond)

AIA Document A310 - Bid Bond, 2010 Edition, is hereby a part of the Specifications as if it were bound herein.

Copies and samples for preview of the document can be obtained online from: https://www.aiacontracts.org/purchase.

END OF DOCUMENT 00 43 13

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DOCUMENT 00 43 16

SUPPLEMENT D: TARGETED SMALL BUSINESS FORM

(To be submitted with Form of Bid)

I. PROJECT TITLE:
S-55 HVAC AND LIGHTING UPGRADES

PROJECT NO.: 19083734
CONTRACT NO.: C4425S277

PROJECT LOCATION:
CAMP DODGE, JOHNSTON, IOWA

_____ _____
Bidder's Company Name Area Code/Telephone

_____
Address City State Zip Code

Bidder is _____ is not _____ a certified Iowa Targeted Small Business.

INSTRUCTIONS: Bidder shall provide the information requested below showing any Targeted Small Business Enterprise contacts made prior to bid submission for the project listed. Bidder shall use the construction-related Iowa Targeted Small Business Directory as certified by the Department of Economic Development, State of Iowa. 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. Information is subject to verification and confirmation.

TSB Company Name and Phone #	**Date Contacted**	**Quote Rec'd (Y/N)**	**$ Amount Proposed (if quote used in bid)**

(Use second sheet if needed)

_____ _____
Date Signature of Bidder (same person signing the Form of Bid)

END OF DOCUMENT 00 43 16

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DOCUMENT 00 43 25

SUPPLEMENT F:
SUBSTITUTION REQUEST FORM (BIDDING PHASE)

TO: **FORWARD ALL SUBSTITUTION REQUESTS TO:**
Carter Burroughs, ISG, Inc.
217 East 2nd Street, Suite 110, Des Moines, IA 50309
952-426-0699 (phone) carter.burroughs@isg.com (email)

PROJECT: S-55 HVAC AND LIGHTING UPGRADES, CAMP DODGE, JOHNSTON, IOWA

Specification: Title, Section, Page, Paragraph / Article

_____

Proposed Substitution: Description, Manufacturer, Model, Phone No., Trade Name

_____

_____

_____

Product Data: Drawings, Specifications, Performance Data, Test Data – Attached

_____

_____

_____

The Undersigned Certifies: (Check each)

_____ Substitution is equal or superior in all respects to specified item.
_____ Will provide same warranty as specified item.
_____ Same maintenance service and source of replacement parts, as applicable, are available.
_____ Substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
_____ Substitution does not affect dimensions or functional clearances.
_____ Will coordinate installation and adjust other work which may be required, at no additional cost to the Owner.
_____ Waives claims for additional costs or time extensions which may subsequently become apparent.
_____ Will reimburse Owner for review or design services for re-approval by authorities, for changes in building design, detailing, and construction costs caused by the substitutions.

Requested By: _____ Signature: _____

Company: _____ Telephone: _____

Address: _____ Fax: _____

END OF DOCUMENT 00 43 25

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DOCUMENT 00 43 36

SUPPLEMENT G:
PROPOSED SUBCONTRACTOR FORM

(To be submitted within 48 hours of notification of selection for the award of a contract)

A. Work proposed to be performed by the Bidder with his/her own forces:

1. _____
2. _____
3. _____
4. _____
5. _____

(attach additional pages as required)

B. A list of names of the subcontractors or other persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work including but not limited to the following (as applicable):

1. Mechanical: _____
2. Electrical: _____
3. Masonry: _____
4. Geothermal:_____
5. Telecommunication: _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____

(attach additional pages as required)

END OF DOCUMENT 00 43 36

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DEPARTMENTS OF THE ARMY AND THE AIR FORCE
NATIONAL GUARD BUREAU
111 SOUTH GEORGE MASON DRIVE
ARLINGTON, VA 22204-1382

RECEIVED
NOV 30 1993
FACILITIES & CONSTRUCTION

NGB-AEN

24 NOV 1993

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Applicability of Davis-Bacon Act

1. The purpose of this memorandum is to clarify the relation of the Davis-Bacon Act to State contracts.

2. All State contracts are exempt from the provisions of the Davis-Bacon Act even though they are funded by 100% Federal funds contributed to the State from the National Guard Bureau. 32 CFR 33.36 (i)(5) requires the use of the Federal Davis-Bacon Act only in cases where it is required by the Federal grant program legislation. Our authorization statues do not require the use of the Davis-Bacon Act. Therefore, the States must follow the applicable State law. Questions should be referred to the State full time Judge Advocate.

3. For further information, please contact Patrick Batt at DSN 327-7911.

FOR THE CHIEF, NATIONAL GUARD BUREAU:

DONALD R. FRANKLAND
LTC EN
Director of Engineering

DISTRIBUTION

Each TAG (1)

CF:
Each FMO (1)
Each USPFO (1)

AGIA-SJA 6 JAN 94

MEMORANDUM FOR CW5 JERRY KLINKEFUS

SUBJECT: APPLICABILITY OF DAVIS BACON ACT TO STATE CONTRACT ACTIVITY

1. As a result of my review of the code of IOWA, I have determined that the IOWA state contracting actions which use ARNG appropriations, do not require the Davis Bacon Act clause(s).

2. This is consistent with NGB guidance specific to National Guard appropriation and authorization language, part 31, Code of Federal Regulations.

EDWARD J STROBL, LT COL, IA ANG
STAFF JUDGE ADVOCATE

END OF DOCUMENT 00 43 43

MICRO-PURCHASE
NATIONAL DEFENSE AUTHORIZATION ACT (NDAA) SECTION 889 REPRESENTATION

For additional information see: https://www.acquisition.gov/FAR-Case-2019-009/889_Part_B

1. ☐ Merchant has an active registration in SAM (www.sam.gov) **and** FAR 52.204-26 is dated Oct 2020 (or later)
   ☐ Merchant is not registered in SAM (www.sam.gov) **or** is registered, but FAR 52.204-26 is dated earlier than Oct 2020

2. Company Name / Merchant (Offeror)	3. Date

4. Company Street Address	5. City	6. State	7. Zip Code

8. Owner or Designated Representative Name	9. E-mail	10. Telephone Number

11. DUNS Number (*if applicable*)	12. Cage Code Number (*if applicable*)	13. SAM Registration Expiration Date (*if applicable*)

14. Complete the following FAR 52.204-26 Representation:

COVERED TELECOMMUNICATIONS EQUIPMENT OR SERVICES-REPRESENTATION (OCT 2020)

(a) *Definitions.* As used in this provision, "covered telecommunications equipment or services" and "reasonable inquiry" have the meaning provided in the clause 52.204-25, Prohibition on Contracting for Certain Telecommunications and Video Surveillance Services or Equipment.

(b) *Procedures.* The Offeror shall review the list of excluded parties in the System for Award Management (SAM) (https://www.sam.gov) for entities excluded from receiving federal awards for "covered telecommunications equipment or services".

(c)(1) *Representation.* The Offeror represents that it ☐ does, ☐ does not provide covered telecommunications equipment or services as a part of its offered products or to the Government in the performance of any contract, subcontract, or other contractual instrument.

(2) After conducting a reasonable inquiry for purposes of this representation, the offeror represents that it ☐ does, ☐ does not use covered telecommunications equipment or services, or any equipment, system, or service that uses covered telecommunications equipment or services

Signature of Owner or Designated Representative identified in Block 8 above. | X |

This representation expires on the date in block 13 or one year from the date in block 3, whichever is soonest. Forward any representation modifications/changes to the sender within 30 days.

Additional Disclosure Instructions to Merchant/Offeror (*if applicable*)

(a) If the Offeror represents in (c)(1) above that, "it *does* provide covered telecommunications equipment […]", then the Offeror should go to FAR 52.204-24 -- Representation Regarding Certain Telecommunications and Video Surveillance Services or Equipment, paragraph (e)(1) *Disclosures* (https://www.acquisition.gov/far/part-52#FAR_52_204_24) to identify the additional documentation that should accompany this representation when sending it back to the sender.

(b) If the Offeror represents in (c)(2) above that, "it *does* use covered telecommunications equipment […]", then the Offeror should go to FAR 52.204-24 -- Representation Regarding Certain Telecommunications and Video Surveillance Services or Equipment, paragraph (e)(2) *Disclosures* (https://www.acquisition.gov/far/part-52#FAR_52_204_24) to identify the additional documentation that should accompany this representation when sending it back to the sender.

GPC-Merchant 889 Representation v.4

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DOCUMENT 00 52 00

FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

IOWA DEPARTMENT OF PUBLIC DEFENSE
(MILITARY DIVISION)

ARMORY BOARD
IOWA ARMY NATIONAL GUARD

STANDARD CONTRACT FOR CONSTRUCTION

STATE PROJECT: PROJECT NO.: 19083734
CONTRACT NO.: C4425S277

AGREEMENT

made as of the _____ day of _____ in the year of Two Thousand Twenty-Four (2024).

BETWEEN the Owner: Iowa Department of Public Defense (Military Division)
Armory Board, Iowa Army National Guard, Adjutant General Chairman
Camp Dodge, 7105 NW 70th Avenue, Johnston, Iowa 50131-1824

and the Contractor:

The Project: S-55 HVAC AND LIGHTING UPGRADES
CAMP DODGE, JOHNSTON, IOWA

The Architect: ISG, Inc.
217 East 2nd Street, Suite 110
Des Moines, IA 50309

Amount: $ _____

Payment to be made by: Iowa Department of Public Defense
State Comptroller Office
Building 3465 (W-41), Camp Dodge
7105 NW 70th Avenue
Johnston, Iowa 50131-1824

The Owner and the Contractor agree as follows:

ARTICLE 1 - THE CONTRACT DOCUMENTS

1.1 The Contract Documents consists of this Agreement, the Conditions of the Contract (General, Supplementary, and other Conditions), the Drawings, the Specifications, all Addenda issued prior to execution of this Agreement, all other documents listed in this Agreement, and all Modifications issued after execution of this Agreement; these form the Contract, and all are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. An enumeration of the Contract Documents, other than modifications, appears in Article 9.

ARTICLE 2 - THE WORK OF THIS CONTRACT

2.1 The Contractor shall fully execute the Work described in the Contract Documents, except to the extent specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 - DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

3.1 DATE OF COMMENCEMENT: The Contractor will be required to commence Work under this Contract by _____, after receipt by the Contractor of Notice to Proceed. The Contract Time shall be measured from the date of commencement.

3.2 SUBSTANTIAL COMPLETION: The Contractor shall achieve Substantial Completion of the entire Work not later than _____, subject to adjustments of this Contract Time as provided in the Contract Documents.

ARTICLE 4 - CONTRACT SUM

4.1 The Owner shall pay the Contractor in current funds for the performance of the Work, subject to additions and deductions by Change Order as provided in the Contract Documents, the Contract Sum of

$ _____

4.2 The Contract Sum is determined as follows:

BASE BID: $ _____

ALTERNATE NO. 1: $ _____

4.3 Unit prices are as follows:

UNIT PRICE NO. 1: $ _____ / L.F.

ARTICLE 5 - PROGRESS PAYMENTS

5.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on

account of the Contract Sum to the Contractor for the period ending on the last day of the month as provided in the Contract Documents and as follows:

5.1.1 Not later than 30 days following the date the Application for Payment is received by the Owner's Representative, ninety-five percent (95%) of the portion of the Contract Sum properly allocable to labor, materials, and equipment incorporated in the Work and ninety-five percent (95%) of the portion of the Contract Sum properly allocable to materials and equipment suitably stored at the Site or at some other location agreed upon in writing, for the period covered by the Application for Payment, less the aggregate of previous payments made by the Owner, and upon Substantial Completion of the entire Work, a sum sufficient to increase the total payments to ninety-five percent (95%) of the Contract Sum, less such amounts as the Architect shall determine for all incomplete Work, retainage applicable to such work and unsettled claims as provided in the Contract Documents.

5.2 Application for Payment: One (1) copy shall be submitted to the Architect via email in pdf format on AIA Document G702 - 1992, Application and Certificate for Payment, supported by AIA Document G703 – 1992, Continuation Sheet.

5.3 Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due in accordance with Section 573.12, Code of Iowa.

ARTICLE 6 - FINAL PAYMENT

6.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when:

6.1.1 The Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Subparagraph 12.2.2 of the General Conditions and to satisfy other requirements, if any, which extend beyond final payment;

6.1.2 all closeout documents required to be submitted with the final Application have been received by the Architect; and

6.1.3 a final Certificate for Payment has been issued by the Architect.

6.2 The Owner's final payment to the Contractor shall be made thirty days after the issuance of the Owner's Letter of Final Acceptance.

ARTICLE 7 - MISCELLANEOUS PROVISIONS

7.1 Terms in this Agreement which are defined in the Conditions of the Contract shall have the meanings designated in those Conditions.

7.2 Where reference is made in this Agreement to a provision of the General Conditions or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

ARTICLE 8 - FUNDING

8.1 Award of this contract is dependent on receiving requested Federal and/or State funding. If such funding is not received within the sixty (60) day bid guarantee after the date of receiving bids, all rights and obligations under this agreement are considered null and void.

ARTICLE 9 - ENUMERATION OF THE CONTRACT DOCUMENTS

9.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated as follows:

1. This executed Agreement
2. Any issued Addendums
3. Performance and Payment Bond
4. Application and Certificate for Payment
5. General Conditions of the Contract for Construction
6. Supplementary and other Conditions
7. Certificate(s) of Insurance
8. Certificate of Substantial Completion
9. General Requirements (Division 1)
10. Technical Specifications (All other Divisions)
11. Drawings

STATE OF IOWA:

Department of Public Defense (Military Division)
Armory Board, Iowa Army National Guard

By _____

_____
(Name Typed)

_____
(Title)

Iowa National Guard
(Address)

Camp Dodge, 7105 NW 70th Avenue

Johnston, Iowa 50131-1824

CONTRACTOR:

By _____
(Contractor)

_____
(Name Typed)

_____
(Title)

_____
(Address)

_____

Phone No.: _____

FAX No.: _____

Federal ID No.: _____

IA Registration No.: _____

NOTE: If the Contractor is a corporation, the following witness signatures are not required, but the annexed Certificate of Corporate Authority must be completed. Type or print names under all witness signatures.

IN WITNESS WHEREOF, the parties hereto have executed this Contract as of the _____day of _____, 2024.

(Date to be completed by Owner upon receipt of all signatures.)

_____
State of Iowa - Witness Signature

_____
Printed Name

_____
Contractor – Witness Signature

_____
Printed Name

CERTIFICATE OF CORPORATE AUTHORITY

I, _____ certify that I am the
(typed name of corporate officer other than person signing Contract)

_____ of the corporation named as Contractor
(typed corporate office of person signing above)

herein; that _____, who signed this Contract on behalf of
(typed name of person who signed Contract)

the Contractor, was then _____ of said corporation;
(typed position of person signing Contract)

that said Contract was duly signed for and in behalf of said corporation by authority of its governing body,

and is within the scope of its corporate powers.

AFFIX YOUR CORPORATE SEAL TO THE BOTTOM OF THIS FORM IF ONE EXISTS

END OF DOCUMENT 00 52 00

DOCUMENT 00 61 00

PERFORMANCE AND PAYMENT BOND

AIA Document A312 – Performance and Payment Bond, 2010 Edition shall be utilized for this project and is hereby a part of the Specifications and Contract Documents as if it were bound herein.

Copies and samples for preview of the document can be obtained online from: https://www.aiacontracts.org/purchase.

END OF DOCUMENT 00 61 00

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DOCUMENT 00 62 10

APPLICATION AND CERTIFICATE FOR PAYMENT

AIA Document G702 (1992) – Application and Certificate for Payment Form, supported by AIA Document G703 (1992) Continuation Sheet shall be utilized for this project and is hereby a part of the Specifications and Contract Documents as if it were bound herein.

Copies and samples for preview of the document can be obtained online from: https://www.aiacontracts.org/purchase.

Note: Electronically submit Applications for Payment to the Architect or Engineer per the Supplementary Conditions.

END OF DOCUMENT 00 62 10

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DOCUMENT 00 72 00

GENERAL CONDITIONS

AIA Document A201-2007 – General Conditions of the Contract for Construction, hereafter referred to as General Conditions, forms the General Conditions for this Construction Contract and is hereby a part of the Specifications and Contract Documents as if it were bound herein.

Copies and samples for preview of the document can be obtained online from: https://www.aiacontracts.org/purchase.

END OF DOCUMENT 00 72 00

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DOCUMENT 00 73 00

SUPPLEMENTARY CONDITIONS

The following supplements modify the General Conditions of the Contract for Construction, AIA Document A201-2007. Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect.

Unless noted otherwise, all references are to Articles and Sections of AIA Document A201-2007, General Conditions of the Contract for Construction.

See also related topics in Division 1 – General Requirements for additional requirements.

REFERENCE ARTICLE 1 - GENERAL PROVISIONS

1. Reference Section 1.1.1:

   A written order for a minor change in the Work may also be issued by the Owner's Construction Manager as provided in Section 2.1.1.5 of these Supplementary Conditions.

2. Reference Section 1.1.2; Add Sections:

   1.1.2.1 All contracts awarded by the State are subject to access by the State, National Guard Bureau, The Comptroller General of the United States, or any of their duly authorized representatives. This includes books, documents, papers, etc., and records of the Contractor which are directly pertinent to that specific contract for the purpose of making audits, examinations, excerpts, and transcriptions.

   1.1.2.2 Regulations for proper operation and administration of construction contracts: Code of Federal Regulations (CFR), provide solicitation provisions and contract clauses that pertain to this Project. A copy of these regulations are not bound herein, but are included by reference. Copies may be reviewed in the State Comptroller Office, Building 3465 (W-41), Camp Dodge, 7105 NW 70th Avenue, Johnston, Iowa 50131-1824.

3. Reference Section 1.2.1; Add Section:

   1.2.1.1 In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities:

   .1 Modifications
   .2 The Agreement.
   .3 Addenda, with those of later date having precedence over those of earlier date.
   .4 The Supplementary Conditions.
   .5 The General Conditions of the Contract for Construction.
   .6 Division 1 of the Specifications.
   .7 Drawings and Divisions 2-49 of the Specifications.
   .8 Other documents specifically enumerated in the Agreement as part of the Contract Documents.

   In the case of conflicts or discrepancies between Drawings and Division 2-49 of the Specifications or within or among the Contract Documents and not clarified by Addendum, the Architect will determine which takes precedence in accordance with Sections 4.2.11, 4.2.12, and 4.2.13. In instances where conflict or discrepancy involves quality or quantities, the better quality or greater quantity of work will take precedence.

4. Reference Section 1.5; Delete Section 1.5.1 and substitute the following:

1.5.1 All Drawings, Specifications, and other Instruments of Service, and copies thereof, including those in electronic form, are and shall remain the Owner's property with the exception of one contract set for each party to the Contract.

5. Reference Section 1.5; Delete Section 1.5.2 and substitute the following:

1.5.2 The Drawings, Specifications and other Instruments of Service prepared by the Owner or Architect and Architect's consultants, and copies thereof furnished to, or made by, the Contractor, are for use solely with respect to this Project. They are not to be reproduced or used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects or for additions to this Project outside the scope of Work without the specific written consent of the Owner.

REFERENCE ARTICLE 2 - OWNER

6. Reference Section 2.1.1; Add Sections:

2.1.1.1 Unless otherwise indicated, the term Owner where referred to in the Contract Documents shall mean The Armory Board for the Iowa Army National Guard – Adjutant General Chairman.

2.1.1.2 The Owner's Representative shall be the State Contracting Officer for the Iowa Army National Guard - State Comptroller Office, executing the Contract on behalf of the State and any other officer or civilian employee properly designated Contracting Officer.

The Owner's Representative hereby authorizes the following persons to represent the Owner in the fulfillment of their respective duties as hereinafter described:

1. The Architect
2. The Owner's Construction Manager

2.1.1.3 Duties of the Owner's Representative

1. The Owner's Representative is authorized to act on behalf of the Owner and shall fulfill the duties, rights and obligations of the Owner under the Contract Documents.
2. The Owner's Representative will prepare and initiate Contract Change Orders in accordance with Section 7.2.
3. The Owner's Representative will have authority to reject Work that does not conform to the Contract Documents in accordance with Section 4.2.6 after review with the Architect.

2.1.1.4 Duties of the Architect

1. The Architect is as defined in Section 4.1.1 and shall provide administration of the Contract as described in the Contract Documents.

2.1.1.5 Duties of the Construction Manager

1. The Owner's Construction Manager shall act on behalf of the Owner in all daily actions and communication in accordance with Section 4.2.4.
2. The Owner's Construction Manager shall be responsible for communication and coordination of concerns of the Project to and from all persons within the Owner's organization.
3. The Owner's Construction Manager shall observe the progress of the Work and report any observed deviations from the Contract Documents to the Architect for a determination. The Owner's Construction Manager is not authorized to permit deviations from the Contract Documents.

4. The Owner's Construction Manager shall assist in coordinating the Contractor's operations with those of the Owner. The Owner's Construction Manager, however, shall not perform any duties for the Contractor.

5. The Owner's Construction Manager shall have the authority to, and may issue an order for a minor change in the Work in accordance with Section 7.4 after review with the Architect.

7. Reference Section 2.2; Delete Section 2.2.5 and substitute the following:

2.2.5 No copies of the Contract Documents will be furnished by the Owner to the Contractor with the exception of any complete sets of Bidding Documents returned to the issuing entity designated in the Advertisement for Bids. Additional reproductions may be made by the Contractor pursuant to Section 1.5.2.

8. Reference Section 2.2; Add Section:

2.2.6 The Owner will procure and bear costs of Special Inspections if required by applicable building codes for the project. See Section 13.5.1.1 of these Supplementary Conditions for additional requirements.

REFERENCE ARTICLE 3 - CONTRACTOR

9. Reference Section 3.1.1; Add Section:

3.1.1.1 Under Chapter 91C of the Iowa Code (1989), any construction contractor performing work in Iowa (including out-of-state contractors) is required to register with the Iowa Division of Labor. (See Article 11 of the Instructions to Bidders).

10. Reference Section 3.2.1; Add Section:

3.2.1.1 The Contract is executed as set forth in the Instructions to Bidders.

11. Reference Section 3.2; Add Sections:

3.2.5 Figured dimensions on the Drawings shall be used in preference to scaling the Drawings. If Contractor scales Drawings, dimensions so obtained shall be the sole responsibility of the Contractor.

3.2.6 Where the Work of the Contractor is affected by finish dimensions of manufacturer's equipment, the finish dimension shall be determined by the Contractor, who shall assume the responsibility for proper coordination.

3.2.7 If in the opinion of the Contractor it is not reasonably possible to provide first-class Work by following the procedures and requirements detailed or specified in the Contract Documents, the Contractor shall make a written request for interpretation to the Architect outlining the conditions and concerns. The Contractor shall not proceed with the portion of the Work in question until a response has been received from the Architect. The Architect shall respond with reasonable promptness.

12. Reference Section 3.3; Add Sections:

3.3.4 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties performed by the Owner or Architect in the Administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

3.3.5 The Contractor shall perform the Work so as to cause a minimum of inconvenience to and interruption of the Owner's operations. Any and all interruptions of the operations of the Owner necessary for the performance of the Work shall be noted in the progress schedule and the Contractor shall additionally give the Owner sufficient advance notice of such interruptions as to allow the Owner time to adjust its operations accordingly. Contractor's failure to give the Owner timely notice of such intentions shall place the responsibility for any resulting delays, additional costs, or other liabilities solely with the Contractor.

3.3.6 Prior to commencing the Work under the Contract, the Contractor shall contact all affected entities supplying utilities and arrange for the moving of such utility installations as is necessary for the performance of the Work. It shall be the responsibility of the Contractor to coordinate the Work with that of the affected entities in such a manner as to cause the least possible interference.

13. Reference Section 3.4.1; Add Section:

3.4.1.1 By virtue of statutory authority, give preference to Iowa domestic labor and materials in the execution of the Work, in accordance with provisions of Chapter 73, Code of Iowa, 1962, and amendments including Senate File 2160, dated April 11, 1984. Machinery, equipment, materials and articles installed or used without such approval are at risk of subsequent rejection.

14. Reference Section 3.4.2; Add Section:

3.4.2.1 After the Contract has been executed, the Owner and Architect will consider a formal request for the substitution of products in place of those specified only under the conditions set forth in the General Requirements (Division 1 of the Specifications).

15. Reference Section 3.5; Add Sections:

3.5.1 This warranty shall be for the period specified in the Contract Performance and Payment Bond unless a longer period is required elsewhere in the Contract Documents for certain portions of Work, in which case the longer period shall govern.

3.5.2 The general warranty provided herein is in addition to and not in limitation of the Contractor's obligations under Section 12.2 and any other warranty or remedy provided by law or by the Contract Documents.

3.5.3 The Contractor will furnish maintenance and 24-hour call-back service for the equipment provided and/or installed by the Contractor for a period of 3 months after the date of Substantial Completion. This maintenance and service will include repair and regular examinations of the equipment and installation by competent and trained employees of the Contractor, and all necessary adjustments, greasing, oiling, cleaning, supplies and parts required to keep the equipment in proper operations, except such parts made necessary due to misuse, accidents, or negligence not caused by the Contractor, Subcontractors, or Sub-subcontractors.

16. Reference Section 3.6; Delete Section and substitute the following:

3.6 TAXES

3.6.1 This project is TAX EXEMPT.

.1 The Iowa Department of Public Defense (DPD) is a registered Designated Exempt Entity (DEE) with the Iowa Department of Revenue (IAC chapter 701 - 19.12.) As a DEE, all contractors that are awarded a contract with the Department are issued a tax-exempt certificate for each project that allows the purchase of building materials or withdraw of inventory without incurring a state sales tax. This special exemption certificate would also allow a manufacturer of building materials to consume materials in the performance of a construction contract with a designated exempt entity, without owing tax on the fabricated cost of those materials.

.2 All Contractors responding to a DPD request for proposal should take this in to consideration when figuring out the cost of materials in the project proposal. Refunds for state sales tax on building materials will not need to be considered in the proposal and are discouraged. For more information please refer to:

https://tax.iowa.gov/construction-contracts-designated-exempt-entities

.3 If the contract includes machinery or equipment, the contractor must purchase it for resale and give the supplier a regular exemption certificate (issued from DPD). The contractor should not charge sales tax on machinery and equipment sold to DPD.

17. Reference Section 3.7.2; Add Section:

    3.7.2.1 Compliance with the above shall not preclude the establishment of and compliance with non-conflicting higher standards as may be specified or indicated elsewhere in the Contract Documents.

18. Reference Section 3.7.4; Add Sections:

    3.7.4.1 The conditions described in the first sentence include any conditions which the Contractor will consider as the basis for a claim for extra compensation and include but are not limited to materials containing asbestos, polychlorinated biphenyl (PCB), or other hazardous materials.

    3.7.4.2 By failing to give notice within the time allotted above, the Contractor waives all rights for extra compensation of any kind arising out of the concealed or unknown conditions.

19. Reference Section 3.7.5; Modify Section by adding the underlined words, so that the section now reads as follows:

    3.7.5 If, in the course of the Work, the Contractor knowingly encounters and recognizes human remains, burial markers, archeological sites or previously undelineated wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence or good faith belief of such existence of such remains or features may be made as provided in Article 15.

20. Reference Section 3.7; Add Sections:

    3.7.6 See Section 10.7 of these Supplementary Conditions for Stormwater Pollution Prevention Plan and Permit requirements.

    3.7.7 The Contractor must recognize mandatory standards and policies relating to energy efficiency contained in the State Energy Conservation Plan issued in compliance with the Energy Policy and Conservation Act (PL 94-163).

21. Reference Section 3.9.1; Modify the first sentence by adding the underlined words, so that the first sentence now reads as follows:

    3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work (including work performed by subcontractors).

22. Reference Section 3.9; Add Section:

    3.9.4 The superintendent shall organize and coordinate scheduling of the Work and shall review and coordinate Work between the trades/Subcontractors.

23. Reference Section 3.10.2; Delete the last sentence.

24. Reference Section 3.13; Add Sections:

3.13.1 The Contractor shall provide any additional facilities or areas beyond those areas permitted at the site as required for construction operations or storage of materials at no additional cost to the Owner.

3.13.2 The Contractor shall take all necessary precautions to prevent damage to pipes, conduits, and other underground structures. The Contractor shall protect from disturbance or damage all monuments and property marks until an authorized agent of the Owner has witnessed or otherwise referenced their location and the Contractor shall not remove such marks or monuments until directed.

25. Reference Section 3.15; Delete Sections 3.15.1 and 3.15.2 and substitute the following:

3.15.1 The Contractor shall at all times keep the site of the Work and adjacent premises as free from materials, debris, rubbish and trash as practical and shall remove same from any portion of the site and adjacent premises if, in the opinion of the Owner, such materials, debris, rubbish or trash constitute a nuisance or are in any way objectionable to the public The Contractor shall be responsible for the timely removal of dirt accumulations or any other debris on access roads and public streets and highways resulting from the Contractor's operations.

3.15.2 At the completion of the Work, the Contractor shall remove all materials, implements, staging, piling falsework, debris and rubbish connected with or caused by operations for such Work immediately upon completion of that Work and shall leave the premises in perfect condition insofar as affected by the Work under the Contract. Fires for disposal of rubbish on the site are prohibited.

3.15.3 If the Contractor should fail to clean up the premises as provided in the Contract Documents, the Owner, after giving the Contractor forty-eight hours notice, may do so and Owner shall be entitled to reimbursement from the Contractor.

26. Reference Section 3.16; Add Section:

3.16.2 The Contractor shall furnish the Owner and Architect all necessary assistance to facilitate inspections throughout the process of manufacture or construction, or for the examination of any materials entering into the Work, or for any other purpose required in the discharge of the Owner or Architect's duties.

27. Reference Section 3.18; Add Sections:

3.18.3 The obligations of the Contractor under Section 3.18 shall not extend to the liability of the Owner and its consultants, its agents or employees arising out of: (1) the preparation or approval of maps, Drawings, opinions, reports, surveys, Contract Change Orders, designs or specifications, or (2) the giving of or failure to give directions or instructions by the Owner, its agents or employees providing such giving or failure to give directions or instructions is the primary cause of the injury or damage.

3.18.4 The Contract Documents define claims, damage, losses, and expenses as, but do not limit them to: (1) injury or damage consequent upon the failure of or use or misuse by the Contractor, its Subcontractors, agents, servants, or employees, of any hoist, rigging, blocking, scaffolding, or any and all other kinds of items of equipment furnished or loaned by the Owner; (2) all attorneys' fees and costs incurred in defense of the claim or in bringing an action to enforce the provision of this indemnity or any other indemnity contained in the Contract Documents; and (3) all costs, expenses, lost time, opportunity costs, etc., incurred by the party being indemnified or its employees, agents, or consultants.

3.18.5 The indemnification obligations of the Contractor under this Contract does not extend to the liability of the Owner, any Owner's consultants, or their agents, consultants, or employees arising out of their own negligence.

3.18.6 If trade unions perform the Work or any portion of the Work, the Contractor shall make all necessary arrangements to reconcile without delay, damage or cost to the Owner and its consultants, any conflict between the Contract Documents and any agreements or regulations of any kind at any time in force among members or councils which regulate or distinguish what activities are not included in the work of any particular trade. If this affects the progress of the Work in finishing or installing any items or materials or equipment required under the Contract Documents because of the conflict involving any such agreement or regulation, the Owner or its consultants may require that the Contractor provide other material or equipment of equal kind and quality at no additional cost to the Owner.

REFERENCE ARTICLE 4 - ADMINISTRATION OF THE CONTRACT

28. Reference Section 4.2.2; Add Section:

4.2.2.1 The presence or absence of an Owner's Representative or the Architect on the site for the purpose of inspection shall not relieve the Contractor from any obligations to perform the Work in accordance with the requirements of the Contract Documents.

29. Reference Section 4.2.6:

The Owner will also have the authority to reject Work as provided in Section 2.1.1.3 of these Supplementary Conditions.

REFERENCE ARTICLE 5 - SUBCONTRACTORS

30. Reference Section 5.3; Add Sections:

5.3.1 Such agreements between the Contractor and each Subcontractor (and where appropriate between Subcontractors and Sub-subcontractors) shall also contain provisions that:

.1 require submission to the Contractor of applications for payment under each subcontract to which the Contractor is a party, in reasonable time to enable the Contractor to apply for payment in accordance with Article 9;

.2 require that all Claims for additional costs, extensions of time, damages for delays or other claims with respect to subcontracted portions of the Work shall be submitted to the Contractor (via any Subcontractor or Sub-subcontractor where appropriate) in sufficient time so that the Contractor may comply in the manner provided in the Contract Documents for like Claims by the Contractor against the Owner;

.3 waive all rights the contracting parties may have against one another for damages caused by fire or other perils covered by property insurance described in Article 11, except such rights as they may have to the proceeds of such insurance held by the Owner as trustee;

.4 inform Subcontractors of their rights under Chapter 573, Code of Iowa; and

.5 obligate each Subcontractor to consent specifically to the provisions of Section 5.2.

5.3.2 In accordance with Section 573.12 of the Code of Iowa, the Contractor will make prompt payments to Subcontractors for satisfactory performance of the Work.

REFERENCE ARTICLE 6 - CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

31. Reference Section 6.1.3; Add Section:

6.1.3.1 The Contractor shall be responsible for furnishing accurate information for and participating in the development of a realistic Project schedule.

32. Reference Section 6.2.4; Add Section:

6.2.4.1 Should the Contractor cause damage to the Work or property of any separate contractor or be the cause of delay or failure to perform, the Contractor shall upon due notice promptly attempt

to settle with such other contractor by agreement, or otherwise to resolve the dispute. If such separate contractor sues or initiates an arbitration proceeding against the Owner on account of any damage alleged to have been caused by the Contractor, the Owner shall notify the Contractor who shall defend such proceedings, and if any judgment or award against the Owner arises therefrom the contractor shall pay or satisfy it and shall reimburse the Owner for all attorneys' fees and court or arbitration costs which the Owner has incurred.

33. Reference Section 6.2; Add Sections:

6.2.6 Claims and other disputes and matters in question between the Contractor and separate contractors are subject to the provisions of Section 15.3 and 15.4 provided the separate contractor has reciprocal obligations.

6.2.7 The Contractor shall execute all Work in such manner and in such order, or procedure, as will permit the commencement and carrying on of the Work of the Owner and of separate contractors with the least interference possible using a reasonable procedure whenever it is necessary or desirable to execute such work either simultaneously with the Work under Contract, or otherwise. To this end the Contractor shall cooperate and assist the Owner and separate contractors in every reasonable way, and shall interfere as little as possible with their Work. The Contractor shall move, free of charge, the Contractor's plant equipment and materials or any part of same whenever the Owner considers it reasonable and necessary for the work of the Owner or separate contractors.

REFERENCE ARTICLE 7 - CHANGES IN THE WORK

34. Reference Section 7.1.2; Add Section:

7.1.2.1 The Owner's Construction Manager shall also have authority to act alone in issuing an order for a minor change in the Work as provided in Section 2.1.1.5 of these Supplementary Conditions.

35. Reference Section 7.1; Add Sections:

7.1.4 The pricing of changes in the Work which result in an adjustment to the Contract Sum (excepting Alternate Bids, see Section 7.1.5) shall be limited to the Contractor's direct expenses as defined in Sections 7.3.7.1 through 7.3.7.5, plus the applicable percentage of overhead and profit subject to the following limits:

.1 Fifteen percent (15%) maximum mark-up for Work directly performed by employees of the Contractor, Subcontractor, or Sub-subcontractor.

.2 Five percent (5%) maximum Contractor's mark-up for Work performed or passed through by a Subcontractor and passed through to the Owner by the Contractor.

.3 Five percent (5%) maximum Subcontractor's mark-up for Work performed by a Sub-subcontractor and passed through to the Owner by the Subcontractor and Contractor.

.4 The maximum allowable mark-up is twenty-five percent (25%) passed through to the Owner by the Contractor under any circumstances.

7.1.5 The pricing of changes in the Work that add work already bid as an Alternate which have expired, shall adhere to the following guidelines:

.1 Direct material and labor costs associated with the alternate shall be enumerated in the Request for Change and highlight the original cost, the current cost, the difference, and the reason for the difference.

.2 The Contractor may add up to 15% mark-up for the difference between the original direct material and labor costs and the current material and labor costs only.

.3 The contractor may add to the total a 2% mark-up for increased bonds and insurance costs.

7.1.6 Prices shall include all subcontracts and shall be itemized as follows:

.1 Labor costs shall indicate trade, hourly rate, man hours, and total costs.

.2 Materials, supplies and equipment costs shall indicate unit cost, quantity, and total cost for each item.

.3 Machinery and equipment costs shall indicate machinery or equipment type, number of each, hourly rate, and total cost for each item.

7.1.7 The Contractor shall be allowed no additional compensation for any costs, fees or expenses incurred in performing services already required by the Contract for Construction, and shall not be entitled to additional reimbursement for its home office, other non-job site or indirect overhead expenses, or tools necessary for construction.

7.1.8 Any request for time extension as a result of the Change in Work must be justified and presented in adequate detail showing that the proposed change will delay the final Contract completion date.

7.1.9 Contractor shall not apply sales, consumer, use and similar tax charges incurred for material purchases in charges toward the overhead and profit percentage.

7.1.10 The following definitions shall be used in establishing process for Changes in Work:

.1 Direct expense is the Contractor's actual cost of any item that is easily defined as a required item for the completion of his Contract obligation.

.2 Overhead is a business expense created by the Project but not necessarily a direct part of that portion of the Work involved.

.3 Profit is the compensation accruing to the Contractor for the assumption of risk in a business enterprise.

36. Reference Section 7.2.1; Delete Section and substitute the following:

7.2.1 A Change Order is a written instrument prepared by the Owner and signed by the Owner and Contractor stating their agreement upon all of the following:

37. Reference Section 7.4; Add Section:

7.4.1 The Owner's Construction Manager shall also have authority to issue an order for a minor change in the Work as provided in Section 2.1.1.5 of these Supplementary Conditions.

REFERENCE ARTICLE 8 - TIME

38. Reference Section 8.2; Add Section:

8.2.4 In the event the Contractor fails to maintain the schedule, including accepted revisions, the Contractor shall promptly, at no additional cost to the Owner, increase work forces, increase hours, and/or initiate revisions to means and methods of construction as required to make up lost time and complete the Work in accordance with the construction schedule.

REFERENCE ARTICLE 9 - PAYMENTS AND COMPLETION

39. Reference Section 9.3.1; Add the following sentence to Section 9.3.1:

The Form of Application for Payment shall be a current authorized edition of AIA Document G702 – 1992, Application and Certificate for Payment, supported by a current authorized edition of AIA Document G703 – 1992, Continuation Sheet. One copy of each Application for Payment shall be submitted electronically in .pdf format via email to the Architect or, if applicable, uploaded to the project website for each progress payment.

40. Reference Section 9.3.1; Add Sections:

9.3.1.3 Applications for Payment shall be submitted once a month.

9.3.1.4 The Owner will withhold until final payment, retainage in an amount consistent with the provisions of Section 573.12, 573.13, and 573.14 of the Code of Iowa.

41. Reference Section 9.5.1; Add Section:

9.5.1.8 third party claims filed pursuant to Chapter 573 of the Iowa Code.

42. Reference Section 9.5.3; Delete section in its entirety.

43. Reference Section 9.6.4; Delete the first two sentences.

44. Reference Section 9.8.5; Delete the second sentence and substitute the following:

Upon such acceptance and consent of surety, if any, the Owner shall make payment sufficient to increase the total payments to ninety-five percent (95%) of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work and unsettled claims.

45. Reference Section 9.10.1; Add Section:

9.10.1.1 Issuance of a letter of Final Acceptance by the Owner shall establish the commencement of the thirty-day period during which the Owner retains final payment of the balance due under the Contract under Iowa law and per provisions of this Agreement. If at the end of such thirty-day period, claims are on file with the Owner, the Owner will withhold a sum equal to double the total amount of claims on file or five percent (5%) of the Contract price, whichever is less, until such claims are released or otherwise adjudicated. The Owner will issue a letter of Final Acceptance to the Contractor upon receipt of the Final Certificate for Payment from the Architect.

46. Reference Section 9.10.2; Add Sections:

9.10.2.1 The Owner will not make final payment until the Contractor has performed final cleanup in accordance with Section 3.15

9.10.2.2 See Division 1 – General Requirements for items to be submitted with the final Application for Payment. The Architect will not issue a final Certificate of Payment until all items indicated are submitted:

REFERENCE ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

47. Reference Section 10.1; Add Sections:

10.1.1 Accident Prevention: The safety provisions of all applicable laws, building and construction codes shall be observed. Machinery, equipment and all hazards shall be guarded or eliminated in accordance with the safety provisions of the latest edition of the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America, to the extent that such provisions are not in contravention of applicable laws.

10.1.2 The Work shall be governed by applicable provisions of the general law, including the latest amendments of the following:

1. William-Steiger Occupational Safety & Health Act of 1970, Public Law 91-596.
2. Part 1910 – Occupational Safety & Health Standards, Chapter XVII of Title 29, Code of Federal Regulations.
3. Part 1518 –Safety and Health Regulations for Construction, Chapter XIII of Title 29, Code of Federal Regulations.

10.1.3 The Contractor is responsible for conducting a safety program and/or precautions on the project site that assures work on the site is conducted in accordance with all guidelines and requirements of OSHA and other applicable laws, building and construction codes, and sound construction practice. The Contractor shall prepare, implement and enforce a project safety plan for the purpose of maintaining a site where work is conducted in a safe manner. A copy of the safety plan shall be maintained on the site at all times.

48. Reference Section 10.2; Add Sections:

10.2.9 The Contractor must comply with provisions of Section 88.6(1) of the Code of Iowa pertaining to Occupational Safety and Health Administration (OSHA) entrance and inspections which states that the State Labor Commissioner or State Labor Commissioner's representative upon presenting appropriate credentials to the Owner, operator, or agent in charge, is authorized:

.1 To enter without delay and at reasonable times a factory, plant, establishment, construction site, or other area, work place, or environment where work is performed by an employee of an employer; and

.2 To inspect and investigate during regular working hours and other reasonable times, and within reasonable limits, and within a reasonable manner, any such place of employment and all pertinent conditions, structures, machines, apparatus, devices, equipment, and materials therein, and to question privately any such owner, operator, agent, or employer.

49. Reference Section 10.3.1; Add Section:

10.3.1.1 The Contractor is not required pursuant to Article 7 to perform without consent any work relating to asbestos or polychlorinated biphenyl (PCB).

50. Reference Section 10.3; Add Sections:

10.3.7 Lamps, bulbs and ballasts indicated to be removed by the Contractor, and not indicated to be reused on the project, can be salvaged by the Owner or the Contractor. If not salvaged, the Contractor shall pay any required fees and ensure proper disposal as universal waste (ballasts labeled as "PCB Free" can be disposed as solid waste).

10.3.8 All self-luminous or photo-luminescent (radioactive tritium) exit signs shown to be removed by the Contractor shall be removed without damage and turned over to the Owner for disposal.

10.3.9 The Contractor shall not use asbestos-containing products or materials. Requests for exceptions shall be forwarded by the Contractor to the Owner for approval by the Environmental Branch of the Directorate of Installation Management.

10.3.10 The Contractor shall not knowingly remove, damage or disturb asbestos-containing materials unless required by the project's plans and specifications. Any asbestos abatement identified in the Contract Documents as the responsibility of the Contractor must be performed by properly trained and certified personnel in accordance with all environmental and worker safety regulations.

51. Reference Section 10.3.1; Add Section:

10.3.1.1 The Contractor is not required pursuant to Article 7 to perform without consent any work relating to asbestos or polychlorinated biphenyl (PCB).

52. Reference Article 10; Add Sections:

10.5 IOWA HAZARDOUS CHEMICAL RISKS RIGHT TO KNOW LAW:

10.5.1 Owner's Responsibility. Upon request, the Owner will provide to the Contractor a list of known hazardous chemicals within the Project Site to which their employees may be exposed and suggestions for appropriate protective measures.

10.5.2 Contractor's Responsibility. Contractor must inform his/her employees of the Iowa Hazardous Chemical Risks Right to Know Law.

10.5.3 The Contractor must provide to the Owner a list of known hazardous chemicals that they anticipate using on site as well as other pertinent information relating to employee protection. Contractor's Material Safety Data Sheets (MSDS) must be available to the Owner upon request.

10.7 POLLUTION PREVENTION PROCEDURES

10.7.1 The following pollution prevention procedures shall apply to all Contractors working on Iowa Army National Guard projects:

.1 Spill Prevention and Response: The Contractor shall take adequate precautions to prevent spills of hazardous chemicals, oils, and fuels. The Contractor shall have procedures in place to immediately clean up all spills that could occur on the job site or during transportation to and from the job site. Expenses incurred in the spill cleanup shall belong to the Contractor. Specifically:

.a When liquid hazardous chemicals, oils, or fuels are stored on the job site, the contractor shall provide secondary containment, for containers with 55 gallon capacity or greater, equal to or greater than 110% of the volume of the single largest container.

.b The Contractor shall notify the Iowa Army National Guard Environmental Branch in the event of a spill of chemicals, oils or fuels. The Contractor must have sufficient resources on the work site to clean up a spill. All workers at the site shall know whom the Contractor point of contact is and what they are to do in the event of a spill.

.c The point of contact for the Environmental Branch is:

Shannan Garretson, Environmental Program Manager
Building 3535 (B-61), Camp Dodge
7105 NW 70th Avenue
Johnston, Iowa 50131-1824
Phone: (515) 252-4557
Non-duty Hours Cell Phone (515) 249-5847

.d The Contractor must notify the Iowa Department of Natural Resources and the local sheriff's office of a hazardous substance spill that meets the definition of a "hazardous condition" as defined in the Iowa Administrative Code. Iowa law requires reporting as soon as possible but not later than six hours. Spills meeting the criteria of a "reportable spill" will also require notification of the National Response Center.

10.7.4 Storm Water Pollution Prevention Plans and Permits:

.1 A Storm Water Pollution Prevention Plan and a discharge permit will be required for construction activities resulting in one acre or more soil disturbance.

.2 The Iowa Army National Guard's Director of Installation Management Environmental Branch shall obtain the permit.

.3 The General Contractor, and each subcontractor that has a responsibility described in the plan, will be a co-permittee with the Owner. The General Contractor shall be responsible for compliance with and fulfilling all requirements of the NPDES General Permit Number 2, including the Storm Water Pollution Prevention Plan.

.4 The initial Storm Water Pollution Prevention Plan and Notice of Intent will be provided by the Owner. These and the General Contractor's project inspection diary must be kept on-site and presented to federal, state and local environmental regulatory personnel, and the Owner, when requested.

.5 The General Contractor will provide an individual experienced with storm water pollution prevention plans and techniques to conduct weekly and rainfall inspections of

the construction site and review the project's Storm Water Pollution Prevention Plan at the time of each inspection. The General Contractor is responsible for maintaining a copy of each inspection report. The General Contractor will review the weekly and rainfall storm water inspection reports and address any deficiencies within seven days. Deficiencies may also be identified by the Owner at any time. Corrective actions may include installation of additional erosion controls and/or maintenance of existing controls.

.6 If the Contractor should fail to conduct inspections, create reports, maintain the project inspection diary, and address deficiencies, the Owner, after giving the Contractor forty-eight hours notice, may do so and the Owner shall be entitled to reimbursement from the Contractor.

The General Contractor shall be responsible for continuing compliance with all SWPPP requirements until final stabilization is achieved regardless of whether Substantial Completion has been granted or the Owner has occupied any portion of the site or facility. Such practices shall include, but not be limited to, inspections and reports and maintenance of erosion control measures as described above.

.7 The Owner will file a Notice of Discontinuation upon final stabilization of the disturbed area. The General Contractor will provide the original project inspection diary and the marked-up copy of the Storm Water Pollution Prevention Plan to the Owner at the completion of the project.

10.7.5 Removal of Regulated Wastes:

.1 At the completion of the construction project, the Contractor will be required to remove all waste and unused hazardous chemicals including, but not limited to: solvents, adhesives, paints, and fuels. Said materials shall be properly identified, containerized and, if no longer usable, disposed at the Contractor's expense.

REFERENCE ARTICLE 11- INSURANCE AND BONDS

53. Reference Section 11.1; Add Sections:

11.1.5 Insurance: No prime Contractor shall commence work under this contract until he/she has obtained all insurance required under this Section and until such insurance has been approved by the Owner, nor his/her sub-contractor until all similar insurance required of the subcontractor has been obtained and approved. No policy of insurance which is cancelable on less than 30 days written notice to the insured is satisfactory to the Owner's Representative.

11.1.6 Compensation and Employer's Liability Insurance: The Contractor shall take out and maintain during the life of this Contract the Statutory Workmen's Compensation and Employer's Liability Insurance for all of his/her employees to be engaged in work on the project under this Contract, and in case any work is sublet, the Contractor shall require the subcontractor similarly to provide Workmen's Compensation and Employer's Liability Insurance for all of the latter's employees to be engaged in such work.

11.1.7 Bodily Injury Liability and Property Damage Liability Insurance: Each prime Contractor shall take out and maintain during the life of the Contract such Bodily Injury Liability and Property Damage Liability Insurance as shall protect him/her and any subcontractor performing work covered by the Contract from claims for damage for personal injury, including accidental death, as well as from claims for property damage, which may arise from operations under this Contract, whether such operations be by him/herself or by any subcontractor or by anyone directly or indirectly employed by either of them and the amount of such insurance shall be no less than:

.1 Public Liability Insurance, in an amount no less than One Million Dollars ($1,000,000.00), for injuries including wrongful death to any one person, and subject to the same limit for each person in any amount not less than Two Million Dollars ($2,000,000.00) on account of one accident.

.2 Property Damage Insurance, in a minimum amount of Two Million Dollars ($2,000,000.00) for damages on account of all accidents other than automobile property damage accidents.

.3 Motor Vehicle Bodily Injury Liability in a minimum amount of One Million Dollars (1,000,000.00) per occupant and Two Million Dollars ($2,000,000.00) per accident on account of any one automobile accident."

11.1.8 Insurance Certificates: Each prime Contractor shall furnish certificates of insurance listed above to the Owner and they shall also be subject to the Owner's approval for adequacy of protection."

11.1.9 Owner's Protective Liability Insurance: Each prime Contractor shall take out and furnish to the Owner and maintain during the life of this Contract, complete Owner's Protective Liability Insurance in amounts as specified in Section 11.1.7 above, for Bodily Injury Liability Insurance and for Property Damage Liability Insurance."

11.1.10 All insurance coverage must be provided by insurance companies having policy holder ratings no lower than "A" and financial ratings not lower than "XII" in the Best's Insurance Guide, latest edition in effect as of the date of the Contract.

11.1.11 The required limits of liability may be met by using a split-limit or a combined single limit basis. However, the total limit of liability cannot be less than that stated in the requirements.

54. Reference Section 11.3; The Contractor is directed to purchase and maintain Builder's Risk insurance. Modify Section 11.3 and subsections as follows:

    a. Modify the first sentence of Section 11.3.1 as follows: Delete "Unless otherwise provided, the Owner" and substitute "The Contractor". Add the following sentence:

       If the Owner is damaged by the failure of the Contractor to purchase and maintain such insurance without so notifying the Owner in writing, then the Contractor shall bear all reasonable costs attributable thereto.

    b. Delete Section 11.3.1.2.

    c. Modify Section 11.3.1.3 by substituting "Contractor" for "Owner".

    d. Modify Section 11.3.2 by substituting "Contractor" for "Owner" at the first reference to "Owner.

    e. Delete Section 11.3.4.

    f. Modify Section 11.3.6 by making the following substitutions: (1) in the first sentence, substitute "Contractor" for "Owner" and "Owner" for "Contractor", and (2) substitute "Owner" for "Contractor" at the end of the last sentence.

    g. Modify Section 11.3.7 by substituting "Contractor" for "Owner" at the end of the first sentence.

    h. Modify Section 11.3.8 by substituting "Contractor" for "Owner"; each time the latter word appears except that at the first reference to "Owner" in the first sentence, the word "this" should be substituted for "the Owner's".

    i. Modify Section 11.3.9 by substituting "Contractor" for "Owner" each time the latter word appears except at the third occurrence in the third sentence and in the last sentence.

    j. Modify Section 11.3.10 by substituting "Contractor" for "Owner" each time the latter word appears except at the third occurrence in the first sentence and in the first occurrence in the last sentence.

55. Reference Section 11.4; Delete Section 11.4.1 and substitute the following:

11.4.1 The Contractor shall furnish bonds on the date of execution of the Contract covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in the Bidding Requirements or specifically required in the Contract Documents. The bond shall be on the form prescribed in the Bidding Requirements and the cost thereof shall be included in the Contract Sum. The amount of each bond shall be equal to one hundred percent (100%) of the Contract Sum.

.1 The Contractor shall deliver the required bonds to the Owner simultaneously with the delivery of the executed Contract.

.2 The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

56. Reference Section 11.4; Add Section:

11.4.3 If any surety upon any bond furnished in connection with this Contract becomes unacceptable to the State, or if any such surety fails to furnish reports as to their financial condition from time to time as additional security as may be required from time to time to protect the interests of the State or of persons supplying labor or materials in the prosecution of the Work contemplated by the Contract, the State may terminate the Contract.

REFERENCE ARTICLE 12- UNCOVERING AND CORRECTION OF WORK

57. Reference Section 12.1.2; Add Section:

12.1.2.1 If the condition noted in Section 12.1.2 above was caused by a separate contractor, the Contractor shall first attempt to reach settlement with the separate contractor as provided in Article 6.

58. Reference Section 12.2.2; Add the following sentence to Section 12.2.2.1:

The obligations of the Contractor under this Section shall survive termination of the Contract.

59. Reference Section 12.2.2; Add Sections:

12.2.2.4 Upon request by the Owner and prior to the expiration of one year from the date of Substantial Completion, the Architect will conduct and the Contractor shall attend a meeting with the Owner to review the facility operations and performance.

12.2.2.5 If it becomes necessary for the Contractor to replace an item after Substantial Completion under the terms of the Contract Documents, the warranty period of time for the replacement shall begin with the date of the completion of the replacement.

12.2.2.6 If the Contractor does not proceed with correction of such nonconforming Work within a reasonable time fixed by written notice, the Owner may remove it and store the salvageable materials or equipment at the Contractor's expense. If the Contractor does not pay costs of such removal and storage within ten (10) days after written notice, the Owner may, upon ten (10) additional days written notice, sell such materials and equipment and account for the proceeds thereof, after deducting costs and damages that should have been borne by the Contractor, including compensation of the Owner's services and expenses made necessary by this action. If such proceeds of sale do not cover costs which the Contractor should have borne, the Contract Sum will be reduced by the deficiency. If payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor must pay the difference to the Owner.

REFERENCE ARTICLE 13 - MISCELLANEOUS PROVISIONS

60. Reference Section 13.1; Delete the words following "…where the Project is located".

61. Reference Section 13.5.1; Add Section:

13.5.1.1 Special Inspections, if required for this Project by the Contract Documents, will be procured and paid for by the Owner. The duties and responsibilities of the Contractor in regard to Special Inspections shall be as defined in the General Requirements of the Contract Documents. Special Inspections, if required, are separate and distinct from other Tests and Inspections required by the Contract Documents which shall be procured and paid for by the Contractor under the provisions of Section 13.5.

62. Reference Section 13.6; Delete Section 13.6 and substitute the following:

13.6 INTEREST: Payments due and unpaid under the Contract Documents shall bear interest in accordance with Section 573.12 and 573.14 of the Code of Iowa.

63. Reference Section 13.7; Delete Section in its entirety and substitute the following:

13.7 COMMENCEMENT OF STATUTORY LIMITATION PERIOD

13.7.1 As between the Owner and Contractor:

.1 Before Substantial Completion. As to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion;

.2 Between Substantial Completion and Final Certificate for Payment. As to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certificate for Payment; and

.3 After Final Certificate for Payment. As to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any Warranty provided under Section 3.5, the date of any correction of the Work or failure to correct the Work by the Contractor under Section 12.2, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last.

64. Reference Article 13; Add Sections:

13.8 ENERGY REBATE FORM(S)

13.8.1 The Contractor shall obtain Energy Rebate Forms from all applicable utility providers for the Work. The Contractor shall partially complete and sign the rebate forms; providing the information identified below. The Contractor shall submit the rebate forms with the Application for Final Payment as directed in Article 9.

Lighting:

1. List brand name & model number of fixture(s).
2. List number of fixtures installed.
3. Provide a copy of invoice(s) from supplier to Contractor.
4. Provide Contractor signature.
5. Note: Owner will provide remaining information such as account number, age and size of facility, hours of operation, etc.

HVAC:

1. List manufacturer, size, efficiency, model number, serial number, and installed cost of unit(s). Include manufacturer, model, and installed cost of programmable thermostats.
2. Provide a copy of invoice(s) from the Supplier to Contractor.
3. Provide Contractor signature.
4. Note: Owner will provide remaining information such as account number, age and size of facility, hours of operation, etc.

Motors:

1. List variable speed drive information including manufacturer, model number, serial number, rating, efficiency, equipment cost, and installation cost.
2. List NEMA Premium motor information including manufacturer, model number, serial number, HP rating, efficiency, motor speed, and motor and installation cost.
3. Provide a copy of invoice(s) from the Supplier to Contractor.
4. Provide Contractor signature.
5. Note: Owner will provide remaining information such as account number, age and size of facility, hours of operation, etc.

13.9 MANUFACTURER'S DIRECTIONS

13.9.1 Manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned as directed by the manufacturer unless herein specified to the contrary.

13.9.2 Any additional costs incurred as a result of this requirement shall be borne by the Contractor.

13.10 CODE OF FAIR PRACTICES

13.10.1 During the performance of this Contract, the Contractor agrees as follows:

.1 The Contractor will not discriminate against any employee or applicant for employment because of race, creed, color, religion, national origin, sex, age, or physical or mental disability, or status as a Vietnam-era disabled veteran. The Contractor will take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to their race, creed, color, religion, national origin, sex, age, physical or mental disability, or status as a Vietnam-era disabled veteran except where it relates to a bona fide occupational qualification. Such action includes but is not limited to the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or terminations, rates of pay or other forms of compensation, and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices provided by the Owner setting forth provisions of the nondiscrimination clause.

.2 The Contractor will in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, creed, color, religion, national origin, sex, age, physical or mental disability, or status as a Vietnam-era disabled veteran except where it relates to a bona fide occupational qualification.

.3 The Contractor will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding a notice advising the labor union or workers' representative of the Contractor's commitments under this nondiscrimination clause and post copies of the notice in conspicuous places available to employees and applicants for employment.

.4 The Contractor will comply with all relevant provisions of the Iowa Civil Rights Act of 1965, as amended by Iowa Executive order #15 of 1973, as amended by Iowa Executive Order #34 of 1988; Federal Executive Order 11246 of 1965, as amended by Federal Executive Order 11375 of 1967; the Equal Employment Opportunity Act of 1972; and all provisions relevant to fair application of the rules and regulations of the Owner. The Contractor will furnish all information and reports requested by the Owner or required by or pursuant to the rules and regulations thereof and will also permit access to its payroll and employment records by the Owner or representatives for purposes of investigation to ascertain compliance with such rules, regulations, or requests, or with this nondiscrimination clause.

.5 In the event of the Contractor's noncompliance with the nondiscrimination clauses of this Contract or with any of the aforesaid rules, regulations, or requests, this Contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further contracts with the Owner. In addition, the Owner may take such further action, and such other sanctions may be imposed and remedies invoked, as provided by the Iowa Civil Rights Act of 1965 as amended, Chapter 601A, Code of Iowa, as heretofore and hereafter amended, or by the rules and regulations of the Owner or as otherwise provided by law.

.6 The Contractor will include the provisions of this section of Article 13 hereof in every subcontract and purchase order unless specifically exempt by approval of the Owner, in accordance with the rules and regulations, so that such provisions will be binding on each Subcontractor and vendor. The Contractor will take such action with respect to any Subcontractor or purchase order as the Owner or the authorized representative thereof may direct as a means of enforcing such provisions including sanctions for noncompliance; provided however, that in the event the Contractor becomes involved in, or is threatened with, litigation by a Subcontractor or vendor as a result of such direction by the Owner, the Contractor may request the State of Iowa to enter into such litigation to protect the interests of the State of Iowa.

REFERENCE ARTICLE 14 - TERMINATION OR SUSPENSION OF THE CONTRACT

65. Reference Section 14.3; Add Section:

    14.3.3 Adjustments made for increases in the cost may have a mutually agreed fixed or percentage fee.

66. Reference Section 14.4; Delete Section 14.4.3 and substitute the following:

    14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive from the Owner, payment for Work executed and for proven loss with respect to material, equipment, tools, and construction equipment and machinery, including reasonable overhead and profit. The Contractor shall transfer title to Owner and deliver in the time, place and manner as directed by the Owner, all fabricated and unfabricated parts, Work-in-process, completed Work, supplies and other materials produced as part of, or acquired in connection with the discontinued Work, and other property which would have been required to be furnished to Owner if the Contract had been completed.

67. Reference Article 14; Add Section:

    14.5 MISCELLANEOUS TERMINATION

    14.5.1 Funding: If the Bidding Requirements indicate Federal funding for this project is received from the Federal Government prior to award of the Contract and such Federal funding is not received within the sixty (60) day bid guarantee after the date of receiving bids, all rights and obligations to enter into a Contract are considered null and void.

14.5.2 Provisions of law as contained in Chapter 573A of the Code of Iowa, current edition (which pertains to termination of contracts for construction of public improvements when Work thereon is stopped because of a national emergency), applies to and is a part of this Contract and binding upon all parties hereto, including Subcontractors and sureties.

REFERENCE ARTICLE 15 – CLAIMS AND DISPUTES

68. Reference Section 15.1.5.1; Add Section:

15.1.5.1.a The Contractor shall not be entitled to an increase in the Contract Sum as a result of any delays in the progress of the Work. The Contractor's sole remedy for delay is an extension of time, extended by Change Order for such reasonable time as proposed by the Contractor and approved by the Owner.

END OF DOCUMENT 00 73 00

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SECTION 01 20 00
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Sum and Contract Time.

C. Change procedures.

D. Correlation of Contractor submittals based on changes.

E. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

A. Section 00 72 00 - General Conditions and Document 00 73 00 - Supplementary Conditions: Additional requirements for progress payments, final payment, changes in the Work.

1.03 SCHEDULE OF VALUES

A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.

C. Forms filled out by hand will not be accepted.

D. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.

E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization.

F. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.

G. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Monthly.

B. Progress Payments: For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due: Five Percent (5%).

C. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.

D. Electronically submit Applications for Payment to the Architect or Engineer per the Supplementary Conditions.

E. Forms filled out by hand will not be accepted.

F. For each item, provide a column for listing each of the following:
   1. Item Number.
   2. Description of work.
   3. Scheduled Values.
   4. Previous Applications.
   5. Work in Place and Stored Materials under this Application.
   6. Authorized Change Orders.
   7. Total Completed and Stored to Date of Application.
   8. Percentage of Completion.
   9. Balance to Finish.
   10. Retainage.

G. Execute certification by signature of authorized officer.

H. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

I. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.

J. Submit one electronic Application for Payment.

K. Include the following with the application:
   1. Transmittal letter as specified for submittals in Section 01 30 00.
   2. Construction progress schedule, revised and current as specified in Section 01 30 00.
   3. Project record documents as specified in Section 01 78 00, for review by Owner which will be returned to the Contractor.

L. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.05 MODIFICATION PROCEDURES

A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to Contract Documents.

B. For minor changes not involving an adjustment to the Contract Price or Contract Time, Architect will issue instructions directly to Contractor.

C. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
   1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
   2. Promptly execute the change.

D. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within seven days.

E. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum 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 Section 01 60 00.

F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
   1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
   2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
   3. For pre-determined unit prices and quantities, where applicable, the amount will based on the fixed unit prices.
   4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.

G. Substantiation of Costs: Provide full information required for evaluation.
   1. On request, provide the following data:
      a. Quantities of products, labor, and equipment.
      b. Taxes, insurance, and bonds.
      c. Overhead and profit.
      d. Justification for any change in Contract Time.
      e. Credit for deletions from Contract, similarly documented.
   2. Support each claim for additional costs with additional information:
      a. Origin and date of claim.
      b. Dates and times work was performed, and by whom.
      c. Time records and wage rates paid.
      d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.

3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

H. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

J. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

K. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
1. All closeout procedures specified in Section 01 70 00.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 22 00
UNIT PRICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. List of unit prices, for use in preparing Bids.

1.02 COSTS INCLUDED

A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1.03 MEASUREMENT OF QUANTITIES

A. Take all measurements and compute quantities. Measurements and quantities will be verified by Architect.

B. Assist by providing necessary equipment, workers, and survey personnel as required.

C. Measurement by Weight: Concrete reinforcing steel, rolled or formed steel or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.

D. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.

E. Measurement by Area: Measured by square dimension using mean length and width or radius.

F. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.

G. Perform surveys required to determine quantities, including control surveys to establish measurement reference lines. Notify Architect prior to starting work.

1.04 PAYMENT

A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.

B. Payment will not be made for any of the following:
   1. Products determined as unacceptable before or after placement.
   2. Products placed beyond the lines and levels of the required Work.

1.05 DEFECT ASSESSMENT

A. Replace Work, or portions of the Work, not complying with specified requirements.

1.06 SCHEDULE OF UNIT PRICES

A. Item: Cost to seal existing fiberglass duct liner insulation per linear foot.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 23 00
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.

1.02 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.03 SCHEDULE OF ALTERNATES

A. Add Alternate No. 1 - Finish Upgrades
   1. Paint Throughout Building, Ceiling and Ceiling Hatch Repair, Door Signage, Vestibule Door Replacement, Latrine Toilet/Urinal Partition Replacement, and Countertop and Lavatory Replacement.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preconstruction meeting.

B. Progress meetings.

C. Construction progress schedule.

D. Submittals in general.

E. Submittals for review, information, and project closeout.

F. Number of copies of submittals.

G. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 3305 - Electronic Submittal Procedures.

B. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.

C. Section 01 78 00 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 PROJECT COORDINATOR

A. Project Coordinator: General Contractor.

B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for employee access, traffic, and parking facilities.

C. During construction, coordinate use of site and facilities through the Project Coordinator.

D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities.

F. Coordinate field engineering and layout work under instructions of the Project Coordinator.

G. Make the following types of submittals to Architect through the Project Coordinator:
   1. Requests for Interpretation.
   2. Shop drawings, product data, and samples.
   3. Test and inspection reports.
   4. Design data.
   5. Manufacturer's instructions and field reports.
   6. Applications for payment and change order requests.
   7. Progress schedules.
   8. Coordination drawings.
   9. Correction Punch List and Final Correction Punch List for Substantial Completion.
   10. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Architect will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.

C. Note: The following agenda items are not intended to be the final or a complete list of the items that will be discussed. A complete agenda will be distributed at the preconstruction meeting.

D. 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. Submission of initial Submittal schedule.
   6. Designation of personnel representing the parties to Contract and Owner.
   7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   8. Scheduling.
   9. Shop drawings submittal, review times, and overall process.
   10. Open for comments; attendees are encouraged to bring other topics or concerns up for discussion at this time.

E. Architect will record minutes and distribute copies within two days after meeting to participants, with copies to the Contractor, Owner, participants, and those affected by decisions made.

3.02 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum bi-weekly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. Contractor's superintendent.
   5. Major subcontractors.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Review of work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of off-site fabrication and delivery schedules.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period.
   10. Maintenance of quality and work standards.
   11. Effect of proposed changes on progress schedule and coordination.
   12. Other business relating to work.

E. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.03 CONSTRUCTION PROGRESS SCHEDULE

A. Within 7 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.

B. If preliminary schedule requires revision after review, submit revised schedule within 5 days.

C. Within 7 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 5 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

3.04 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format within two weeks from Award of Contract.

3.05 SUBMITTALS IN GENERAL

A. All submittals shall be submitted to the Architect through the Project Coordinator - No exceptions.

B. PDFs by methods listed in Section 01 3305 Electronic Submittal Procedures is the preferred method of transmitting Submittals.
   1. Refer to "Requirements for Electronically Submitted Shop Drawings" attached to this section.

C. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

D. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

E. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

F. By submitting submittals, the General Contractor represents to Architect that General Contractor has:
   1. Reviewed and approved them.
   2. Determined and verified materials, field measurements and field construction criteria related thereto, or will do so.
   3. Checked and coordinated the information contained within such submittals with the requirements of the Work of the Contract Documents.

G. Submittals that do not appear to be reviewed and approved will be returned to the General Contractor without the Architect's review. Time delays for this breach in procedure will be at the sole expense of the General Contractor.

H. All shop drawings shall be submitted no later than 45 days after execution of the contract.

3.06 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 Architect for review for the limited purpose of checking for compliance 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.

3.07 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 Architect's knowledge as contract administrator or for Owner.

3.08 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

E. Refer to Section 01 7800 - Closeout Submittals. This checklist shall be completed in its entirety and uploaded to the Project Website prior to requesting and receiving final payment.

3.09 SUBMITTAL PROCEDURES

A. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related work.
   2. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

B. Transmit each submittal with a copy of approved submittal form.
   1. For shop drawing submittals use form attached to this specification section.

C. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

D. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

E. 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.

F. Schedule submittals to expedite the Project, and coordinate submission of related items.

G. For each submittal for review, allow 10 days excluding delivery time to and from the Contractor.

H. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

I. Provide space for Contractor and Architect review stamps.

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.

END OF SECTION

SECTION 01 30 00 -- ATTACHMENT

SHOP DRAWING SUBMITTAL FORM

Architects Project No: 24-30667 **Date:** _____

Project Name: Iowa Army National Guard S-55 HVAC and Lighting Updates

Specification Section Number: _____ **Shop Drawing #** _____

Specification Section Name: _____

Description: _____

Subcontractor or Supplier Approval:	**General Contractor or Construction Manager Approval:**
Architect / Engineer Review:	**Other Reviews and Comments:**

Requirements for Electronically Submitted Shop Drawings

1. The Contractor shall fill out and include the submittal cover sheet included in the specification book. This is to be the first page of the submittal. If the Contractor elects to use transmittal sheets they shall be the last page of the submittal.
2. If construction management software (ProCore or similar type program) is used, the cover sheet shall also be used as the document needs to be able to live outside those programs with all notes present on the submittal.
3. Routing of all shop drawings shall be submitted to the Architect through the Project Coordinator.
4. The shop drawings are to be reviewed by the Contractor before submitting. All field required verifications and missing information shall be completed and duly noted on the drawings. The Contractor shall verify that the products submitted are acceptable per the specifications. The Contractor shall then affix their stamp on the submittal cover sheet. Contractor must review - no pass through drawings are permitted. Time delays for this breach in procedure will be at the sole expense of the Project Coordinator.
5. Shop drawing representation: By submitting shop drawings, the Project Coordinator represents to the Architect that the Project Coordinator has: (1) reviewed and approved them, (2) determined and verified materials types and use, obtained field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the work of the contract documents and other trades working on the project and their submittals.
6. The Contractor shall prepare a PDF document so that all sheets of the submittal are one document. Do not submit duplicate submittals for the sole reason to comply with required submittals. Note on the submittal if it is used for another section as well. (The only reason to include more than one section for a submittal).
7. Scans shall be in color. All pages shall be oriented correctly and legible. Actual sheet sizes for the submittal shall be 8 ½ x11 or 11x17 whenever possible. All print and details must be legible at those sizes.
8. Samples and color selections associated with the drawings shall be included when practical. Actual samples shall be photographed, converted to .pdf format and the sheet sized to letter size and any required notes provided on the page. If a separate color selection submittal is provided, provide a cover sheet and list names of all samples and colors on cover sheet and attach the photographs of the samples to document the approval. Actual samples, color selections shall be delivered to Architect / Engineer and the shop drawings will not be reviewed until actual samples are received. Architect / Engineer uses staff from various offices so confirm where the samples need to be sent to expedite the review.
9. Scanned color charts or web sites will not be used to review colors, only to indicate the color that was selected.
10. The PDF file shall be named as follows. Example: 2022-169 23 3700 - Air outlets & inlets.pdf.
11. The email subject line shall list the project number first followed by the project name. Then the section number and a brief description of the submittal contents shall follow the submittal number. Example: 2022-169 Decorah VA 23 3700 Air outlets & inlets
12. The Architect/Engineer will review the drawings, make notes as required on the drawings and stamp them. The PDF file shall then be renamed by adding the action required such as (R) REVIEWED, (FAC) FURNISH AS CORRECTED, (R&R) REVISE AND RESUBMIT or (REJECT) REJECTED. Example: 2022-169 23 3700-Air outlets & inlets R.pdf
13. The Architect/Engineer shall then use the original email and attach the reviewed drawings and forward back to the Project Coordinator. The email that they are attached to will be considered the transmittal.
14. No hard copies will be sent by the Architect/Engineer. Note: Hard copies will be required to be included in the O+M Manuals as part of the project close out submittals.
15. The Project Coordinator shall maintain a shop drawing log for all submittals. Project Coordinator to update on a regular basis and distribute to Architect, Owner and others as requested.

SECTION 01 33 05
ELECTRONIC SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Electronic Shop Drawings, Electronic Product Data, and other electronic submittals.

B. Related Sections and Documents:
   1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
   2. Division 00 – Bidding and Contract Requirements issued by the Contracting Officer, apply to this Section.
   3. Division 01 Section "Submittal Procedures" for general submittal requirements.

1.02 SUBMITTALS

A. Website provider operation and access instructions.

PART 2 PRODUCTS

2.01 PROJECT WEBSITE SERVICE PROVIDER

A. Website Service Provider: Subject to compliance with requirements, provide products and/or service under their current licensing agreements by one of the following website service providers:
   1. “Submittal Exchange” (www.submittalexchange.com) (800-714-0024).
   2. Equal website service provider pre-approved prior to Bid Date. (See Document 00 43 25 Supplement F – Substitution Request Form (Bidding Phase).

B. Website Service shall have the following capabilities:
   1. Independently hosted, web-based system designed specifically for transmitting submittals and other construction communications between all project team members. FTP site and e-mail exchanges are not acceptable.
   2. Utilize SSL encryption and hosted at SAS70 Type II compliant data centers.
   3. Minimum four years documented experience of use on comparable commercial construction projects.
   4. Unlimited individual user accounts and system access for all project subcontractors, general contractor, owner, design consultants, and subconsultants.
   5. Capability to log and organize by tab an unlimited number of electronic submittals with no file size limitations.
   6. Separate locations for owner, design consultant, and subconsultant review comments with contractors restricted from viewing comments until final review or release by owner or primary design consultant.
   7. Automatic customized company-specific PDF review and transmittal forms setup as required for owner, design consultants, subconsultants, and general contractor.
   8. Full version histories and dates of exchanges automatically tracked and available for viewing, searching, and reporting in a linear log format compatible with AIA G712.
   9. Automatic, configurable email notifications for each project team member for new and reviewed submittals and other items.
   10. Automatic, configurable email reminders of past due items.
   11. Prior to project start, system vendor shall create submittal log with all required items from project manual. Owner or primary design consultant shall have full control over required items list and access to edit, add, or remove items during project.
   12. Training shall be provided to general contractor, owner, design consultants, and subconsultants after Notice to Proceed but prior to start of construction.
   13. Training sessions for subcontractors shall be provided minimum of twice weekly throughout project.
   14. Allowance for scanning and printing services provided by local third-party reprographic vendor to assist with obtaining documents electronically and online print ordering.
   15. At completion of project closeout, make available for download an electronic archive of all documents and tracking logs. Electronic archive shall emulate the online project website

in organization and operation.

2.02 MINIMUM INTERNET SERVICE AND EQUIPMENT REQUIREMENTS

A. Email address and internet service at Contractor's main office(s).

B. Adobe Acrobat (www.adobe.com), Bluebeam PDF Revu (www.bluebeam.com), NitroPDF (www.nitropdf.com) or other similar PDF review software for applying electronic stamps, mark-ups, and comments.

2.03 COSTS AND DURATION

A. General Contractor shall obtain and pay for the website service subscription. (The cost for the service shall be included in the Contractor's Base Bid. Contact the website service provider prior to submitting Bid to obtain pricing).
   1. The minimum duration of the website service subscription shall extend 6 months beyond the Contractor's anticipated Date of Substantial Completion.

PART 3 EXECUTION

3.01 PROCEDURES

A. General Contractor's project management team and subcontractors shall attend training sessions with the Owner, Design Consultants, and website provider on the use of the project website prior to uploading any submittals.

B. Contractor shall not alter the layout or function of the project website.

C. Electronic Submittals shall be transmitted to the Architect in electronic (PDF) format via a website service designed specifically for transmitting electronic submittals between construction team members.

D. The intent of electronic submittals is to:
   1. Reduce paperwork and shipping costs.
   2. Improve and expedite information flow.
   3. Decrease turnaround time.
   4. Provide the Owner with an electronic archive of submittals at project completion.

E. Contractor shall be responsible for coordinating with the website service provider for training of their employees, sub-contractors, and suppliers in the use of the website service and PDF submittals.

F. The following items, at a minimum, shall be electronic submittals and shall be uploaded under the appropriate "tab" on the project website (where applicable, these submittals will be uploaded by the Owner or Design Consultant):
   1. Project Team Directory.
   2. Shop Drawings.
   3. Product Data.
   4. Transmittals for Samples delivered.
   5. Informational Submittals.
   6. Closeout Submittals.
   7. Substantial Completion Documents
   8. Supplemental Instructions (SI's).
   9. Change Directives (CD's).
   10. Requests for Information (RFI's).
   11. Requests for Change (RFC's) and Requests for Proposal (RFP's).
   12. Meeting Minutes.
   13. Schedules.
   14. Photos.
   15. Reports.
   16. Tests and Inspections.
   17. Punchlists.

G. Submittal Preparation: Contractor may use any or all of the following options:
   1. Subcontractors and Suppliers provide electronic (PDF) submittals to General Contractor via uploading to the website service.
   2. Subcontractors and Suppliers provide electronic (PDF) submittals to General Contractor via email and General Contractor uploads submittals to the website service.

3. Subcontractors and Suppliers provide paper copy submittals to General Contractor. General Contractor scans submittals to convert to PDF format, and uploads submittals to website service.
4. Subcontractors and Suppliers provide paper copy submittals to Scanning Service. Scanning Service scans submittals to convert to PDF format. Subcontractors and Suppliers uploads submittals to the website service or forwards to General Contractor for uploading.

H. Submittal Format:
1. All submittals shall be uploaded in “PDF” format. Reduce pdf file size before uploading whenever feasible.
2. For all submittals larger than 11” x 17”, Contractor shall submit two (2) full-size paper copy to Architect for reference only (paper copy will not be returned) in addition to the electronic submittal.

I. Shop Drawing and Product Data Submittal Procedures:
1. General Contractor shall review submittals, add review comments, and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work.
2. General Contractor shall create an electronic transmittal for each submittal, attach to submittal in PDF format, and upload submittal to website.
3. Architect (and/or Sub-Consultant if applicable) shall review submittal, add review comments, apply electronic stamp indicating status of submittal, and upload reviewed submittal to website. General Contractor will receive email notice of completed review.
4. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the General Contractor.
5. Re-submittals, if required, shall be uploaded to the website service under the same procedures as described above.

3.02 NON-ELECTRONIC SUBMITTALS

A. The following items shall be hard-copy submittals:
1. Color Samples, Actual Color Charts, Physical Material Samples
a. Upload a transmittal form to the project website for review and tracking purposes.
2. Applications for Payment.
3. Change Orders.
a. Upload a pdf copy to the project website upon approval of change order.

END OF SECTION

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SECTION 01 35 10
STRUCTURAL TESTING AND SPECIAL INSPECTION

PART 1 GENERAL

1.01 INTENT AND CONDITIONS

A. Intent
   1. Define and coordinate structural testing and special inspection services.
   2. Define and coordinate conventional testing and inspection services.
   3. Provide greater confidence that the specified work is constructed in compliance with the contract documents and Chapter 17 of the 2015 International Building Code.
   4. Testing and Inspection services are intended to assist in determining probable compliance of the work with requirements specified. These services do not relieve the Contractor of responsibility for compliance with the requirements of the contract documents.

B. Conditions
   1. If inspection of fabricator's work is required, the Owner's representative may require testing and inspection of the work at the plant, before shipment. Owner, Architect and Structural Engineer of Record (SER) reserve the right to reject material not complying with the contract documents.
   2. Testing and inspection shall be performed in accordance with the industry standard used as the reference for the specific material or procedure unless other criteria are specified. In the absence of a referenced standard, tests shall be accomplished in accordance with generally accepted industry standards.
   3. Work shall be checked as it progresses, but failure to detect any defective work or materials shall in no way prevent later rejection if defective work or materials are discovered, nor shall it obligate Owner to accept such work.

1.02 RELATED REQUIREMENTS

A. Refer to PART 3 for technical scope sections regarding specific qualifications, inspections, tests, frequency and standards required.

1.03 DEFINITIONS

A. Testing – Evaluation of systems, primarily requiring physical manipulation and analysis of materials, in accordance with approved standards.

B. Inspection – Evaluation of systems, primarily requiring observation and engineering judgment.

C. Structural Testing and Special Inspection – Structural Testing and Special Inspection Services herein include items required by the 2015 International Building Code, and other items which in the professional judgment of the Structural Engineer of Record, are critical to the integrity of the building structure.

D. Conventional Testing and Inspection – Conventional Testing and Inspection Services herein describe those items not specially required by Code but may be considered essential to the proper performance of the building systems.

E. Architect of Record – The prime consultant in charge of overall design and coordination of the project.

F. Structural Engineer of Record (SER) – The Licensed Engineer in responsible charge of the structural design for the project.

G. Licensed Structural Engineer: – A professional engineer with education and experience in the design of structures similar to this project licensed to practice in the state in which the project is located.

H. Testing Agency (TA) – The properly qualified firm performing testing services.

I. Special Inspector (SI) – A properly qualified individual or firm performing special inspections.

J. Building Official – The Officer or his duly authorized representative charged with the administration and enforcement of the 2015 International Building Code.

K. Continuous –The full-time observation of work requiring special inspection by an approved special inspector who is present in the area where the work is being performed.

L. Periodic –The part-time or intermittent observation of work requiring special inspection by an approved special inspector who is present in the area where the work is being performed.

1.04 REFERENCES

A. ASTM E329-13 - Standard Specification for Agencies Engaged in Construction, Inspection, Testing, or Special Inspection.

B. ASTM E543-15 - Standard Practice for Agencies Performing Nondestructive Testing.

C. ASTM C1077-15 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.

D. ASTM C1093-15 - Standard Practice for Accreditation of Testing Agencies for Masonry.

E. ASTM D3740-12 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

F. AISC Steel Construction Manual 14th Edition (2010)

G. 2015 International Building Code.

H. See technical sections of PART 3 for specific references.

1.05 QUALIFICATIONS

A. Testing Agency (TA) – The testing agency shall be an approved independent testing agency acceptable to the Owner, Architect, SER and as noted below:
   1. Authorized to operate in the state in which the project is located and experienced with the requirements and testing methods specified in the technical scope sections of PART 2.
   2. Meeting applicable requirements of Section 1.04 "References".
   3. Testing equipment shall be calibrated at reasonable intervals by devices of accuracy traceable to either the National Bureau of Standards, or to accepted values of natural physical constants.

B. Special Inspector (SI) – The special inspector shall be under the direct supervision of a registered civil/structural engineer, experienced with the type of work requiring structural testing and special inspection.
   1. The categories of special inspector are:
      a. Special Inspector - Technical I, II, and III: Usually an employee of a testing agency.
      b. Special Inspector - Structural I and II: Preferably an employee of the SER's firm.
   2. Unique special inspector requirements, for specific materials and system, are noted in related technical specification sections.

1.06 RESPONSIBILITIES

A. Structural Testing and Special Inspection
   1. Special Inspectors:
      a. Sign the Structural Testing and Special Inspection Summary Schedule in conjunction with other responsible parties prior to commencement of construction.
      b. If requested, attend a pre-construction meeting to review the scope of structural testing and special inspection.
      c. Test and/or inspect the work assigned for conformance with the building department approved design drawings, specifications and applicable material and workmanship provisions of the Code. Perform testing and inspection in a timely manner to avoid delay of work.
      d. Bring discrepancies to the immediate attention of the contractor for correction, confirm that they are corrected and, if uncorrected after a reasonable period of time, bring to the attention of the Structural Engineer of Record, the Building Official, and to the Architect.
      e. Submit test and/or inspection reports to the Building Official, Contractor, the Structural Engineer of Record, and other designated persons in accordance with the Structural Testing and Special Inspection Summary Schedule.
      f. Submit a final signed report stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in conformance with the approved plans, specifications and the applicable workmanship provisions of the Code.
   2. Testing Agency:
      a. Sign the Structural Testing and Special Inspection Summary Schedule in conjunction with other responsible parties prior to commencement of construction.

b. If requested, attend a pre-construction meeting to review the scope of structural testing and special inspection.
c. When engaged as a special inspector, provide structural testing and special inspection services as previously described.

3. Architect of Record (or other prime consultant):
   a. Complete and sign the Structural Testing and Special Inspection Summary Schedule in conjunction with other responsible parties prior to commencement of construction. Provide a completed copy of the schedule to all signed parties including Building Official.
   b. If appropriate, arrange and attend a pre-construction meeting to review the scope of structural testing and special inspection. Include Contractor, Building Official, SER, Testing Agency and other parties concerned.
   c. Coordinate the flow of reports and related information to expedite resolution of construction issues.
4. Structural Engineer of Record (SER):
   a. Identify items requiring structural testing and special inspection including special cases.
   b. Define "type" of special inspector required for "description" of work indicated on the structural testing and special inspection schedule.
   c. Complete and sign the Structural Testing and Special Inspection Summary Schedule prior to commencement of construction.
   d. If requested, attend a pre-construction meeting to review the scope of structural testing and special inspection.
   e. Review reports submitted by special inspectors.
   f. If engaged as a special inspector, provide structural testing and special inspection services as previously described.
5. Contractor:
   a. Sign the Structural Testing and Special Inspection Summary Schedule in conjunction with other responsible parties prior to commencement of construction.
   b. Coordinate efforts to gain signatures of all signing parties other than the Architect and Structural Engineer of Record (SER).
   c. If requested, attend a pre-construction meeting to review the scope of structural testing and special inspection.
   d. Post or make available the Structural Testing and Special Inspection Summary Schedule within its office at the job site. Also, provide adequate notification to those parties designated on the schedule so they may properly prepare for and schedule their work.
   e. Provide the special inspectors access to the approved drawings and specifications at the job site.
   f. Review reports submitted by special inspectors.
   g. Retain at the job site all reports submitted by the special inspectors for review by the building official upon request.
   h. Correct in a timely manner, deficiencies identified in inspection and/or testing reports.
   i. Provide the special inspector safe access to the work requiring inspection and/or testing.
   j. Provide labor and facilities to provide access to the work and to obtain, handle and deliver samples, to facilitate testing and inspection and for storage and curing of test samples.
   k. Verification of conformance of the work within specified construction tolerances is solely the Contractor's responsibility.
6. Fabricator:
   a. Sign the Structural Testing and Special Inspection Summary Schedule in conjunction with other responsible parties prior to commencing construction.
   b. Submit a Certificate of Compliance to the Building Official, Special Inspector, and Structural Engineer of Record that the work was performed in accordance with the approved plans and specifications.
7. Building Official (Typical responsibilities noted for information only):
   a. Determine work, which in the Building Officials opinion, involves unusual hazards or conditions in accordance with the 2015 International Building Code.

b. Review special inspector qualifications.
c. Accept and sign the completed Structural Testing and Special Inspection Summary Schedule.
d. Review all fabricators who perform work in their shop, which requires special inspection.
e. Review reports and recommendations submitted by the special inspectors.
f. Review the "final signed reports" submitted by the special inspector(s). These documents should be accepted and approved by the building department prior to issuance of a Certificate of Occupancy.

8. Owner:
a. Establish direct funding to provide for cost of structural testing and special inspection services.
b. Provide special inspector with approved design drawings, specifications and approved shop drawings.
c. Provide special inspectors and testing agencies with full access to site at all times.
d. Sign the Structural Testing and Special Inspection Summary Schedule in conjunction with other responsible parties prior to commencement of construction.

B. Conventional Testing and Inspection
1. Testing Agency:
a. Test or inspect the work assigned, for conformance with building department approved plans, specifications and applicable workmanship provisions of the 2015 International Building Code.
b. Bring non-conforming items to the immediate attention of the Contractor, and if uncorrected to the Architect of Record.
c. Submit test and/or inspection reports to the Architect of Record, the Contractor and other designated persons.

2. Contractor:
a. Provide adequate notification to testing agency so they may properly prepare for and schedule their work.
b. Provide testing agency with access to the approved design drawings, approved shop drawings and specifications at the job site.
c. Correct in a timely manner, deficiencies identified in test and/or inspection reports.
d. Provide testing agency with safe access to the work requiring testing and inspection.
e. Provide labor and facilities to provide access to the work and to obtain and handle samples, to facilitate testing and inspection and for storage and curing of test samples.
f. Verification of conformance of the work within specified construction tolerances is solely the Contractor's responsibility.

3. Architect of Record (or other prime consultant):
a. Coordinate the flow of reporting and related information to expedite resolution of construction issues.

C. Inspections by Building Official
1. Contractor shall provide adequate notice for inspections performed by the Building Official, as required by the 2015 International Building Code, and local ordinance.

D. Periodic Site Observations by Design Consultant
1. Special structural testing and inspection, conventional testing and inspection, and periodic inspections by the Building Official do not preclude the normal field involvement and site observations by Architect or Structural Engineer of Record, nor shall it relieve the Contractor of any responsibility to complete the work in accordance with the approved drawings and specifications.

E. Limits of Authority
1. Testing agents and/or special inspectors may not waive or alter contract requirements, or approve or accept any portion of the work unless specifically authorized by the Architect or Structural Engineer of Record. They may not assume any duties of the Contractor, and they have no authority to stop or reject "Work".

1.07 PAYMENT

A. Owner shall directly employ and pay for services of the special inspectors to perform required Structural Testing and Special Inspection.

B. Owner shall employ and pay for services of the testing agency to perform required Conventional Testing and Inspection.

C. Unless noted otherwise, the Contractor shall provide and pay for all materials, samples, mock-ups, and assemblies required for testing and inspection and shall pay for all shipping costs related to delivery of this work. Testing agency will pay for shipping costs of samples transported from site to lab.

D. If exploratory work is required to determine the cause of defects, the cost of such work shall be paid by the Contractor, if the work is found to be defective, in the judgment of the Architect/Engineer. Contractor shall reimburse the Owner for all costs incurred in this event.

E. Any tests required to qualify the Contractor, or the workmen for any phase of the work, shall be performed at no additional cost to the Owner.

1.08 INSPECTION NOTICE

A. Contractor shall provide minimum of 24 hours notice for all items requiring testing or inspection. Items requiring testing and inspection services prior to or during placement shall not be placed until testing and inspection services are available. Items requiring testing and inspection services after placement shall not be enclosed or obscured until testing and inspection services are performed.

1.09 REPORTS

A. Testing agency and/or special inspectors shall submit reports in accordance with the Structural Testing and Special Inspection Summary Schedule and shall conduct and interpret tests and inspections and state in each report whether; (1) test specimens and observations comply with Contract Documents, and specifically state any deviations, (2) record types and locations of defects found in work, (3) record work required and performed, to correct deficiencies.

B. Reports for structural testing and special inspection, shall be submitted in timely manner to the Contractor, Building Official, SER, and Architect of Record.
   1. Submit reports for ongoing work, to provide the information noted below:
      a. Date issued.
      b. Project title and number.
      c. Firm name and address.
      d. Name and signature of tester or inspector.
      e. Date and time of sampling.
      f. Date of test or inspection.
      g. Identification of product and specification section.
      h. Location in project, including elevations, grid location and detail.
      i. Type of test or inspections.
      j. Results of tests or inspections and interpretation of same.
      k. Observations regarding compliance with Contract Documents or deviations there from.
   2. Submit a final signed report stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in conformance with the approved plans, specifications and the applicable workmanship provisions of the code.

C. Reports for conventional testing and inspection shall be submitted in a timely manner to the Contractor and the Architect of Record.

1.10 FREQUENCY OF TESTING AND INSPECTION

A. For detailed requirements see technical sections of PART 3.

1.11 PROTECTION AND REPAIR

A. Upon completion of testing, sample-taking, or inspection, the Contractor shall repair damaged work and restore substrates and finishes to eliminate deficiencies, including deficiencies in the visual qualities of exposed surfaces, as judged solely by the Architect/Engineer of Record. Protect work exposed by or for testing and/or inspection and protect repaired work. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for testing and/or inspection.

1.12 TESTS TO DEMONSTRATE QUALIFICATION

A. If the Contractor proposes a product material, method, or other system that has not been pre-qualified, the Architect may require applicable tests, to establish a basis for acceptance or rejection. These tests will be paid for by the Contractor.

B. The Architect/Engineer of Record reserves the right to require certification or other proof that the system proposed, is in compliance with any tests, criteria or standards called for. The certificate shall be signed by a representative of an independent testing agency.

PART 2 MATERIALS (NOT USED)

PART 3 SCOPE OF TESTING AND INSPECTION

3.01 STRUCTURAL TESTING AND SPECIAL INSPECTION PROGRAM SUMMARY

A. The parties involved shall complete and sign the Structural Testing and Special Inspection Summary Schedule. The Program, including Summary Schedule, shall be submitted to the building official for approval prior to issuance of a building permit. The competed schedule includes the following:
   1. A specific listing of the items requiring inspection and testing.
   2. The associated technical scope sections that define the applicable standards by which to judge conformance with the approved plans and specifications in accordance with 2015 International Building Code. The technical scope sections should also include the degree or basis of inspection and testing; i.e., intermittent/will-call or full-time/continuous.
   3. The frequency of reporting, i.e., weekly, monthly, per test/inspection, per floor, etc.
   4. The parties responsible for performing the inspection and testing work.
   5. The required acknowledgments by each designated party.

3.02 CONVENTIONAL TESTING AND INSPECTION

A. (Not Used)

3.03 STRUCTURAL TESTING AND SPECIAL INSPECTION STATEMENT OF SPECIAL INSPECTIONS

A. Refer to attached Program Summary Schedule for this project. It includes a schedule of Special Inspection services applicable to this project and the identity of agencies to be retained for conducting these inspections and tests.

B. The Special Inspector shall keep records of all inspections and shall furnish inspection reports to the Building Official, the Architect and Structural Engineer of Record. Discrepancies shall be brought to the immediate attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official, the Architect and SER. The Special Inspection program does not relieve the Contractor of his or her responsibilities.

C. Interim reports shall be submitted to the Building Official, Architect, and SER.

D. A Final Report of Special Inspections documenting completion of all required Special Inspections, testing and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Certificate of Use and Occupancy.

3.04 TECHNICAL SECTIONS

A. **<u>Section 31 22 00 - Earthwork - Grading, Excavation Filling</u>**
   1. (Not Used)
   2. Definitions
      a. Refer to PART 1 for standard definitions.
      b. Special Inspector – Technical
         1) Technical I: Technician shall be under the direct supervision of a Technical III. Work shall be performed in a qualified geotechnical/testing laboratory.
         2) Technical II: Technical with a minimum of 2 years experience, or a graduate engineer, and is an employee of a qualified and approved geotechnical/testing laboratory, under the direct supervision of a Technical III.
         3) Technical III: A civil/geotechnical engineer regularly engaged in this type of work with a minimum of 4 years experience, licensed in the State in which the project is located, and is an employee of a qualified and approved geotechnical/testing laboratory. This licensed engineer shall review and

approve all final field reports.

3. Structural Testing and Special Inspection Requirements (Item and Frequency and Qualifications)
    a. Classification of materials used and encountered during construction per ASTM:D2488 and ASTM:D2487. Technical I
    b. Performance of laboratory testing of materials, as needed (Proctor, Sieve Analysis, Atterberg Limits, Consolidation Test, etc.). Technical I
    c. Field Density Tests: Technical I
    d. Provide periodic results of field compaction and laboratory work for general compliance with Contract Documents and Geotechnical Reports. Technical I
    e. Observe all subgrades/excavation bases below footings and slabs and verify design bearing capacity is achieved. Technical II
    f. Document presence of groundwater within excavations. Technical I
    g. Provide reports of subgrade observations for general compliance with Contract Documents and Geotechnical Report. Technical II
    h. Verify cut and fill slopes as specified in the contract documents. Technical III
4. Conventional Testing and Inspections Requirements
    a. Contractor shall verify that footings comply with frost depth requirements and shall report any variances to the SER in a timely manner.

B. **Section 03 3000 - Cast-in-Place Concrete**

1. General
    a. Structural testing is required for all concrete. Thus, Special inspections as outlined below are not required for the following items:
        1) Isolated spread footings of buildings three stories or less in height that are fully supported on earth or rock.
        2) Strip footings of buildings three stories or less in height that are fully supported on earth or rock, where the footings support walls of light frame construction, the footings are designed in accordance with Table 1809.7, or the footing structural design is based on a f 'c no greater than 2500 psi.
        3) Non-structural slabs on grade, including prestressed slabs on grade when effective prestress in concrete is less than 150 pounds per square inch.
        4) Concrete foundation walls constructed in accordance with Table 1807.1.6.2.
2. Definitions
    a. Refer to PART 1 for standard definitions.
    b. Special Inspector – Technical
        1) Technical I: ACI Certified Grade I inspector. Inspector shall be employed by a testing laboratory, under the direct supervision of a Technical III.
        2) Technical II: ACI Certified Grade II inspector. Inspector shall be employed by a testing laboratory, under the direct supervision of a Technical III.
        3) Technical III: A civil/structural engineer regularly engaged in this type of work, with a minimum of 4 years experience and licensed in the State in which the project is located and is an employee of a qualified and approved testing laboratory. The licensed engineer shall review and approved all reports.
        4) Testing laboratory shall have C.C.R.L. certification at the National Bureau of Standards.
    c. Special Inspector – Structural
        1) Structural I: Graduate civil/structural engineer, or other personnel acceptable to the SER, with experience in the design of structural systems of this type. Inspections shall be performed under the direct supervision of a Structural II.
        2) Structural II: Civil/structural engineer regularly engaged in the design of structural systems of this type, licensed in the State in which the project is located. The licensed engineer shall review and approve all inspection reports.
        3) Special Inspector - Structural may be an employee of the SER.
3. Structural Testing and Special Inspection Requirements (Item and Frequency and Qualifications)
    a. Sample and test all cast in place concrete; Technical I.
        1) Prepare compression test specimens (ASTM C31), one set of four standard cylinders of concrete for each compressive strength test, mold and store

cylinders for laboratory-cured specimens. Specimens shall be 4x8 cylinders except where an alternate size has been approved by the structural engineer.

2) Perform compressive strength tests (ASTM C39). One set of four cylinders for each day's pour between one and 25 cubic yards. If a day's pour exceeds 25 cubic yards, one set of four cylinders for each additional 50 cubic yards, or fraction thereof. One specimen at seven days, two at 28 days, and one specimen retained in reserve for later testing if required. For post tensioned concrete, make and test an additional cylinder at three days to verify strength prior to stressing. (When frequency of testing will provide less than five strength tests for a given class of concrete, conduct at least five strength tests from randomly selected batches. If fewer than five batches are used, conduct one test from each batch.)

3) Slump (ASTM C143): One test at point of discharge for each set of compression test specimens; additional tests when concrete consistency appears to have changed.

4) Air entrainment (ASTM C231): Test the first batch of air entrained concrete and one additional test for each set of compression test specimens.

5) Concrete Temperature: Test concrete temperature hourly when air temperature is 40F and below and when 80F and above, and each time a set of compression test specimens is made.

b. On a periodic basis, perform concrete mix verification; Technical I.

1) Verify mixer truck trip ticket conforms to approved mix design.

2) Verify that total water added to mix on site does not exceed that allowed by concrete mix design.

3) Verify that concrete quality is indicative of adequate mixing time, consistency, and relevant time limits. Technical I

c. On a continuous basis, inspect preparation and placement of all concrete.

1) Verify the following; Structural I:

(a) Verify acceptable general condition of concrete base prior to placement.

(b) Verify concrete has been sampled for required concrete tests.

(c) Verify that concrete conveyance and depositing avoids segregation and contamination.

(d) Verify that concrete is properly consolidated.

(e) Verify reinforcement remains at proper location.

(f) Unless noted, inspections shall be on a continuous basis. Inspections may be performed on a periodic basis for the following types of work:

d. On a periodic basis, observe protection and curing methods for all concrete requiring inspections as outlined above; Structural I:

1) Verify specified curing procedures are followed.

2) Verify specified hot and cold weather procedures are followed.

e. On a continuous basis, inspect all bolts installed in concrete prior to and during concrete placement; Structural I:

1) Verify specified size, type, spacing, configuration, embedment, and quantity.

2) Verify proper concrete placement and means have been taken to achieve consolidation around all bolts.

4. Conventional Testing and Inspection Requirements

a. (Not Used)

END OF SECTION

Structural Testing and Special Inspection Program Summary Schedule

Project Name: Iowa Army National Guard S-55 HVAC and Lighting Upgrades Project No. 24-30667

Location: Camp Dodge, Johnston, Iowa Permit No. _____ (1)

Technical (2)		Description (3)	Type of Inspector (4)	Specific Report Frequency (5)	Assigned Firm (6)
Section	Article				
31 2200	1705.6	Soils	TA	IBC Table 1705.6	
03 3000	1705.3	Cast-In-Place Concrete	TA	IBC Table 1705.3	

Note: This schedule shall be filled out and included in a Special Structural Testing and Inspection Program.
(If not otherwise specified, assumed program will be "Guidelines for Special Inspection & Testing".)

(1) Permit No. to be provided by the Building Official
(2) Referenced to the specific technical scope section in the program.
(3) Use descriptions per IBC Chapter 17.
(4) Special Inspector – Technical (SIT); Special Inspector – Structural (SIS)
(5) Weekly, monthly, per test/inspection, per floor, etc. Per section 01 3510 of spec book.
(6) Name of Firm contracted to perform services.

ACKNOWLEDGEMENTS
(Each appropriate representative shall sign below)

Owner: _____ Firm: _____ Date: _____

Contractor: _____ Firm: _____ Date: _____

Architect: _____ Firm: _____ Date: _____

SER: _____ Firm: _____ Date: _____

SI-T: _____ Firm: _____ Date: _____

SI-S: _____ Firm: _____ Date: _____

TA: _____ Firm: _____ Date: _____

F: _____ Firm: _____ Date: _____

If requested by engineer/architect of record or building official, the individual names of all prospective special inspectors and the work they intend to observe shall be identified as an attachment.

Legend: SER = Structural Engineer of Record SI-T = Special Inspector - Technical TA = Testing Agency
SI-S = Special Inspector - Structural F = Fabricator

Accepted for the Building Department By _____ Date _____

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SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. References and standards.

C. Testing and inspection agencies and services.

D. Control of installation.

E. Mock-ups.

F. Tolerances.

G. Manufacturers' field services.

H. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Document 00 72 00 - General Conditions: Inspections and approvals required by public authorities.

B. Section 01 30 00 - Administrative Requirements: Submittal procedures.

C. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2023).

B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2024.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2023.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2023.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2021.

G. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components; 2016.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. General: As indicated in individual specification sections.

C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents, or for Owner's information.

D. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of test/inspection.
      h. Date of test/inspection.
      i. Results of test/inspection.
      j. Compliance with Contract Documents.

k. When requested by Architect, provide interpretation of results.

2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents, or for Owner's information.

E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
   1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
   2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

G. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
   1. Submit report in duplicate within 30 days of observation to Architect for information.
   2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents.

H. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents.
   2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.05 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.06 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform other specified testing and inspection.
   1. Where indicated in individual specification sections the Contractor shall employ and pay for services of an independent testing agency to perform specified testing and inspection.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

C. Contractor Employed Agency:
   1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM E699, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.
   2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
   3. Laboratory: Authorized to operate in the State in which the Project is located.
   4. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.

5. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and 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 stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.03 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.

3.04 TESTING AND INSPECTION

A. See individual specification sections for testing and inspection required.

B. Testing Agency Duties:
   1. Test samples of mixes submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
   6. Perform additional tests and inspections required by Architect.
   7. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of 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 manufacturers' 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 tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
   5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
   6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

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 as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary sanitary facilities.

C. Temporary Controls: Barriers, enclosures, and fencing.

D. Waste removal facilities and services.

1.02 TEMPORARY UTILITIES

A. Owner will provide the following:
   1. Electrical power, consisting of connection to existing facilities.
      a. Contractor shall provide portable generator power as required when connection to existing facilities is not adequate to complete the Work.
   2. Water supply, consisting of connection to existing facilities.

B. Provide and pay for all additional lighting, heating and cooling, and ventilation required to complete the Work.

C. Provide and pay for all temporary heating shelters required to complete the work. The Owner will not consider any requests for extra charges related to weather.

D. Provide and maintain a minimum light level of 5 foot-candles for a safe work environment throughout the project.

E. Permanent convenience receptacles may be utilized during construction.
   1. Replace all damage and worn receptacles used during construction prior to substantial completion.

F. Use trigger-operated nozzles for water hoses, to avoid waste of water.

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.

C. At end of construction, return facilities to same or better condition as originally found.

1.04 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 from construction operations and demolition.

B. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.
   1. The term "non-owned" refers to insurance coverage for other vehicles not owned by the named insured's.

1.05 FENCING

A. Construction: Commercial grade safety orange color heavy duty diamond mesh safety fence; Product Guardian by Tenax Corporation: www.tenaxus.com or equivalent.

B. Provide 4 foot high fence, minimum; equip with vehicular and pedestrian gates with locks where applicable.
   1. Install fence around entire construction site.

C. Installation: Install safety fencing according to manufacturer's instructions, and according to local governing authorities.

1.06 INTERIOR ENCLOSURES

A. Provide temporary partitions as required to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
   1. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.

a. Cleaning of ductwork is not contemplated under this Contract.
b. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
c. Establish condition of existing ducts and equipment prior to start of alterations.
d. If extremely dusty or dirty work must be conducted, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.

B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.07 SECURITY

A. Provide security and facilities to protect Work, and Owner's operations from unauthorized entry, vandalism, or theft.

B. Standard Covid related protocols.

1.08 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.09 WASTE REMOVAL

A. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

B. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

C. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

D. Provide containers with lids. Remove trash from site periodically.

E. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

1.10 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition.

E. Restore existing site damaged by construction to original condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Base specified/scheduled products and design intent.

F. Inconsistencies.

G. Substitutions in general.

H. Substitution limitations.

I. Procedures for Owner-supplied products.

J. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittals.

B. Section 01 40 00 - Quality Requirements: Product quality monitoring.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. The Contractor shall assure the Owner that all new equipment and materials are asbestos free. The Contractor, subcontractors, and material suppliers are required to provide letters of non-asbestos confirmation with supporting documentation prior to material installations. The Owner may select materials to test for asbestos at any time including prior to and/or after installation. If suspect asbestos materials are tested and found to contain asbestos, the materials shall be abated in accordance with asbestos regulations by an Owner approved consultant and abatement contractor. New asbestos free products shall be re-installed by the Contractor supplying such material. The Contractor shall be responsible for any and all new materials. If asbestos is found in the new materials, the cost for asbestos design, on-site monitoring, abatement, and replacement shall be the responsibility of the Contractor. Owner will collect and pay for the testing of any random suspect asbestos samples.

C. Use of products having any of the following characteristics is not permitted:
   1. Made using or containing CFC's or HCFC's.

D. Where other criteria are met, Contractor shall give preference to products that:
   1. Are extracted, harvested, and/or manufactured closer to the location of the project.
   2. Have longer documented life span under normal use.
   3. Result in less construction waste.

E. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

D. Products that do not meet project specifications may be rejected at any time during the project.

E. Cost associated with replacement product and delay in project schedule due to rejection shall be at sole expense of Contractor.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 BASE SPECIFIED/SCHEDULED PRODUCTS AND DESIGN INTENT

A. Certain specification sections will indicate a base manufacturer and will then list other acceptable manufacturers. Similarly, certain specification sections will list multiple acceptable manufacturers but only one of the manufacturers will be scheduled on a plan sheet. In these scenarios, the designer has designed the system with considerations for the base manufacturer or the product scheduled on the plan sheet. It is the responsibility of all bidders, contractors, suppliers to ensure that when bidding using an acceptable manufacturer other than the base manufacturer or the scheduled manufacturer that the design intent is met. Providing a product by an acceptable manufacturer other than the base specified or scheduled manufacturer constitutes a representation that the submitter:

1. Has investigated supplied product and determined that it meets or exceeds the quality level of the base specified/scheduled product.
2. Will provide the same warranty for the supplied product as for the base specified/scheduled product.
3. As a result of differences between the base specified/scheduled product and the other acceptable manufacturers will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension that may subsequently become apparent.
5. Will reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
6. Will maintain dimensions, locations, clearances, accesses and other design intent shown on the plan or otherwise provided by the base specified/scheduled product.

3.02 INCONSISTENCIES

A. If there is an inconsistency in the quality and/or quantity of Work required by the Contract Documents, either the greater quality and/or quantity of Work indicated shall be provided in accordance with the Engineer/Architect's interpretation without change in the contract sum.

3.03 SUBSTITUTIONS IN GENERAL

A. Proposed substitutions are required to be equivalent in all aspects to the specified products including but not limited to appearance, quality, and performance.

B. When specified in individual sections actual samples shall be provided a minimum of 12 days prior to the bid due date for Architect's review and approval before products other than those scheduled or specified with be accepted; No Exceptions.

C. Requests for substitutions during the bid period shall comply with Article 14 – Substitutions of the Instructions to Bidders and with this specification section.

3.04 SUBSTITUTION LIMITATIONS

A. Where the Bid Documents stipulate a particular product, substitutions will be considered up to 10 days before receipt of bids.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
   1. The substantiating data shall provide a side by side comparison consisting of sufficient information to determine acceptability of such products.

C. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.
   5. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

D. Provide complete information on required changes to other Work to accommodate each proposed substitution.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. When a request to substitute a product is made, Architect may approve the substitution and will issue an Addendum to known bidders.

G. Substitution Submittal Procedure
   1. Transmit each substitution request with the Substitution Request cover letter attached to this specification section.
   2. PDFs via online platform is the preferred method; coordinate with Architect's representative. Only submit paper copies where necessary as follows:
      a. Submit five copies of request for substitution for consideration.
   3. The submitter shall prepare a single PDF file when submitting via online platform so that all sheets of a submittal are included in one document. Only ONE major product per submittal is permitted. Each PDF shall contain Bookmarks set to the destination of separate items contained within the file. If the submitter elects to use their own transmittal sheet it shall be a separate attachment.
      a. Scans shall be in color, pages shall be oriented correctly, actual sheet sizes for the submittal shall be 11 by 17 inch or 8-1/2 by 11 inch whenever possible, and all content must be legible.
   4. Limit each request to one proposed substitution.
   5. Multiple proposed substitutions submitted on one form will only be considered when products are directly related. Major products and components should be listed first.
   6. Submit shop drawings, product data, certified test results, etc. attesting to the proposed product equivalence. Burden of proof is on proposer.
   7. The Architect will reply with a decision to accept or reject request in a timely manner.

H. Substitution Submittal Procedure (after contract award):
   1. Subsequent requests for substitutions will be considered in the case of product unavailability or other conditions beyond the control of the Contractor or as follows:
      a. Timing: Architect will consider requests for substitution if received within 60 days after commencement of the Work or the Notice to Proceed. Requests received after that time may be considered or rejected at the discretion of the Architect.
      b. Condition: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
         1) Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.

2) Requested substitution does not require extensive revisions to the Contract Documents.
3) Requested substitution is consistent with the Contract Documents and will produce indicated results.
4) Substitution request is fully documented and properly submitted.
5) Requested substitution will not adversely affect Contractor's Construction Schedule.
6) Requested substitution has received necessary approvals of authorities having jurisdiction.
7) Requested substitution is compatible with other portions of the Work.
8) Requested substitution has been coordinated with other portions of the Work.
9) Requested substitution provides specified warranty.

3.05 OWNER-SUPPLIED PRODUCTS

A. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

3.06 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.

3.07 STORAGE AND PROTECTION

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 weathertight, climate-controlled enclosures in an environment favorable to 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 manufacturer's warranty conditions, if any.

H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

I. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

J. Prevent contact with material that may cause corrosion, discoloration, or staining.

K. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

L. 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

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SECTION 01 60 00 -- ATTACHMENT

SUBSTITUTION REQUESTS

Architects Project No: 24-30667 **Date:** _____

Project Name: Iowa Army National Guard S-55 HVAC and Lighting Updates

Specification Section	Manufacturer Specified	Proposed Manufacturer

Indicate drawing sheet name in lieu of specification section where applicable.

Vendor/Supplier

Name: _____

Address: _____

Contact: _____ **E-Mail:** _____

Telephone: _____ **Fax:** _____

Reason for Substitution: _____

_____

_____

_____

Does Specification Allow for Substitutions of Proposers Items? Yes: ___ No: ___

Will the Substitution Provide Cost Savings to the Owner? Yes: ___ No: ___

Are Proposed Substitutions Equivalent/Superior to those Specified? Yes: ___ No: ___

Did you provided marked-up product information showing side by side comparisons for both the specified products and proposed products? Yes: ___ No: ___

I, _____, accept responsibility for coordination of proposed substitution and accept all additional costs resulting from the incorporation of proposed substitution into the Project. (Proposers Signature Required)

For Architect's Use:……Comments: _____

Accepted: ___ Not Accepted: ___ _____

No Action Required: ___ _____

Submission: Incomplete: ___ Too Late: ___ _____

Reviewed By: _____ _____

Date: _____ _____

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SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Access panels required by trade.

C. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.

D. Pre-installation meetings.

E. Cutting and patching.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner personnel.

I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

J. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittals procedures.

B. Section 01 50 00 - Temporary Facilities and Controls: Temporary exterior enclosures.

C. Section 01 50 00 - Temporary Facilities and Controls: Temporary interior partitions.

D. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.

E. Section 01 79 00 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

F. Section 07 84 00 - Firestopping.

G. Individual Product Specification Sections:
   1. Advance notification to other sections of openings required in work of those sections.
   2. Limitations on cutting structural members.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.
   6. Include in request:
      a. Identification of Project.
      b. Location and description of affected work.
      c. Necessity for cutting or alteration.
      d. Description of proposed work and products to be used.
      e. Alternatives to cutting and patching.
      f. Effect on work of Owner or separate Contractor.
      g. Written permission of affected separate Contractor.
      h. Date and time work will be executed.

C. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 PROJECT CONDITIONS

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

B. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

1.06 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, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new 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 that are indicated diagrammatically on drawings. Follow routing indicated 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, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

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.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

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 misfabrication.

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, including 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.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 GENERAL INSTALLATION REQUIREMENTS

A. 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.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.05 ACCESS PANELS REQUIRED BY TRADE

A. Trade requiring access shall provide and install access panels where not show or specified.

B. The finished appearance and function will be subject to approval by the Architect/Owner.

C. Provide panels that accommodate adjacent finishes in finished spaces.

D. Access panels shall meet all code requirements for each location they are installed and shall be sized appropriately.

3.06 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 .
   2. Provide walk-off mats as required to separate demolition and construction from existing building.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.
   3. Relocate items indicated on drawings.
   4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if

necessary for successful application of new finish.
5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC, Plumbing, and Electrical): Remove, relocate, and extend existing systems to accommodate new construction.
1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
   b. Provide temporary connections as required to maintain existing systems in service.
4. Verify that abandoned services serve only abandoned facilities.
5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

J. Remove demolition debris and abandoned items from alterations areas and dispose of off-site.

K. Do not begin new construction in alterations areas before demolition is complete.

L. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove and replace defective and non-conforming work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
   1. All other cutting and patching is to be performed by the responsible trade.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.

J. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF EXISTING AND NEWLY INSTALLED WORK

A. Protect existing and newly installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for existing and newly installed products. Control activity in immediate, adjacent, and other areas related to the Work to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Prohibit traffic from landscaped or grass covered areas.

H. Remove protective coverings when no longer needed; reuse or recycle materials if possible.

I. Replace soiled or damaged existing and newly installed work that cannot be cleaned to a condition equal to or better than the condition prior to the work; or cleaned to a like new condition for newly installed work.

3.10 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. See Section 01 79 00 - Demonstration and Training.

B. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.

C. After all utilities have been installed but prior to substantial completion, Contractor shall demonstrate, in the presence of the Owner, continuity of all tracer wires from end to end at all underground utilities. Tracer wires which fail a continuity test shall be repaired or replaced and re-tested until a successful continuity test is achieved. Provide Owner 48 hour notice of this activity.

3.12 ADJUSTING

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

3.13 FINAL CLEANING

A. Execute final cleaning prior to Substantial Completion.
   1. The intent of final cleaning is to provide the Owner with a product that is free of all dust, dirt, and debris related to the Work, and in a like new condition.

B. Use cleaning materials that are nonhazardous.

C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Wipe clean wood and laminate surfaces including doors, countertops, cabinets, windows, sills and all other similar surfaces.

F. Wipe clean all painted surfaces.

G. Clean all hard finish floors including tile and sealed concrete and all others according to manufacturer's instructions.

H. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

I. Clean filters of operating equipment.

J. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner.

3.14 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect and Owner.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.15 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

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SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous demolition and construction waste.
   2. Recycling nonhazardous demolition and construction waste.
   3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:
   1. Section 31 10 00 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.02 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Divert: Redirection of demolition or construction waste from disposal in landfills to alternate destinations for recycle, salvage, or reuse.

E. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

F. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

G. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.03 PERFORMANCE REQUIREMENTS

A. General: Achieve minimum end-of-Project rate for salvage/recycling of 60 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including, but not limited to, the following:
   1. Demolition Waste:
      a. Asphalt paving.
      b. Concrete.
      c. Concrete reinforcing steel.
      d. Brick.
      e. Concrete masonry units.
      f. Wood studs.
      g. Wood joists.
      h. Plywood and oriented strand board.
      i. Wood paneling.
      j. Wood trim.
      k. Structural and miscellaneous steel.
      l. Rough hardware.
      m. Roofing.
      n. Insulation.
      o. Doors and frames.
      p. Door hardware.
      q. Windows.
      r. Glazing.
      s. Metal studs.

t. Gypsum board.
u. Acoustical tile and panels.
v. Carpet.
w. Carpet pad.
x. Demountable partitions.
y. Equipment.
z. Cabinets.
aa. Plumbing fixtures.
bb. Piping.
cc. Supports and hangers.
dd. Valves.
ee. Sprinklers.
ff. Mechanical equipment.
gg. Refrigerants.
hh. Electrical conduit.
ii. Copper wiring.
jj. Lighting fixtures.
kk. Lamps.
ll. Ballasts.
mm. Electrical devices.
nn. Switchgear and panelboards.
oo. Transformers.
pp. Site-clearing waste.

2. Construction Waste:
   a. Concrete
   b. Masonry and CMU.
   c. Lumber.
   d. Wood sheet materials.
   e. Wood trim.
   f. Metals.
   g. Roofing.
   h. Insulation.
   i. Carpet and pad.
   j. Gypsum board.
   k. Piping.
   l. Electrical conduit.
   m. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
      1) Paper.
      2) Cardboard.
      3) Boxes.
      4) Plastic sheet and film.
      5) Polystyrene packaging.
      6) Wood crates.
      7) Plastic pails.

B. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.

C. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, State, and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.04 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 10 days of date established for the Notice to Proceed or prior to commencement of any work, whichever comes first.

1.05 INFORMATIONAL SUBMITTALS

A. Waste Reduction Reports: Reports shall be created using Owner's "Waste Reduction Report Template". Print reports to pdf prior to submission. Include scans of all related invoices/weight tickets with each report.
   1. Progress Reports: Submit an updated report monthly. Submit concurrently with Applications for Payment. Failure to submit report may delay payment. Upload reports to the Project website. Include the following information:
      a. Total quantity of construction waste in tons.
      b. Total quantity of diverted waste in tons (itemized by material type).
         1) If containers taken to a recycling facility contain co-mingled waste to be sorted by the recycler, use the current recovery rate for their facility for each drop-off drop-off date when calculating actual diverted waste quantities for reporting. For example, if the facility's recovery rate is 75.8%, and 20 tons of co-mingled waste is dropped off, even though it may be 100% recyclable, only 75.87% of it can be reported (15.16 tons). Verify the facility's current recovery rate for the month in which each drop-off was made.
      c. Total percentage of construction waste diverted from landfill.
      d. Landfill Disposal:
         1) Identification of material.
         2) Amount of waste material disposed of in landfills in tons. List weights for each individual haul and calculated total weight on each updated report.
         3) Identity of the landfill, hauler, date of haul, and ticket number.
      e. Recycled and Salvaged Material:
         1) Identification of material, including material retrieved by installer for use on other projects or for return to manufacturer for recycling.
         2) Amount of waste material recycled or salvaged in tons. List weights for each individual haul and calculated total weight on each updated report.
         3) Identity of the receiving party, hauler, date of haul, and ticket number.
         4) Certification by receiving party that materials will not be disposed of in landfills or by incineration.
      f. Material Reused on Project:
         1) Identification of material and how it was reused on the Project.
         2) Amount of waste material reused in tons. List weights for each material and calculated total weight on each updated report.
         3) Include weight tickets or calculations as evidence of quantities.
      g. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.
   2. Final Report: At completion of Project, upload a Final Report to the Project website.

1.06 WASTE MANAGEMENT PLAN

A. Develop a waste management plan to include the following information:
   1. Analysis of the trash and waste projected to be generated during the entire project cycle, including types and quantities.
   2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of.
   3. Landfill Alternatives: List all waste materials that will be diverted from landfills using reuse, salvage, or recycling. Include list of local receivers and processors and type of material each will accept. Include names, addresses, and telephone numbers.
   4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
   5. Materials Handling and Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
   6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated

centers, or whether mixed materials will be collected by a waste hauler.

B. The following sources may be useful in developing the Waste Management Plan:
   1. Note to Specifier: Add known recyclers in the area and delete non-applicable recyclers below.
   2. Phoenix C&D Recycling
      a. www.phoenixrecycling.net
      b. creynolds@phoenixrecycling.net
      c. 4764 NE 22nd St, Des Moines, Iowa
      d. (515) 323-5888
   3. Alter Trading Corporation
      a. https://www.altertrading.com/locations/8
      b. 1810 E. Hull Ave
      c. Des Moines, IA 50313
      d. (515) 262-0764
   4. Hallett Material
      a. www.hallettmaterials.com
      b. jsinclair@hallettmaterials.com
      c. 4764 NE 22nd St, Des Moines, Iowa
      d. (515) 266-9928

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PLAN IMPLEMENTATION

A. Coordinator: Designate an on-site waste management coordinator responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures as appropriate for the work:
   1. Distribute and review the Waste Management Plan with each entity when they first begin work on-site. Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse and return methods to be used by all parties at the appropriate stages of the project.
   2. Provide follow-up training for each entity as needed to maintain compliance with the plan.

C. Meetings:
   1. Review the Waste Management Plan at the Pre-Construction Meeting. Discuss responsibilities of each involved party and goals for the project. Revise and resubmit the plan as agreed to at the meeting.
   2. Include waste management and recycling discussion in pre-installation meetings.
   3. Include waste management and recycling as an agenda item in all progress meetings with the Owner and job safety meetings with the subcontractors..

D. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
   1. As a minimum, provide:
      a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
      b. Separate dumpsters for each category of recyclable.
      c. Recycling bins at worker lunch areas.
   2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
   3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

E. Hazardous Wastes: Separate, store, and dispose of hazardous wastes in accordance with applicable regulations.

F. Transportation: Arrange for timely pickups from the site or deliveries to approved facilities of trash/waste material to keep construction site clear and prevent contamination of materials. Keep copies of delivery and pickup receipts for reporting.

3.02 SALVAGING DEMOLITION AND CONSTRUCTION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
   3. Store items in a secure area until installation.
   4. Protect items from damage during transport and storage.
   5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for sale and donation not permitted on Project site.

C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
   3. Store and protect items from damage in a secure area until pick-up by Owner.
   4. Notify Owner when items are ready for pick-up.

3.03 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
   1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
      a. Inspect containers and bins for contamination and remove contaminated materials if found.
   2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
   4. Store components off the ground and protect from the weather.
   5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.04 RECYCLING DEMOLITION WASTE

A. Land Clearing Debris: Collect wood debris from land clearing separate from large amounts of dirt and other non-wood materials and transport to recycling facility.

B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

C. Concrete and Masonry: Free of metals including reinforcing, wood, and other contaminants. Process by one of the following means:
   1. If allowed by specifications, during demolition, crush concrete and concrete masonry to aggregate size. Store crushed material on-site in a clean area to avoid contamination from other materials or building processes. Re-use on site crushed material for fill, for stabilizing soils, or as base and sub-base materials.
   2. If crushing on-site is impractical, store material during demolition processes on site in a clean, uncontaminated area and transport concrete and masonry materials to a certified concrete recycler.

D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials. Reuse on-site as appropriate or transport to recycling facility.

E. Metals: Cut as required to fit into containers.

F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

G. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

H. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

I. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

J. Carpet (and pad): Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
   1. Store clean, dry carpet (and pad) in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

K. Carpet Tile: Remove debris, trash, and adhesive.
   1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

L. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

M. Conduit: Reduce conduit to straight lengths and store by type and size.

N. Packaging:
   1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
   2. Polystyrene Packaging: Separate and bag materials.
   3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
   4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

3.05 DISPOSAL OF WASTE

A. General: 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 acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

END OF SECTION

SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Individual Product Sections: Specific requirements for operation and maintenance data.

C. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

B. Preliminary Operation and Maintenance Manual: Submit preliminary draft of proposed format and outline of contents in a PDF format before start of Work. Architect will review draft and return with comments.

C. Final Operation and Maintenance Manual: Submit final manual and electronic copies with claim for final Application for Payment. Architect will retain one electronic copy. The original manual and one electronic copy will be provided to the Owner.
   1. At the option of the Owner provide only an electronic copy in PDF format.
   2. Include all inspections, testing results and other reports in the closeout documents.

D. Warranties and Bonds: Include originals and electronic copy of each in operation and maintenance manuals, indexed separately on Table of Contents.

E. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.

F. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 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 (SI's, RFI's, RFP's, RFC's, etc.).
   5. Reviewed shop drawings, product data, and samples.

6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Record all revisions to the work. All recorded changes shall be “clouded” or otherwise clearly identified; make reference to the document that originated the change.

C. Ensure entries are complete and accurate, enabling future reference by Owner.

D. Store record documents separate from documents used for construction.

E. Record information concurrent with construction progress, not less than weekly. Provide status update as agenda item at regular progress meetings. Provide record documents for review during progress meeting when requested.

F. Specifications: Legibly mark and record the following:
   1. Changes made by Addenda.
   2. Changes made by the following:
      a. Change Orders.
      b. Supplemental Instructions (SI).
      c. Responses to Requests for Information (RFI).
      d. Construction Change Directives (CD).
      e. Changes documented by Meeting Notes or Field Reports discussed and agreed to during Progress Meetings or Site Observations.

G. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction on one "Record" set of the Drawings and Shop Drawings, including the following:
   1. Changes made by Addenda.
   2. Measured depths of foundations in relation to finish first main floor datum.
   3. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   4. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   5. Actual Equipment locations.
   6. Revisions to routing of piping and conduit.
   7. Revisions to electrical circuitry.
   8. Record information of any work that is described schematically in the Contract Documents.
   9. Field changes of dimensions and details.
   10. Details not on the original Contract Drawings.
   11. Changes made by the following:
      a. Change Orders.
      b. Supplemental Instructions (SI).
      c. Responses to Requests for Information (RFI).
      d. Construction Change Directives (CD).
      e. Changes documented by Meeting Notes or Field Reports discussed and agreed to during Progress Meetings or Site Observations.

H. Submit Record Documents to Owner's Representative at Project Close-out.

3.02 OPERATION AND MAINTENANCE DATA

A. 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.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. 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.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION 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. Additional information as specified in individual product specification sections.

D. 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 specific products.

3.04 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 replaceable 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 specific products.

C. 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.

D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

E. Provide servicing and lubrication schedule, and list of lubricants required.

F. Include manufacturer's printed operation and maintenance instructions.

G. Include sequence of operation by controls manufacturer.

H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

I. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

J. Include test and balancing reports.

K. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. O&M binders shall include all final, approved submittals that have been uploaded to the Closeout Tab of the Project Website. Do not submit O&M binders until all electronic copies of the required O&M and Warranty submittals have been uploaded to the Project Website and have achieved final approval.

D. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

E. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

F. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants,Contractor, and subcontractors, with names of responsible parties.

G. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

H. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

I. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

J. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

K. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Product data, shop drawings, and other submittals.
      c. Operation and maintenance data.
      d. Field quality control data.
      e. Original warranties and bonds.

L. Submit the number of copies of O&M binders requested by the A/E for review (up to three copies maximum). A/E shall review the O&M binders to verify completion. Contractor shall make any corrections to the O&M binders noted and upon final approval submit the number of final copies requested by the Owner (up to two copies maximum).

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Completion is determined.

B. Effective dates of warranties shall be the Date of Substantial Completion (not the date of delivery or installation) and must be identified on the warranty or by signed letter modifying the warranty.

C. Verify that documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals when required.

E. Retain warranties and bonds until time specified for submittal.

F. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

END OF SECTION

SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. HVAC systems and equipment.
   2. Plumbing equipment.
   3. Electrical systems and equipment.
   4. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Operation and maintenance manuals.

B. Section 01 91 13 - General Commissioning Requirements: Additional requirements applicable to demonstration and training.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
   2. Submit one copy to the Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Commissioning Authority for review and inclusion in overall training plan.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

C. Demonstration may be combined with Owner personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.

B. Conduct training on-site unless otherwise indicated.

C. Owner will provide classroom and seating at no cost to Contractor.

D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

E. Provide training in minimum two hour segments.

F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.

G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

I. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
   8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
   9. Review recommended tools and spare parts inventory suggestions of manufacturers.
   10. Review spare parts and tools required to be furnished by Contractor.
   11. Review spare parts suppliers and sources and procurement procedures.

J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

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SECTION 01 91 13
GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:
   1. Verify that the work is installed in accordance with Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.
   2. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
   3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
   4. Verify that the Owner's operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.

B. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.

1.02 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
   1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F and resolution of plus/minus 0.1 degree F.
   2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
   3. Calibration: According to the manufacturer's recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.

C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

D. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.
   1. Dataloggers required to for Functional Tests will be provided by the Commissioning Authority and will not become the property of Owner.

PART 3 EXECUTION

3.01 COMMISSIONING PLAN

A. Commissioning Authority has prepared the Commissioning Plan.
   1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.
   2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.

B. Contractor is responsible for compliance with the Commissioning Plan.

C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.

D. Commissioning Schedule:
   1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.
   2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.
   3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
   4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.02 STARTUP PLANS AND REPORTS

A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.

B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.

C. Submit directly to the Commissioning Authority.

3.03 PREFUNCTIONAL CHECKLISTS

A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.
   1. No sampling of identical or near-identical items is allowed.
   2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.
   3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
      a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
      b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
      c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."
      d. Serial number of installed unit.
      e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer’s start-up checklist items and minor testing.
      f. Sensor and actuator calibration information.

B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.
   1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.
   2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.
   3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
   4. If any Checklist line item is not relevant, record reasons on the form.
   5. Contractor may independently perform startup inspections and/or tests, at Contractor's option.
   6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
   7. Submit completed Checklists to Commissioning Authority within two days of completion.

C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.
   1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in Contract Documents.
   2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
   3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in Contract Documents or not.
   4. When asked to review the proposed Checklists, do so in a timely manner.

D. Commissioning Authority Witnessing: Required for:
   1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.
   2. A sampling of non-primary equipment, as allowed by the commissioning plan.

E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
   1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.04 FUNCTIONAL TESTS

A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.

B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.

C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.

D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.
   1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with Contract Documents or does not perform properly.
   2. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.
   3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
   4. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing.
   5. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.

E. Functional Test Procedures:
   1. Some test procedures are included in Contract Documents; where Functional Test procedures are not included in Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.
   2. Examples of Functional Testing:
      a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).

b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.
c. Systems are run through all the HVAC control system's sequences of operation and components are verified to be responding as the sequence's state.
d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.

F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.

3.05 SENSOR AND ACTUATOR CALIBRATION

A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gauges, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.

B. Calibrate using the methods described below; alternate methods may be used, if approved by Commissioning Authority and Owner beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.

C. All Sensors:
1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
2. Verify that sensors with shielded cable are grounded only at one end.
3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
4. Tolerances for critical applications may be tighter.

D. Sensors Without Transmitters - Standard Application:
1. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
2. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
3. If not, install offset, calibrate or replace sensor.

E. Sensors With Transmitters - Standard Application.
1. Disconnect sensor.
2. Connect a signal generator in place of sensor.
3. Connect ammeter in series between transmitter and building automation system control panel.
4. Using manufacturer's resistance-temperature data, simulate minimum desired temperature.
5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
7. Record all values and recalibrate controller as necessary to comply with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
8. Reconnect sensor.
9. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
10. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
11. If not, replace sensor and repeat.
12. For pressure sensors, perform a similar process with a suitable signal generator.

F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:
1. Watthour, Voltage, Amperage: 1 percent of design.

2. Pressure, Air, Water, Gas: 3 percent of design.
3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F.
4. Relative Humidity: 4 percent of design.
5. Barometric Pressure: 0.1 inch of Hg.
6. Flow Rate, Air: 10 percent of design.
7. Flow Rate, Water: 4 percent of design.
8. AHU Wet Bulb and Dew Point: 2.0 degrees F.

G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

H. Valve/Damper Stroke Setup and Check:
1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
2. Set pump/fan to normal operating mode.
3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
4. Command valve/damper to open; verify position is full open and adjust output signal as required.
5. Command valve/damper to a few intermediate positions.
6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.
1. With full pressure in the system, command valve closed.
2. Use an ultra-sonic flow meter to detect flow or leakage.

3.06 TEST PROCEDURES - GENERAL

A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:
1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.
2. Sampling is not allowed for:
a. Major equipment.
b. Life-safety-critical equipment.
c. Prefunctional Checklist execution.
3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.
5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
7. If YY percent of the units in the second sample fail, test all remaining identical units.
8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.

D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).

E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the

response in a VAV box.

F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.

G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.

H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.

I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:
   1. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Authority's request, Contractor shall trend up to 20 percent more points than specified at no extra charge.
   2. Other points will be monitored by the Commissioning Authority using dataloggers.
   3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
   4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
   5. Graphical output is desirable and is required for all output if the system can produce it.
   6. Monitoring may be used to augment manual testing.

3.07 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 78 00 - Closeout Submittals for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

END OF SECTION

SECTION 01 91 14
COMMISSIONING AUTHORITY RESPONSIBILITIES

PART 1 GENERAL

1.01 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section covers the Commissioning Authority's responsibilities for commissioning:
   1. Verify that the work is installed in accordance with Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists are utilized to achieve this. Prefunctional Checklists are provided in this project specification for each participating Division.
   2. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests performed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
   3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed O&M data submittals are specified.
   4. Verify that the Owner's operating personnel are adequately trained: Formal training conducted by Contractor is specified.

B. Commissioning, including TAB review, Pre Functional Test review, Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Substantial Completion.

C. Coordinate and direct all the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.

D. The work of the Commissioning Authority will be performed by the Engineer's Office.

1.02 SCOPE OF COMMISSIONING

A. The following are to be commissioned:

B. Refrigeration equipment and systems.

C. Plumbing Systems:
   1. Water heaters.
   2. Booster pumps.
   3. Plumbing Fixture

D. HVAC Systems:
   1. Major and minor equipment items.
   2. Piping systems and equipment.
   3. Ductwork systems and accessories.
   4. Terminal units.
   5. Control system.
   6. Variable frequency drives.

E. Integrated Automation Systems.
   1. Building automation system (BAS) and equipment.

F. Electronic Safety and Security Systems:
   1. Security system, including doors and hardware.
   2. Fire and smoke alarms.

G. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

1.03 DEFINITIONS

A. Acceptance Criteria: Threshold of acceptable work quality or performance specified for a commissioning activity, including, but not limited to, construction checklists, performance tests, performance test demonstrations, commissioning tests and commissioning test demonstrations.

B. Basis of Design: A document that records the concepts, calculations, decisions, and product selections used to meet Owner's project requirements and to satisfy applicable regulatory

requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

C. Commissioning Authority (CxA): A qualified and certified firm or individual responsible for delivery of the commissioning process.
   1. When applicable to a firm, indicates a entity certified through one or more of the organizations listed in the Quality Assurance article.
   2. When applicable to an individual, equivalent terms with same meaning used in this Section include: Building Commissioning Professional (BCxP); Commissioning Professional (CxP); Commissioning Process Professional (CxPP).

D. Commissioning Process: Quality-oriented process for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meets defined objectives and criteria.

E. Deferred Tests: Tests performed after Date of Substantial Completion, with Owner's approval, due to seasonal requirements, site conditions , or both, that prohibit the tests from being performed prior to achieving Substantial Completion.

F. Deficiency: Condition of a component, piece of equipment, or system that is not in compliance with the Contract Documents.

G. Integrated System Test: Test of multiple systems that are designed to dynamically function and operate in coordinated and properly sequenced fashion. Tests are intended to be conducted under various modes and through every specified sequence of operations.

1.04 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - HVAC&R Technical Requirements for the Commissioning Process; 2007, with Errata (2012).

B. CSI/CSC MF - Masterformat; 2016.

1.05 SUBMITTALS

A. Commissioning Plan:
   1. Submit preliminary draft for review by Owner and Architect within 30 days after commencement of Commissioning Authority contract.
   2. Submit revised draft to be included in the construction Contract Documents, not less than 4 weeks prior to bid date.
   3. Submit final plan not more than 90 days after commencement of construction, for issuance to all parties.

B. General Commissioning Specifications.
   1. Submit preliminary draft for review by Owner and Architect at start of construction documents phase or within 30 days after commencement of Commissioning Authority contract, whichever is later.
   2. Submit final draft for review by Owner and Architect not less than 6 weeks prior to bid date.

C. List of Functional Test procedures to be developed:
   1. Submit preliminary list at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
   2. Submit revised list not less than 6 weeks prior to bid date, for inclusion in Contract Documents; this is intended to be a list of titles, not full description of the tests.
   3. Submit final list not more than 60 days after start of construction.

D. Functional Test Procedures:
   1. Submit preliminary draft at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
   2. Submit revised draft for review by Owner and Architect not less than 6 weeks prior to bid date, for inclusion in the construction Contract Documents.
   3. Submit final draft to Contractor not less than 4 weeks prior to startup of particular items to be commissioned.

E. Commissioning Process Record: Submit to Contractor for inclusion with O&M manuals. Include, at a minimum the following:
   1. Issues Log

2. Construction Checklists
3. CxA Site Visit and Cx Team Meeting Minutes
4. O & M Review
5. Warranty Review
6. Test Data Reports
7. Summary Report

F. Final Commissioning Report: Submit to Owner. Include the following:
1. A statement that systems have been completed in accordance with Contract Documents, and that the systems are performing in accordance with the final Owner's project requirements document.
2. Identification and discussion of any substitutions, compromises, or variances between the final design intent, Contract Documents and as-built conditions.
3. Description of components and systems that exceed Owner's project requirements and those which do not meet the requirements and why.
4. Summary of issues, both resolved and unresolved, and any recommendations for resolution of remaining items.
5. A list of post-construction activities and results including deferred & seasonal testing results, test data reports and additional training documentation.
6. A narrative of lessons learned for future commissioning project efforts

1.06 QUALITY ASSURANCE

A. Commissioning Firm Qualifications: Firm experienced in commissioning assemblies and systems specified to be included in scope of work of this Section, and certified by one or more of the following organizations.
1. AABC Commissioning Group (ACG), for commissioning of HVAC Systems and Special Ventilation Systems.
2. Building Commissioning Association (BCA) for commissioning of HVAC Systems
3. National Environmental Balancing Bureau (NEBB) for commissioning of HVAC Systems

B. Commissioning Plan: Prepare a plan that provides direction for commissioning tasks during construction phase of the project. Include, at a minimum, the following content at the level of detail appropriate to project scope and complexity:
1. General project information.
2. List of team members.
3. Team members' roles and responsibilities
4. Description of the goals of the plan.
5. Scope of commissioning activities.
6. Proposed overall schedule, tied to project construction schedule.
7. Description of the commissioning process, including documents to be used for facilitating:
a. Prefunctional checking and readiness verification.
b. Start-up plan and procedures.
c. Functional test plan and verification procedures.
d. Retesting procedures.
e. Management protocols for address deficiencies due to defective products or non-complying work.
f. Management protocols for addressing other project-specific issues.
8. Warranty period seasonal and deferred testing.
9. Progress reporting and log for tracking issues.
10. Commissioning record table of contents.

PART 2 PRODUCTS

2.01 DOCUMENTATION IDENTIFICATION SYSTEM

A. Give each submitted form or report a unique identification; use the following scheme.

B. Type of Document: Use the following prefixes:
1. Commissioning Plan: CP-.
2. Prefunctional Checklist: PC-.
3. Functional Test Procedure: FTP-.
4. Functional Test Report: FTR-.

5. Commissioning Report: CR-.

C. System Type: Use the first 4 digits from CSI/CSC MF (Master Format), that are applicable to the system; for example:
   1. 2300: HVAC system as a whole.
   2. 2320: HVAC Piping and Pumps.
   3. 2330: HVAC Air Distribution.

D. Component Number: Assign numbers sequentially, using 1, 2, or 3 digits as required to accommodate the number of units in the system.

E. Test, Revision, or Submittal Number: Number each successive iteration sequentially, starting with 1.

F. Example: PC-2320-001.2 would be the Prefunctional Checklist for equipment item 1 in the HVAC piping system, probably a pump; this is the second, revised submittal of this checklist.

PART 3 EXECUTION

3.01 COMMISSIONING PLAN

A. Prepare and implement the Commissioning Plan, covering commissioning schedule, Prefunctional Checklist and Functional Test procedures, coordination requirements, and forms to be used, for all parties in the commissioning process.
   1. Call and chair meetings of the Commissioning team when appropriate.
   2. Give Contractor sufficient notice for scheduling commissioning activities.
   3. Develop a comprehensive start-up and initial systems checkout plan with cooperation of Contractor and subcontractors.
   4. ASHRAE Guideline 1.1 may be used as a guide for the Commissioning Plan.
   5. Avoid replication of information included in the construction Contract Documents to the greatest extent possible.

B. Review the construction Contract Documents for Contractor submittals of draft checklists, draft test procedures, manufacturer startup procedures, and other information intended for the use of the Commissioning Authority in preparing the Commissioning Plan.

C. Commissioning Schedule:
   1. Coordinate with Contractor anticipated dates of startup of each item of equipment and system.
   2. Contractor's scheduling responsibilities are specified in the construction Contract Documents.
   3. Revise and re-issue schedule whenever revised.
   4. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
   5. Deliver relevant Prefunctional Checklists and Functional Test Procedures to Contractor in time to avoid delay.

D. Commissioning Team: Project manager or other designated person of:
   1. Owner's building or plant operation staff.
   2. Commissioning Authority.
   3. Construction Manager.
   4. Design professional's design team.
   5. General Contractor.
   6. Plumbing subcontractor.
   7. HVAC subcontractor.
   8. HVAC control system subcontractor.
   9. HVAC testing, adjusting, and balancing (TAB) subcontractor.
   10. Electrical subcontractor.
   11. Communications subcontractor.

3.02 CONSTRUCTION CONTRACT DOCUMENTS

A. General Commissioning Specifications: Architect has prepared general commissioning specifications for inclusion in the construction Contract Documents; review and submit comments to Owner.
   1. These specifications include:

a. Procedures applicable to all types of items to be commissioned.

2. Prepare specifications for any of the following that would be recommended, for incorporation into the construction Contract Documents by Architect:
   a. Additional Contractor submittals needed for purposes of commissioning, such as startup procedures, draft test procedures, draft training plans, etc.
   b. Additional operation or maintenance data that should be submitted.

B. Functional Testing: Develop detailed procedures for each item to be commissioned; submit for review by Owner and Architect.
   1. List of Test Procedures to be Developed: Prepare and maintain a detailed list of titles, not full text.
   2. The forms the Commissioning Authority will use to report Functional Test results are not intended to be part of Contractor's Contract Documents, but the Functional Test Procedures that must be executed by the Contractor must be made part of the Contract Documents, by modification if necessary.

C. Develop any other reporting forms Contractor will be required to use; if they are likely to require a substantially different amount of work than the Contractor can reasonably anticipate, they must be included in the construction Contract Documents.

D. If any part of the documents described above have not been developed by the bid date, coordinate with Architect the issuance of modifications to the construction Contract Documents

3.03 FUNCTIONAL TEST PROCEDURES

A. Develop test procedures in sufficient detail to demonstrate that functional performance is in accordance with Contract Documents, including proper operation through specified modes of operation where there is a different system response, including seasonal, unoccupied, warm-up, cool-down, part- and full-load regimes.
   1. Obtain assistance and review by installing subcontractors.
   2. Itemize each test sequence in step-by-step order, with acceptance criteria for each step and for the test as a whole.
   3. Include test setup instructions, description of tools and apparatus, special cautions, and.
   4. Avoid procedures that would void or otherwise limit warranties; review with Contractor prior to execution.
   5. For HVAC systems, procedures may include energy management control system trending, stand-alone datalogger monitoring, or manual functional testing.
   6. Obtain explicit approval of Contractor in regard to feasibility and safety prior to execution.

B. Functional Test Forms: Prepare and distribute forms in advance of testing. Use a consistent format to the greatest degree practicable. For each form, include the following:
   1. General and specific instructions for using form.
   2. Document Identifiers:
      a. Form Identifier (see Documentation Identification Scheme).
      b. Date and Test Party Identifier: Identification of the date(s) of the test, and the party conducting it.
   3. Checklist of activities required of the Contractor prior to, during, and after the testing.
   4. Complete testing procedure information.
      a. Instrumentation: A listing of instrumentation and tools necessary to complete the test.
      b. Test Instructions: Step-by-step instructions of how to complete the test, including functionality to test, and conditions under which the tests should be performed. Include instructions for returning affected systems and equipment to their as-found state at the conclusion of the tests.
      c. Formulas to be used in calculations.
      d. Acceptance Criteria: Measurable pass/fail criteria for each step of the test, as applicable.
   5. Test Data:
      a. Results: Include side-by-side space for recording the expected system response and the actual response. Note observed readings, results, and adjustments.
      b. Deficiencies: Include space for a list of any discovered deficiencies and for an explation of how they were mitigated.
   6. "Yes/No" checkboxes to for documenting status of completion of required testing prerequisites and procedures.

a. Functional Test Prerequisites Checkboxes: Include for applicable items:
    1) Related equipment has been started up, and start-up reports and Prefunctional Checklists have been submitted and approved, and are ready for Functional Testing.
    2) Control system functions for this and any interlocking systems have been programmed and are operable in accordance with Contract Documents, including final set points and schedules with debugging, loop tuning, and sensor calibrations completed.
    3) Incomplete items identified by Architect during closeout inspections have been corrected or completed.
    4) Vibration control report has been approved (if required).
b. Functional Test Checkboxes: Include for applicable items:
    1) Procedures have been reviewed and approved by the affected installer.
    2) Safeties and operating ranges have been reviewed.
    3) False loading equipment, system and procedures are ready.
    4) Sufficient clearance around equipment for servicing has been provided.
    5) Original values of pre-test setpoints that need to be changed to accommodate testing have been recorded, .

7. List of Attachments.
    a. A copy of the specified sequence of operation.
    b. A copy of applicable schedules and setpoints.
    c. A copy of the specified Functional Test Procedures is attached.
        1) Any other items on the Prefunctional Checklist or Start-up Reports that need to be re-verified.
8. Signature Block: Signature of the designated commissioning lead and the system and equipment installer attesting that the recorded test results are accurate.

3.04 CONSTRUCTION PHASE

A. Coordinate the commissioning work with Contractor and Construction Manager; ensure that commissioning activities are being incorporated into the master schedule.

B. Perform site visits, as necessary, to observe component and system installations. Attend planning and job-site meetings to obtain information on construction progress. Review Contractor's meeting minutes for issues relating to the commissioning process. Assist in resolving discrepancies.

C. Commissioning Kick-Off Meeting: Plan and conduct a meeting early in the construction phase to review proposed commissioning schedule, activities, and responsibilities with parties involved. Require attendance by every member of the Commissioning Team.

D. Conduct periodic meetings as necessary to coordinate, resolve planning issues, and aid in resolution of deficiencies, minimizing the time spent by Contractor and Owner personnel; hold meetings at least monthly.

E. Submit periodic progress reports to Owner and Contractor.

F. Review Contractor shop drawing submittals applicable to systems being commissioned for compliance with commissioning needs; verify that Owner's responsibilities are clearly defined in warranties.

G. Review and approve submittals directly related to commissioning.

H. Deliver Prefunctional Checklists and Functional Test procedures to Contractor.

I. Verify satisfactory completion of Prefunctional Checklists by Contractor by reviewing checklists and by site observation and spot checking; provide formal approval when satisfactory.

J. Verify startup of all systems by reviewing start-up reports and by site observation; provide formal approval when satisfactory.

K. Coordinate, witness and approve Functional Tests performed by Contractor. Coordinate retesting until satisfactory performance is achieved.

L. Plumbing Systems Commissioning:
    1. Comply with requirements stated in applicable Division 22 sections.

M. HVAC Commissioning:

1. Gather and review the control sequences and interlocks and work with Contractor and design engineers until sufficient clarity has been obtained, in writing, to be able to prepare detailed Functional Test procedures.
2. Witness all or part of HVAC piping test and flushing procedures, sufficient to be confident that proper procedures were followed; document testing and include documentation in O&M manuals.
3. Witness all or part of duct testing and cleaning procedures, sufficient to be confident that proper procedures were followed; document testing and include documentation in O&M manuals.
4. Review TAB Plan prepared by Contractor.
5. Before TAB is executed, witness sufficient Functional Testing of the control system to approve it to be used for TAB.
6. Verify air and water systems balancing by spot testing, by reviewing completed reports, and by site observation; provide formal approval when satisfactory.
7. Analyze trend logs and monitoring data to verify performance.

N. Electrical Systems Commissioning:

O. Witness and document testing of systems and components over which the Commissioning Authority does not have direct control, such as smoke control systems, tests contracted directly by Owner, and tests by manufacturer's personnel; include documentation in O&M manuals.

P. When Functional Testing for specific systems or equipment is specified to be performed by the Commissioning Authority rather than the Contractor, perform such testing without assistance of Contractor.

Q. Maintain a master deficiency and resolution log and a separate testing record. Provide written progress and test reports with recommended actions.

R. Operation and Maintenance Data: Review submitted operation and maintenance data for completeness; provide formal approval if satisfactory.

S. Notify Contractor and Owner of deficiencies in procedures or results; suggest solutions.

3.05 CLOSEOUT

A. Commissioning Record: Use the same format and organization as specified for the O&M manuals. **All final reports shall be in pdf format and hyperlinked index.**
1. Include the Final Commissioning Plan and Final Report.
2. For each product or system and equipment item, include the following organized as indicated, with separator tabs:
a. Design intent documentation, furnished by Architect or others.
b. Detailed operational sequences.
c. Startup plan and approved startup reports.
d. Filled out Prefunctional Checklists.
e. Filled out Functional Test reports; trend logs and monitoring reports and analysis; other verification documentation.
f. Training plan and training records.
g. Recommissioning recommendations, including time schedule and procedures; include blank copies of all Prefunctional Checklists and Functional Test report forms.

B. Final Commissioning Report: Include:
1. Executive summary.
2. List of participants and roles.
3. Brief facility description.
4. Overview of commissioning scope and general description of testing and verification methods.
5. For each item commissioned, an evaluation of adequacy of:
a. The product itself; i.e. compliance with Contract Documents.
b. Installation.
c. Functional performance; include a brief description of the verification method used and observations and conclusions from the testing.
d. O&M documentation, including design intent.
e. Operator training.

6. List of all outstanding non-compliance items, referenced to the specific functional test, inspection, trend log, etc., where the deficiency is documented.
7. List of unresolved issues, seasonal or deferred testing, and other concerns that could affect facility operation.
8. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. (about four to six pages).
9. Attach appendices containing all commissioning documentation, including logs, minutes, reports, deficiency lists, communications, findings, etc., except that specified to be part of the Commissioning Record.

C. Recommissioning Manual: Revise the Commissioning Plan documents, checklists, and Functional Test forms as necessary based on accepted recommendations of the final Commissioning Report. Provide step-by-step instructions for recommissioning, blank forms, and cross-references to O&M data needed during recommissioning.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete formwork.

B. Floors and slabs on grade.

C. Concrete sidewalks.

D. Concrete reinforcement.

E. Joint devices associated with concrete work.

F. Miscellaneous concrete elements, including equipment pads.

G. Concrete curing.

H. Concrete finishing.
   1. Floor surfaces to be left exposed.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

B. Section Division 22 - Plumbing Piping Specialties: Mechanical items for casting into concrete.

C. Section Division 26 - Grounding and Bonding for Electrical Systems: Electrical items for casting into concrete. Coordinate location with electrical contractor.

1.03 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).

B. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.

C. ACI PRC-302.1 - Guide to Concrete Floor and Slab Construction; 2015.

D. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).

E. ACI PRC-305 - Guide to Hot Weather Concreting; 2020.

F. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.

G. ACI PRC-308 - Guide to External Curing of Concrete; 2016.

H. ACI PRC-347 - Guide to Formwork for Concrete; 2014 (Reapproved 2021).

I. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

J. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

K. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.

L. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.

M. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2023.

N. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2024.

O. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

P. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2020.

Q. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2023.

R. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

S. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2019.

T. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).

U. ASTM C595/C595M - Standard Specification for Blended Hydraulic Cements; 2021.

V. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2023, with Editorial Revision.

W. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2017.

X. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2021.

Y. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2020.

Z. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.

AA. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers; 2020.

BB. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.

CC. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

C. Mix designs: Submit mix design for each mix showing compliance with specified requirements.

D. Test Reports: Submit report for each test or series of tests specified.

E. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.

F. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.

B. Follow recommendations of ACI PRC-305 when concreting during hot weather.

C. Follow recommendations of ACI PRC-306 when concreting during cold weather.

PART 2 PRODUCTS

2.01 FORMWORK

A. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
   1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
   2. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
   3. Form Ties: Contractor's choice of standard product type that will leave no metal within 1-1/2 inches of concrete surface.

2.02 REINFORCEMENT MATERIALS

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Type: Deformed billet-steel bars.
   2. Finish: Unfinished, unless otherwise indicated.

B. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.

2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
3. Do not use clay bricks or similar blocks/chunks of material as rebar chairs. Concrete dobies as rebar chairs are acceptable.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal, Type II - Moderate, Portland type; or ASTM C595/C595M, Type IL - Portland-Limestone Cement Type.
   1. Acquire cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C33/C33M.
   1. Acquire aggregates for entire project from same source.
   2. Provide aggregate free of shale at all slab locations exposed to freeze/thaw action.

C. Fly Ash: ASTM C618, Class C or F.

D. Calcined Pozzolan: ASTM C618, Class N.

E. Silica Fume: ASTM C1240, proportioned in accordance with ACI PRC-211.1.

F. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES

A. Chemical Admixture:
   1. Manufacturers by concrete supplier:
      a. Master Builders Solutions: www.master-builders-solutions.com.
      b. Grace Construction Products: www.gcpat.com.
      c. Fritz-Pak: www.fritzpak.com.
      d. Mapei GRT: www.mapei.com.
      e. Sika Corporation U.S.: www.usa.sika.com
      f. Euclid Chemical: www.euclidchemical.com.
      g. Substitutions: See Section 01 60 00 - Product Requirements.

B. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

C. Admixtures shall comply with ASTM C494/C494M.

D. Air Entrainment Admixture: ASTM C260/C260M.

2.05 ACCESSORY MATERIALS

A. Aggregate Base:
   1. Crushed stone, gravels of which 30% or more of the particles retained on the 3/8 inch sieve have at least one fractured face, crushed PCC, or uniformaly blended combinations of these materials.

B. Gradation:

Sieve	Percent Passing
2-1/2"	100
2"	90 to 100
1-1/2"	35 to 75
1"	0 to 20
1/2"	0 to 5

C. Gravel Subbase: Thickness as indicated on drawings.

D. Epoxy Grout Systems: Where indicated provide Hilti Hit-Hy 200 Epoxy System; other indicated systems; or approved equivalent system.
   1. Hilti: www.hilti.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.06 BONDING AND JOINTING PRODUCTS

A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
   1. Products:
      a. SpecChem, LLC; Strong Bond Acrylic Bonder: www.specchemllc.com/#sle.

b. W. R. Meadows, Inc; ACRY-LOK-: www.wrmeadows.com/#sle.
c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Expansion-Joint Filler: Polyethylene/polypropylene semi-rigid closed-cell backing complying with ASTM D 3575/ASTM D 8139/ASTM D 1751, 1/2 inch thick and full depth of slab less 1/2 inch with peel-off feature.
1. Provide product by one of the following:
a. BoMetals, Inc. 1000 Series Expansion Board Caps.
b. Master Builders Solutions.
c. Namaco.
d. Reflectix, Expansion strips.
e. Sealed Air, Cellu-Cushion EXP 200.
f. W.R. Meadows.
g. or equivalent.
2. Place peel-off feature at top of slab when sealants are specified. Remove peel-off portion of expansion-joint filler prior to application of sealants.
3. Place peel off feature at bottom of slab when no sealants are specified.

C. Plate Dowel System: Steel plate dowel and plastic dowel sleeve; with integral fasteners for attachment to formwork.

2.07 CURING MATERIALS

A. Liquid Membrane Curing Compound: ASTM C309, Type 2, Class B, White Pigmented.
1. Product: L&M CURE R2 by Laticrete or approved equivalent.
a. Other Approved Products:
1) SpecRez White by SpecChem.
2. Application Locations: Exterior Concrete surfaces unless indicated otherwise. Finish surfaces to a light broom finish prior to applying curing compound.

B. Moisture-Retaining Sheet: ASTM C171.
1. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard.

2.08 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI PRC-211.1 recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI SPEC-301.
1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended or required by manufacturer.

D. Materials In General: Do not use materials or combinations thereof that will result in a reaction that is detrimental to the structural integrity or visual appearance of concrete.

E. Normal Weight Concrete: Refer to structural notes on the drawings.

2.09 MIXING

A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.

B. Transit Mixers: Comply with ASTM C94/C94M.

C. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

B. Verify gradients and elevations of the subgrade are correct as shown on drawings. Where poor subgrade material is encountered, remove and replace with suitable material.

C. Verify compacted subgrade is acceptable, ready to support imposed loads and paving, and ready to receive work.

3.02 PREPARATION

A. Maintain subgrade in a smooth, compacted condition with required section and established grade until concrete is placed.

B. Formwork: Comply with requirements of ACI SPEC-301. Design and fabricate forms to support all applied loads until concrete is cured and for easy removal without damage to concrete.

C. Verify that forms are clean and free of rust before applying release agent.

D. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

E. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
   1. Use latex bonding agent only for non-load-bearing applications.

F. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Comply with requirements of ACI SPEC-301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

3.04 PLACING CONCRETE

A. Place concrete in accordance with ACI PRC-304.

B. Place concrete for floor slabs in accordance with ACI PRC-302.1.

C. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 SLAB JOINTING

A. Locate joints as indicated on drawings.
   1. If no pattern is shown, contractor shall provide for 15 by 15 feet saw cut areas and shall contact Engineer for exact locations of joints on slabs.
   2. Sidewalks: Provide scored joints every 4 feet.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
   1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.

D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 24 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.
   1. Do not exceed 2 inches deep when/if slab thicknesses are greater than 8 inches.

E. Construction Joints: Where not otherwise indicated, use materials compatible with plate dowel system steel plate dowel and plastic dowel sleeves with integral fasteners for attachment to formwork.

3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Refer to structural notes on the drawings.

3.07 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.
   1. Where indicated install mechanical plugs for tie holes in accordance with manufacturers instructions.

B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.

C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide other finishes as follows:
   1. Grout-Cleaned Finish (Class A per ACI PRC-347): Wet concrete surfaces and apply grout of a consistency of thick paint to coat surface and fill small holes. Mix one part portland cement to one and one-half parts fine sand with 1:1 moisture of bonding admixture and

water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

a. Locations: Provide this finish only where indicated on the drawings.

D. Concrete Slabs: Finish to requirements of ACI PRC-302.1 and as follows:
   1. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains as indicated on drawings.

F. At exterior slabs, aprons, and other horizontal locations provide a light broom finish perpendicular to direction of travel and liquid membrane curing compound finish unless indicated otherwise.

3.08 CURING AND PROTECTION

A. Comply with requirements of ACI PRC-308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Surfaces Not in Contact with Forms:
   1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than 7 days by saturated burlap unless noted otherwise.
      a. Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place.
   2. Final Curing: Begin after initial curing but before surface is dry.
   3. Where damp curing is not feasible due to location, and with written permission of SER, spray with an approved curing compound. In general, curing compound is not an acceptable substitute for damp curing.

3.09 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to Architect for review prior to commencement of concrete operations.

D. For testing requirements refer to structural notes on the drawings and, where applicable, as indicated below.

E. Refer to Section 01 3510 - Structural Testing and Special Inspection Requirements for testing requirements.

3.10 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.
   1. Concrete damaged by the construction activities required to complete the Work of this section shall also be considered defective concrete.

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.11 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items.

1.02 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

G. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2022.

H. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

I. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

J. SSPC-SP 2 - Hand Tool Cleaning; 2018.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on all finishing products, including VOC content.

C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Indicate unit identification mark and location for each unique item.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel W Shapes and Tees: ASTM A992/A992M.

B. Steel Sections, Angles, and Plates: ASTM A 36/A 36M.

C. Steel Tubing: ASTM A500/A500M Grade B cold-formed structural tubing.

D. Pipe: ASTM A 53/A 53M Grade B Schedule 40, black finish.

E. Bolts, Nuts, and Washers: ASTM A307, Grade A, galvanized to ASTM A153/A153M where connecting galvanized components.

F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

G. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.
   1. Color: Manufacturer's Standard.

H. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Mark each item with its identification mark. Use a non-permanent method at units that will remain exposed; welding is not acceptable, it shall be ground smooth, filled, and primed by the supplier at no additional cost to the Owner.

C. Fabricate items with joints tightly fitted and secured.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

A. Lintels: As detailed; galvanized finish.

B. Other items indicated on the drawings.

2.04 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.

B. Prepare surfaces to be primed in accordance with SSPC-SP2 minimum.
   1. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
   2. Prime Painting: One coat.
      a. Provide primer products indicated for surfaces to be primed and painted, Refer to Section 09 9113 - Exterior Painting and Section 09 9123 - Interior Painting.

C. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.

D. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

2.06 CONCRETE ANCHORING SYSTEMS

A. Approved Manufacturers/Products:
   1. HILTI: www.us.hilti.com.
   2. MiTek: www.mitek-us.com.
   3. Powers: www.powers.com.
   4. Red Head: www.itwredhead.com.
   5. Simpson Strong-Tie: www.strongtie.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Perform field welding in accordance with AWS D1.1/D1.1M.

D. Obtain approval prior to site cutting or making adjustments not scheduled.

E. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

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SECTION 07 31 00
SHINGLE ROOFING

PART 1 GENERAL

1.01 GENERAL NOTES

A. All prospective bidders are to familiarize themselves with this project by visiting the project site to verify all dimensions, and existing conditions.

B. Preceding bidding, bidders shall decide to their satisfaction that all specifications, plans, and details contained herein are workable. Commencing job start-up shall imply that the contractor accepts existing conditions (except unknown conditions).

C. Contractor will perform all work with competent, trained, and properly equipped personnel in strict accordance with NRCA Roofing and Waterproofing Manual, Fifth Addition.

D. Contractor will observe all published safety prevention policies and practices relating to application of roof system and related work. All federal, state and local codes shall be followed.

E. Contractor will follow application and safety information as published in the most current edition of the manufacturer's technical manual.

1.02 SECTION INCLUDES

A. Granule surfaced asphalt shingle roofing

B. Moisture shedding underlayment, eaves, valley and ridge protection.

C. Associated metal flashing.

D. Ridge ventilation.

1.03 REFERENCES

A. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017 (Reapproved 2023).

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

C. ASTM D3018/D3018M-11 - Standard Specification for Class A Asphalt Shingles Surfaced With Mineral Granules; 2017.

D. ASTM D3161/D3161M - Standard Test Method for Wind Resistance of Steep Slope Roofing Products (Fan-Induced Method); 2020.

E. ASTM D3462/D3462M - Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules; 2023.

F. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).

G. ASTM D6381/D6381M-15 - Standard Test Method For Measurement Of Asphalt Shingle Mechanical Uplift Resistance; 2020.

H. ASTM D6757/D6757M - Standard Specification for Underlayment Felt Containing Inorganic Fibers Used in Steep-Slope Roofing; 2018.

I. ASTM D7158/D7158M - Standard Test Method for Wind Resistance of Asphalt Shingles (Uplift Force/Uplift Resistance Method); 2020.

J. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2020a.

K. ASTM G90 - Standard Practice for Performing Accelerated Outdoor Weathering of Materials Using Concentrated Natural Sunlight; 2017.

L. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings; Current Edition, Including All Revisions.

M. ASTM E 108 - Standard Test Methods for Fire Tests of Roof Covering.

1.04 SUBMITTALS

A. Shop Drawings: Include plans, evaluations, sections, details, and attachments to other work.

B. Product Data: Provide manufacturer's printed product information indicating material characteristics, performance criteria, and product limitations for each product indicated.

C. Manufacturer's Installation Instructions: Provide published instructions that indicate preparation required and installation procedures.

D. Maintenance Data and Warranties: Submit at completion of project.

E. Forward Submittals (with an AF Form 3000) to:
   1. United States Property and Fiscal Office
   2. USPFO-PC, Attention: Theresa Cory
   3. Camp Dodge, Building W-41
   4. 7105 NW 70th Avenue
   5. Johnston, Iowa 50131
   6. 515-252-4647

1.05 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Maintain on copy of manufacturer's application instructions on project site.
   2. Verify that manufacturer's label contains reference to specified ASTM standards.
   3. Products used in the work included in this section shall be produced by the manufacturer and must have a history of successful production acceptable to the Owner. Private labeled products are not eligible for approval.

B. Installer Qualifications:
   1. All contractors must be certified by the shingle manufacturer as an approved applicator.
   2. All contractors shall have had said approval for a minimum of five years prior to the date set for opening bids. Contractors not meeting the minimum experience requirements must be able to provide supporting documentation of experience with like and/or similar systems that is acceptable to the Owner.
   3. The bidding entity will have never defaulted on, failed to complete, or requested to be relieved of the responsibilities of a contract with a public entity.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Take special care when applying underlayment and shingles when ambient or wind chill temperature is below 45 degrees F (7 degrees C). Tack underlayment in place if it does not adhere immediately to the deck.

B. All debris from roof removal will be disposed of in an approved landfill. Recycling of any metal products is encouraged but not required.

1.07 EXTRA MATERIALS

A. Provide 1,200 square feet of (1 complete pallet, 48 bundles) of extra shingles. At the conclusion of the project those will be turned over to Iowa Army National Guard representatives, in unopened packages in good condition.

B. Deliver to and unload shingles at location on Camp Dodge as directed by Owner.

1.08 WARRANTY

A. Manufacturer's Warranty: Furnish shingle manufacturer's warranty for product(s) of this section as follows:
   1. ASPHALT FIBER GLASS SHINGLES – provide signed warranty sheets for a minimum manufacturer’s warranty period of fifty (50) years, to be dated from the date of project substantial completion, as determined by the Contracting Officer.

B. Extended Warranty Protection: Provide a fifteen (15) year warranty to cover material and labor costs for repair or replacement of defective materials or installation to include tear off and landfill cost for the entire roofing system including all sheet materials. Contractor must be a manufacturer's credentialed contractor to provide this warranty.

1.09 SUBSTITUTIONS

A. Approved products listed in Part 2 represent the minimum standard required by the owner. Proposed substitutions shall be equal to or superior in performance to those listed. Manufacturer's/distributors submitting products for "approved equal” status will be required to complete the "Substitution Request Form" found at the end of these specifications prior to being considered for approval. Completion of the form does not imply or guarantee approval. Submit form to the contracting officer at the address listed in Section 1.4 a minimum of five days prior

to bid. The contracting officer will notify in writing his decision to accept or reject request.

PART 2 PRODUCTS

2.01 ASPHALT FIBERGLASS SHINGLES

A. Shingles shall conform to the following:
   1. Glass fiber mat base.
   2. UL Certified to ASTM D3462/D3462M.
   3. Conforms to ASTM D3018/D3018M-11 Type I – Self-Sealing.
   4. Conforms to ASTM D3161/D3161M, Class “F” Wind Resistance (Regional), ASTM D3161/D3161M Wind Resistance, UL 997 Wind Resistance, ASTM D6381/D6381M-15 Class “H” and ASTM D7158/D7158M Class “H” Wind Resistance.
   5. Conforms to UL 790 and ASTM E108 for a Class A Fire Resistance.
   6. Ceramically colored/UV resistant mineral surface granules across entire face of shingle.
   7. Two-piece laminated.
   8. Color to be red to match surrounding facilities and approved by contracting officer.
   9. Weight 300-330 pounds per square (100 Square feet).
   10. Algae Resistant.

B. Approved Products. The following product has been approved by the owner. For substitutions, see section 1.9 above.
   1. CertainTeed Landmark PREMIUM/Architect 80 (formerly Landmark 50/Architect 80)
      a. Color: Cottage Red
   2. Approved equal

2.02 SHEET MATERIALS

A. Install sheet materials required by the shingle manufacturer to ensure warranty will be issued as described in Section 1.8 above.

B. Eave and Valley Protection: Conform to ASTM D1970/D1970M, sheet barrier of self-adhering rubberized asphalt membrane shingle underlayment having internal reinforcement, and "split" back plastic release film; provide material with warranty equal in duration to that of shingles being applied.
   1. Approved Products
      a. CertainTEED WinterGuard Sand
      b. Approved equal

C. Underlayment: Conform to ASTM D6757/D6757M and ASTM D226/D226M; asphalt-impregnated fiberglass-reinforced organic felt designed for use on roof decks as water-resistant layer beneath roofing shingles.
   1. Approved Products
      a. CertainTEED Roofer’s Select
      b. Approved equal

D. Waterproofing Underlayment: Conforms to ASTM D1970/D1970M, sheet barrier of self-adhering rubberized asphalt membrane shingle underlayment having internal reinforcement, and "split" back plastic release film; Use in "low-slope" areas (below 4:12, but no less than 2:12); provide material with warranty equal in duration to that of shingles being applied.
   1. Approved Products
      a. CertainTEED WinterGuard Sand
      b. Approved equal

2.03 FLASHING MATERIALS

A. Pre-finished Galvanized Steel
   1. Acceptable Manufacturers
      a. ColorKlad as manufactured by Vincent Metals
      b. Pac-Clad as manufactured by Petersen Aluminum Corp.
      c. UnaClad as manufactured by Elevate
      d. Approved equal
   2. Materials used to fabricate items including but not limited to: drip edge, fascia, counter-flashing, step shingles and curb flashing shall have the following characteristics:
      a. Materials shall be 24 gauge (minimum) hot dipped galvanized steel (ASTM G90), primed and finished one side with 70% Kynar 500 resin based floropolymer coating

1.0 + 0.1 mil dry film thickness.

b. A wash coat of 0.3 - 0.4 mil dry film thickness shall be applied to the reverse side.
c. The pre-painted finished side shall be coated with a factory installed strippable film for protection of the finished surface during shipping, fabrication, and installation. Plastic film must be removed immediately after installation.
d. Colors will be Colonial Red, or Medium Bronze to match adjoining surfaces.
e. Thickness shall be 24 gauge (minimum) and shall increase in thickness as recommended by metal manufacturer as face height increases.

2.04 ACCESSORIES

A. Nails: Standard round wire type roofing nails, corrosion resistant; hot dipped zinc coated steel, aluminum, or chromated steel; minimum 3/8 inch (9.5mm) head diameter; minimum 11 or 12 gauge (2.5 mm) shank diameter; shank to be of sufficient length to penetrate through roof sheathing or 3/4 inch (19 mm) into solid wood, plywood, or non-veneer wood decking.

B. Asphalt Roofing Cement: ASTM D4586/D4586M, Type I or II

C. Shingle Vent II Ridge Vent

D. Plumbing Vent Flanges
1. F.J. Moore Galvanized Slant Adjustable Base Flange with Style Top #1, or approved equal, field painted. Painting to be done prior to installation, so there is no paint transfer to shingles.

2.05 PAINT

A. Paint system for plumbing vent flanges to be (or approved equals):
1. Cleaner / Etcher: “Clean N’ Etch” Manufactured by Great Lakes Laboratories (800-888-1105, or www.greatlakeslaboratories.com).
2. Primer: Pro-Cry Universal Primer Red Oxide.
3. Base Coat: Sher-Cryl High Performance Acrylic Semi Gloss, Color: Match Colonial Red Color at existing metal flashing.
4. Top Coat: Sher-Clear Acrylic Clear Coat Flat.

2.06 FLASHING FABRICATION

A. Form flashing to profiles indicated on Drawing, and to protect roofing materials from physical damage and shed water.

B. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.

PART 3 EXECUTION

3.01 REMOVAL

A. Hang tarps to prevent debris of the shingle removal from marking building or concrete.

B. Tear off all existing roofing material, felt, metal edges, gutters, and downspouts.

C. All material is to be disposed of at an approved landfill. It is recommended that any material that can be recycled, such as metal products, be recycled if possible.

D. After removal and clean up of all debris, a magnet will be run over entire area to pick up any nails that were missed during the clean up operation.

E. No more of an area of existing roofing will be removed than can be covered during the same work day. At no time will any area be left uncovered overnight.

3.02 ROOF DECK PREPARATION

A. Verify deck surfaces are dry, properly attached, and in good condition.

B. Follow shingle manufacturer's recommendations for acceptable roof deck materials.

C. Broom clean deck surfaces under eave protection and underlayment prior to their application.

3.03 INSTALLATION – EAVE ICE DAM PROTECTION

A. Place eave edge metal flashing tight with fascia boards. Weather-lap joints 2 inches (50 mm). Secure flange with nails spaced 8 inches (200 mm) on center.

B. Apply eave protection in accordance with manufacturer's instruction.

C. Extend eave protection membrane minimum 24 inches (610 mm) up slope beyond interior face of exterior wall.

3.04 INSTALLATION – PROTECTIVE UNDERLAYMENT

A. Roof Slope Between 2:12 and 4:12: Apply one layer of underlayment over all areas not protected by eave protection, with ends and edges weather-lapped per application instructions. Stagger end-laps each consecutive layer. Nail in place.

B. Any underlayment that is left exposed overnight and has been exposed to moisture resulting from rain, dew or frost must be allowed to dry and flatten out prior to being covered.

3.05 INSTALLATION - VALLEY PROTECTION

A. For "closed-cut" valleys, first place one ply of underlayment, minimum 36 inches (910 mm) wide, centered over valleys. Lap joints minimum 6 inches (152 mm). Follow instructions of shingle and waterproofing membrane manufacturer.

3.06 INSTALLATION - METAL FLASHING

A. Weather-lap joints minimum 2 inches (50 mm).

3.07 INSTALLATION-PLUMBING VENT FLANGES

A. Install underlayment barrier and plumbing vent flange in accordance with Manufacturer’s instructions and as detailed.

B. Clean/etch vents prior to shingle installation to avoid damage to shingles.

C. Apply primer, base coats, and top coat.

D. Turn any extra paint over to owner.

3.08 INSTALLATION - ASPHALT SHINGLES

A. Install shingles in accordance with manufacturer's instructions for product type and application specified.

3.09 FIELD QUALITY CONTROL

A. Field inspection will be performed by a quality control person employed by the contractor, and will be done on a daily basis. This person will not be the superintendant on the project.

B. Visual inspection of the Work will be provided by the Owner. If conditions are unacceptable, Owner will notify the Contractor immediately so changes can be make before additional work proceeds.

C. Do not permit traffic over finished roof surface.

END OF SECTION

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SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not.

C. Marking and identification of fire walls, fire barriers, fire partitions, smoke barriers, and smoke partitions, or any other wall required to have protected openings or penetrations.

1.02 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.

B. ITS (DIR) - Directory of Listed Products; Current Edition.

C. FM (AG) - FM Approval Guide; Current Edition.

D. UL (FRD) - Fire Resistance Directory; Current Edition.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Each respective trade shall provide submittals as it relates to their Scope of Work.

C. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

D. Product Data: Provide data on product characteristics, performance ratings, and limitations.

E. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

F. Installer's qualification statement.

1.04 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the specified fire ratings when tested in accordance with methods indicated.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
   2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
   3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

B. Installer Qualifications: Personnel specializing and trained in performing the work of this section and:
   1. Trained by manufacturer.

C. Each respective trade shall perform the Work of this section as it relates to their Scope of Work. Coordinate the Work between all trades so that firestopping locations and adjacent Work are within the limitations of firestopping products to be used at each location.

D. Prior to installation of any of the fire-resistive “through” or “membrane” penetration fire block systems and any fire-resistive “joint” systems, detailed testing, and installation information on each of the specific listed assemblies intended for use must be submitted to Building Official for code review. The specific assemblies must also be listed for each intended use (i.e. proper penetration size and rating condition and for the type of construction material that it is being used in/on). Each trade person responsible for sealing said conditions must provide this information to the building inspector for review prior to installation of any assembly.

1.05 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MATERIALS

A. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

B. Firestopping where cabling penetrates fire rated walls shall facilitate ease of future cabling.
   1. Specify “EZ-Path” as manufactured by Specified Technologies, Inc. or approved equal.
   2. Where “EZ-Path” type is not feasible, specify “pillow” or “brick” type.
   3. Size penetrations to allow for installed cables plus 50 percent growth.

2.02 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
   1. Fire Ratings: Use any system that is listed by UL (FRD) and tested in accordance with ASTM E814 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

2.03 MATERIALS

A. Firestopping Sealants: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

B. Intumescent Firestop Sealants
   1. FlameSafe FS 1900 Intumescent Elastomeric Sealant.
   2. 3M Fire Barrier Caulk CP25WB+
   3. A/D Firebarrier Intumescent Caulk.
   4. Hilti USA
   5. Specified Technologies, Inc: www.stifirestop.com.

C. Endothermic Water-Based Sealants
   1. FlameSafe FS 900 Endothermic Sealant
   2. 3M Interam FireDam 150 Caulk
   3. A/D Firebarrier Seal & Seal NS
   4. Hilti USA
   5. Specified Technologies, Inc: www.stifirestop.com.

D. Elastomeric Firestop Coating
   1. FlameSafe FS2900 Intumescent Elastomeric Firestop Coating
   2. 3M FireDam Spray
   3. A/D Firebarrier Spraymastic
   4. Hilti USA
   5. Specified Technologies, Inc: www.stifirestop.com.

E. Intumescent Firestop Putty
   1. FlameSafe FSP 1000 Intumescent Putty
   2. 3M Fire Barrier Moldable Putty+
   3. A/D Firebarrier Putty
   4. Hilti USA
   5. Specified Technologies, Inc: www.stifirestop.com.

F. Firestop Mortar
   1. FlameSafe Mortar Seal
   2. 3M Fire Barrier Mortar
   3. A/D Firebarrier Mortar
   4. Hilti USA
   5. Specified Technologies, Inc: www.stifirestop.com.

G. Firestop Bags
   1. FlameSafe Intumescent Firestop Bags
   2. A/D Firebarrier Pillows
   3. Hilti USA
   4. Specified Technologies, Inc: www.stifirestop.com.

H. Firestop Sleeves
   1. FlameSafe Intumescent Sleeve

2. Hilti USA
3. Specified Technologies, Inc: www.stifirestop.com.

I. Wrap Strips
1. FlameSafe Intumescent Wrap Strip
2. 3M Fire Barrier FS-195+ Wrap/Strip
3. A/D Firebarrier Wrap Strip
4. Hilti USA
5. Specified Technologies, Inc: www.stifirestop.com.

J. Restraining Collars
1. FlameSafe FSRC 100/FSRC 150 Restraining Collars
2. 3M Fire Barrier RC-1 Restraining collar
3. A/D Firebarrier Collars & Collar Strips
4. Hilti USA
5. Specified Technologies, Inc: www.stifirestop.com.

K. Composite Sheet
1. 3M Fire Barrier CS-195+ Composite Sheet
2. Hilti USA
3. Specified Technologies, Inc: www.stifirestop.com.

L. Accessories
1. Forming or Damming Materials as specified by the manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

C. Install labeling required by code.
1. Marking and Identification: Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:
a. Be located in accessible concealed floor, floor-ceiling or attic spaces;
b. Be located within 15 feet of the end of each wall and at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
c. Include lettering not less than 3 inches in height with a minimum 3/8 inch stroke in a contrasting color incorporating the suggested wording. "FIRE AND/OR SMOKE BARRIER-PROTECT ALL OPENINGS" or other wording.

3.04 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

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SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Joint backings and accessories.

1.02 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

D. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2023.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

F. Executed warranty.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least five years of documented experience.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 5-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

C. Extended Correction Period: Correct defective work within 5-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Base Manufacturer: Tremco Global Sealants: www.tremcosealants.com.

B. Other Acceptable Manufacturers:
   1. Master Builders Solutions: www.master-builders-solutions.basf.us/en-us.
   2. Bostik Inc: www.bostik-us.com.
   3. Dow Chemical Company: www.dow.com.

4. Hilti: www.hilti.com.
5. Manus Products, Inc.: www.manus.net.
6. Pecora Corporation: www.pecora.com.
7. Red Devil: www.reddevil.com.
8. Sherwin-Williams Company: www.sherwin-williams.com.
9. Sika Corporation US: www.usa.sika.com.
10. W.R.Meadows: www.wrmeadows.com.
11. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
      a. Joints between door, window, and other frames and adjacent construction.
      b. Other joints indicated below.
      c. Other joints where indicated on the drawings.
   2. Do not seal the following types of joints:
      a. Joints indicated to be treated with manufactured expansion joint cover, or some other type of sealing device.
      b. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
      c. Joints where installation of sealant is specified in another section.
      d. Joints between suspended panel ceilings/grid and walls.

B. Interior Wet Areas: Bathrooms and restrooms; fixtures in wet areas include plumbing fixtures, countertops, and other similar items.

2.03 JOINT SEALANTS - GENERAL

A. Colors: Color shall be selected by the Architect from manufacturer's full range unless specifically indicated to be a specific color.

2.04 NONSAG JOINT SEALANTS

1. Products:
   a. Tremsil 200 manufactured by Tremco Commercial Sealants.
   b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Color: To be selected by Architect from manufacturer's standard range.
   3. Products:
      a. Master Builders Solutions; MasterSeal NP1 or NP2: www.master-builders-solutions.com/en-us/#sle.
      b. Tremco Commercial Sealants & Waterproofing; Dymeric 240 FC or Dymonic FC: www.tremcosealants.com/#sle.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

C. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
   1. Color: To be selected by Architect from manufacturer's full range.
   2. Products:
      a. Tremco Commercial Sealants & Waterproofing; Tremflex 834: www.tremcosealants.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
   1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.

2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type C - Closed Cell Polyethylene.
3. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Provide joint sealant installations complying with ASTM C1193.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

D. Install bond breaker backing tape where backer rod cannot be used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

H. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Protect sealants until cured.

END OF SECTION

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SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Thermally insulated hollow metal doors with frames.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware.

B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.

C. Section 09 91 23 - Interior Painting: Field painting.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2022.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

H. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.

I. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

K. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.

L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

M. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

N. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

O. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2017.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   3. Fleming Door Products, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   4. Mesker, dormakaba Group: www.meskeropeningsgroup.com/#sle.
   5. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
   6. Steelcraft, an Allegion brand: www.allegion.com/#sle.
   7. Technical Glass Products: www.tgpamerica.com/#sle.
   8. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.
   3. All exterior doors shall be closed flush at the top and bottom edges. Install minimum 20 gauge channels (legs down at top of door, legs up at bottom of door) even with the top and bottom edges of door face sheets (no recesses). Seam wire weld continuous or spot weld around entire perimeter of channel. Fill all welds and seams and finish smooth for no visible seams. Provide openings in the bottom closure channel to permit the escape of entrapped moisture.
   4. Door Edge Profile: Manufacturers standard for application indicated.
   5. Typical Door Face Sheets: Flush.
   6. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
   7. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
      a. Based on NAAMM HMMA Custom Guidelines: Provide at least A25/ZF75 (galvannealed) for interior applications, and at least A60/ZF180 (galvannealed) or G60/Z180 (galvanized) for corrosive locations.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Exterior Doors: Thermally insulated.
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 3 - Extra Heavy-duty.
      b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 2 - Seamless. All seams on the vertical edges are continuously welded the full height of the door, filled, and finished smooth for no visible seams.
      d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.

e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.

2. Door Core Material: Polystyrene, 1 lbs/cu ft minimum density.
   a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
3. Door Thickness: 1-3/4 inches, nominal.

B. Interior Doors, Non-Fire-Rated:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 2 - Heavy-duty.
   b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
   c. Model 2 - Seamless. All seams on the vertical edges are continuously welded the full height of the door, filled, and finished smooth for no visible seams.
   d. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.
   e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
2. Door Thickness: 1-3/4 inches, nominal.
3. Non-handed doors are not acceptable.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Exterior Door Frames: Full profile/continuously welded type.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A60/ZF180 coating.
2. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.
3. Frame Finish: Factory primed and field finished.
4. Weatherstripping: Separate, see Section 08 71 00.

C. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
1. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.
2. Frame Finish: Factory zinc coated with field applied finish.

D. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

E. Frames Depth: Size frame depth to accommodate wall assembly thickness and to allow proper attachment to assembly components.

F. Knock-down frames are not acceptable.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Finish: Paint in field. Color as selected/indicated by the Architect.

2.06 ACCESSORIES

A. Glazing: As specified in Section 08 80 00, factory installed.

B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

C. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; Gypsum based grout or plaster grout and thinner pumpable grout are prohibited.

D. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

E. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

F. Fiberglass insulation: Unfaced fiberglass insulation for sound deadening door frames.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

B. Fill frames at exterior doors and doors between heated and unconditioned space with foam-in-place insulation. Product: Great Stuff Pro window and door by Dupont or approved equivalent.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Coordinate frame anchor placement with wall construction.

C. Countersink anchors, fill and make smooth, flush, and invisible on exposed faces.

D. Frames installed in cut openings within existing masonry walls shall be un-grouted. Stuff frame with fiberglass batt insulation for sound deadening.

E. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

F. Frames to be securely anchored to the structural portion of the wall and not the brick veneer.

G. Install door hardware as specified in Section 08 71 00.

3.04 TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.06 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 31 00
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall- and ceiling-mounted access units.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Manufacturer's Installation Instructions: Indicate installation requirements and rough-in dimensions.

PART 2 PRODUCTS

2.01 WALL AND CEILING MOUNTED ACCESS UNITS

A. Basis of Design:
   1. Type AP-1: UF-5000 by ACUDOR; Steel Trim, Steel Flush Face.
   2. Type AP-2: UF-5040 by ACUDOR; Drywall Flange, Steel Flush Face.

B. Manufacturers:
   1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
   2. ACUDOR Products Inc: www.acudor.com/#sle.
   3. Babcock-Davis: www.babcockdavis.com/#sle.
   4. Bilco Co: www.bilco.com.
   5. Cendrex, Inc: www.cendrex.com/#sle.
   6. Dur-Red Products: www.dur-red.com.
   7. Elmdor: www.elmdor.com/#sle.
   8. Karp Associates, Inc: www.karpinc.com.
   9. Nystrom, Inc: www.nystrom.com/#sle.
   10. Substitutions: See Section 01 60 00 - Product Requirements.

C. Wall- and Ceiling-Mounted Units: Factory-fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
   1. Material: Steel.
   2. Style: As indicated by Basis of Design.
   3. Door Style: Single thickness with rolled or turned in edges.
   4. Steel Finish: Primed.
   5. Primed and Factory Finish: Polyester powder coat; color as selected by Architect from manufacturer's standard colors.
   6. Door/Panel Size: As indicated on the drawings.
   7. Hardware:
      a. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
      b. Latch/Lock: Tamperproof tool-operated cam latch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

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SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for hollow metal doors.

B. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. BHMA A156.1 - Standard for Butts and Hinges; 2021.

C. BHMA A156.3 - Exit Devices; 2020.

D. BHMA A156.4 - Door Closers and Pivots; 2024.

E. BHMA A156.5 - Cylinders and Input Devices for Locks; 2020.

F. BHMA A156.13 - Mortise Locks & Latches Series 1000; 2022.

G. BHMA A156.16 - Standard for Auxiliary Hardware; 2023.

H. BHMA A156.18 - Standard for Materials and Finishes; 2020.

I. BHMA A156.28 - Standard for Recommended Practices for Mechanical Keying Systems; 2023.

J. DHI (KSN) - Keying Systems and Nomenclature; 2019.

K. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.

L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

M. ITS (DIR) - Directory of Listed Products; Current Edition.

N. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

O. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

P. UL (DIR) - Online Certifications Directory; Current Edition.

Q. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Keying Requirements Meeting:
   1. Schedule meeting at project site prior to Contractor occupancy.
   2. Attendance Required:
   3. Agenda:
   4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
   5. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
   6. Deliver established keying requirements to manufacturers.

1.05 SUBMITTALS

A. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

B. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.

1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
2. Provide complete description for each door listed.

C. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
2. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
3. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.

D. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
1. Bitting List: List of combinations as furnished with set-up chart to Owner at Project Closeout.

E. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.
3. Keys (Blanks): 3 per door cut as directed by Owner (This is in addition to the 3 cut keys per door required).
4. Interchangeable Cores: Additional 10%.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

C. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) to assist in work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

A. Manufacturer's Warranty: Provide warranty against defects in material and workmanship for period indicated. Complete forms in Owner's name and register with manufacturer.
1. Closers: Five years, minimum.
2. Exit Devices: Three years, minimum.
3. Locksets and Cylinders: Three years, minimum.
4. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Provide door hardware products that comply with the following requirements:
1. Applicable provisions of federal, state, and local codes.
2. Accessibility: ADA Standards and ICC A117.1.
3. Applicable provisions of NFPA 101.
4. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.

5. Hardware for Smoke and Draft Control Doors: Provide door hardware that complies with local codes, and requirements of assemblies tested in accordance with UL 1784.
    a. Air Leakage Rate: Tested in accordance with UL 1784, with air leakage rate not to exceed 3.0 cfm/sf of door opening at 0.10 inch of water for both ambient and elevated temperature tests.

D. Fasteners:
1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
    a. Aluminum fasteners are not permitted.
    b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
2. Fire-Rated Applications: Comply with NFPA 80.
    a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
    b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.02 HINGES

A. Manufacturers:
1. McKinney; an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Bommer Industries, Inc: www.bommer.com/#sle.
3. Hager Companies: www.hagerco.com/#sle.
4. Stanley, dormakaba Group: www.stanleyhardwarefordoors.com/#sle.
5. Ives, an Allegion brand: www.allegion.com/us/#sle.
6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Hinges: Comply with BHMA A156.1, Grade 1.
1. Provide hinges on every swinging door.
2. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
3. Provide ball-bearing hinges at each door.
4. Provide non-removable pins on exterior outswinging doors.
5. Provide non-removable pins on interior outswinging doors at locations where hinge knuckle is to non-secured side.
6. Exterior hinges to be stainless steel with non-removal hinge pins. Pins and fasteners to be stainless steel.
7. Provide following quantity of butt hinges for each door:
    a. Doors From 60 inches High up to 90 inches High: Four hinges.
    b. Doors 90 inches High up to 120 inches High: Four hinges.
    c. Doors over 36 inches Wide: One additional hinge per each additional 12 inches in width.

2.03 EXIT DEVICES

A. Manufacturers:
1. Basis of Design: Grade 1 - Lever Handle as Selected - Mortise Cylinders Lever Lock - Smooth Mechanism Case.
2. Corbin Russwin, Sargent, or Yale; an Assa Abloy Group company: www.assaabloydss.com/#sle.
3. Precision, dormakaba Group: www.precisionhardware.com/#sle.
4. Von Duprin, an Allegion brand: www.allegion.com/us/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Exit Devices: Comply with BHMA A156.3, Grade 1.
1. Lever design to match lockset trim.
2. Provide cylinder with cylinder dogging or locking trim.
3. Provide exit devices properly sized for door width and height.
4. Provide strike as recommended by manufacturer for application indicated.
5. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.

2.04 LOCK CYLINDERS

A. Manufacturers:
   1. Best, dormakaba Group: www.bestaccess.com/#sle.
   2. Falcon.
   3. Sargent.
   4. Schlage.
   5. Yale.

B. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
   1. Provide standard and small format interchangeable core (SFIC) type cylinders, A2 System, Grade 1, with seven-pin core in compliance with BHMA A156.5 at locations indicated.
   2. Provide cylinders from same manufacturer as locking device.
   3. Provide cams and/or tailpieces as required for locking devices.

2.05 MORTISE LOCKS

A. Manufacturers:
   1. Basis of Design: Grade 1 - Lever Handle as Selected..
   2. Corbin Russwin, Sargent, or Yale; an Assa Abloy Group company: www.assaabloydss.com.
   3. Best, dormakaba Group: www.bestaccess.com/#sle.
   4. Hager Companies: www.hagerco.com/#sle.
   5. Schlage, an Allegion brand: www.allegion.com/us/#sle.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Mortise Locks: Comply with BHMA A156.13, Grade 1, Security Grade 2, 1000 Series, mortis locks with "anti-panic" operation (inside lever simultaneously retracts deadbolt and latchbolt).
   1. Latchbolt Throw: 3/4 inch, minimum.
   2. Deadbolt Throw: 1 inch, minimum.
   3. Backset: 2-3/4 inch unless otherwise indicated.
   4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
      a. Finish: To match lock or latch.

C. Certain rooms and buildings are classified as “Secured Storage” and as such may require deadbolt locks. All projects will be reviewed by the Owner’s Security Specialist at the various design submittal phases to identify which doors shall receive deadbolt locks. The following list includes examples of such rooms:
   1. Mechanical Rooms.

2.06 CLOSERS

A. Manufacturers; Surface Mounted:
   1. Basis of Design: Grade 1 - Parallel Arm Push Side Mount - Metal Cover Plate - Sprayed to match.
   2. Corbin Russwin, Norton, Rixson, Sargent, or Yale; an Assa Abloy Group company: www.assaabloydss.com.
   3. Hager Companies: www.hagerco.com/#sle.
   4. LCN, an Allegion brand: www.allegion.com/us/#sle.
   5. Stanley, dormakaba Group: www.stanleyhardwarefordoors.com/#sle.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Closers: Comply with BHMA A156.4, Grade 1.
   1. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.

2.07 KICK PLATES

A. Manufacturers:
   1. Basis of Design: 10 inch high x .05 inch thick, stainless steel.
   2. Hiawatha, Inc, an Activar Construction Products Group company: www.activarcpg.com/hiawatha/#sle.
   3. Ives, an Allegion brand: www.allegion.com/us/#sle.
   4. Trimco: www.trimcohardware.com/#sle.

5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated. Verify any exceptions with Owner.
   1. Size: 8 inch high by 2 inch less door width (LDW) on push side of door.

2.08 WALL STOPS

A. Manufacturers:
   1. Basis of Design: Hiawatha 9211T Concave Style.
   2. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
   1. Type: Bumper, concave, wall stop.
   2. Material: Aluminum housing with rubber insert.

2.09 KEY CONTROL SYSTEMS

A. Keying:
   1. Keyed to Owner's requirements. All keying and coordination shall be by hardware supplier. Coordinate Owner's keying requirements during course of Work. Upon return of reviewed finish hardware schedule, arrange a meeting between the Owner, hardware supplier, Interchangeable Core Manufacturer's Representative (if required) and other involved parties to establish a keying schedule based on Owner's project requirements.

B. Key Control Systems: Comply with guidelines of BHMA A156.28.
   1. Provide keying information in compliance with DHI (KSN) standards.
   2. Keying: Grand master keyed.
   3. Include construction keying and control keying with removable core cylinders.
   4. Key to existing keying system.
   5. Supply keys in following quantities:
      a. 3 each for each door.
      b. 1 each Grand Master keys.
      c. 6 each Construction Master keys.
      d. 15 each Construction keys.
      e. 2 each Construction Control keys.
      f. 2 each Control keys if new system.

2.10 FINISHES

A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
   1. Primary Finish: 626; satin chromium plated over nickel, with brass or bronze base material (former US equivalent US26D); BHMA A156.18.
   2. Secondary Finish: 626; satin chromium plated over nickel, with brass or bronze base material (former US equivalent US26D); BHMA A156.18.
      a. Use secondary finish in kitchens, bathrooms, and other spaces containing chrome or stainless steel finished appliances, fittings, and equipment; provide primary finish on one side of door and secondary finish on other side if necessary.
   3. Exceptions:
      a. Where base material metal is specified to be different, provide finish that is an equivalent appearance in accordance with BHMA A156.18.
      b. Door Closer Covers and Arms at Aluminum Doors: Sprayed to match where not factory finished to match.
      c. Aluminum Surface Trim and Gasket Housings: Anodized to match door panel finish, not other hardware, unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Use templates provided by hardware item manufacturer.

C. Do not install surface mounted items until application of finishes to substrate are fully completed.

D. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
   1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.

3.02 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 01 40 00 - Quality Requirements.

B. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.03 ADJUSTING

A. Adjust work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Adjust hardware for smooth operation.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.04 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation.

C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.05 PROTECTION

A. Protect finished Work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

PART 4 SCHEDULE

4.01 BASIC DOOR HARDWARE AND DOOR OPERATION INTENT HAS BEEN ATTACHED. PROVIDE ANY ADDITIONAL HARDWARE TO MEET APPLICABLE CODES AND TO ACHIEVE OPERATION, FUNCTION, AND INTENT. IF INTENT IS UNCLEAR TO BIDDER, CONTACT THE ARCHITECT REPRESENTATIVE FOR CLARIFICATION. PLEASE NOTE THAT SOME REQUIRED DOOR HARDWARE ITEMS ARE ONLY LISTED ABOVE AND NOT WITHIN THE HARDWARE GROUP.

5.01 HARDWARE GROUP 1

3	Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom Lockset	10XG04 LL	US26D	SA
1	Door Closer	281 P10	EN	SA
1	Wall Stop	400	US26D	RO
3	Silencer	608-RKW		RO

5.02 HARDWARE GROUP 2

A. Hinges

B. Rim Exit Device

C. No Exterior Hardware - Exit Only, Secure

D. Closer

E. Gasketing

F. Drip

G. Threshold

H. Sweep

5.03 HARDWARE GROUP 1 (DOUBLE DOOR)

A.	8	Hinges	T4A3786 5" x 4-1/2"	US26D	MK
B.	1	Automatic Flush Bolt	2848	US26D	
C.					

5.04 HARDWARE GROUP 1 (DOUBLE DOOR)

A. Hinges
B. Cylindrical Lockset - Active Leaf - Classroom Function
C. Automatic Flush Bolts - Inactive Leaf
D. Closers - With Hold Open
E. Coordinator
F. Astragal
G. Wall Stops
H. Gasketing
I. Intumescent Seals
J. Fire Rating Labels

END OF SECTION

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SECTION 08 80 00
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Laminated glass interlayers.

D. Glazing compounds.

1.02 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).

C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).

D. ASTM C1036 - Standard Specification for Flat Glass; 2021.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

F. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

H. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.

I. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.

J. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.

K. GANA (SM) - GANA Sealant Manual; 2008.

L. ITS (DIR) - Directory of Listed Products; Current Edition.

M. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2023.

N. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2023.

O. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2023.

P. UL (DIR) - Online Certifications Directory; Current Edition.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

C. Verification Samples: Submit two samples 12 by 12 inch in size of glass units.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years documented experience.

1.05 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Float Glass Manufacturers:
   1. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
   2. Guardian Glass, LLC: www.guardianglass.com/#sle.
   3. Pilkington North America Inc: www.pilkington.com/na/#sle.
   4. Vitro Architectural Glass (formerly PPG Glass); _____: www.vitroglazings.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   3. Glass thicknesses listed are minimum.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
   1. In conjunction with weather barrier related materials described in other sections, as follows:

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
   2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
   3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
   4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.
   2. Polyvinyl Butyral (PVB) Interlayer: 0.030 inch thick, minimum.

2.04 INSULATING GLASS UNITS

A. Basis of Design: Products listed by Viracon are considered the "basis of design" and not considered proprietary. Submit two 12 inch by 12 inch samples of insulated glass units to Architect for acceptance for all other products.

B. Do not provide coatings on tinted glass that change the appearance from the intended color. Alternate combination of tinted glass and coatings will be considered and will only be approved based on actual sample.

C. Manufacturers:
   1. Glass: Any of the manufacturers specified for float glass.

2. AGC Glass North America, Inc: www.agcglass.com/#sle.
3. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
4. Guardian Glass, LLC: www.guardianglass.com/#sle.
5. Pilkington North America Inc: www.pilkington.com/na/#sle.
6. Viracon, Apogee Enterprises, Inc: www.viracon.com/#sle.
7. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
8. Oldcastle Building Envelope: www.obe.com/#sle.
9. Substitutions: Refer to Section 01 60 00 - Product Requirements.

D. Insulating Glass Units: Types as indicated.
1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
3. Spacer Color: Aluminum.
4. Edge Seal:
   a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
5. Color: Black.
6. Purge interpane space with dry air, hermetically sealed.

E. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.
1. Applications: Exterior glazing unless otherwise indicated.
2. Space between lites filled with argon.
3. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.
   b. Coating: Low-E (passive type), on #2 surface.
4. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.
5. Total Thickness: 1 inch.
6. Performance Values: Based on Viracon's VE1-2M. (Clear).

F. Type IG-2 - Insulating Glass Units: Safety glazing.
1. Applications:
   a. Glazed lites in exterior doors.
   b. Glazed sidelights and panels next to doors.
   c. Other locations required by applicable federal, state, and local codes and regulations.
   d. Other locations indicated on drawings.
2. Space between lites filled with argon.
3. Glass Type: Same as other vision glazing except use fully tempered float glass for both outboard and inboard lites.
4. Total Thickness: 1 inch.

2.05 GLAZING UNITS

A. Type G-1 - Monolithic Interior Vision Glazing:
1. Applications: Interior glazing unless otherwise indicated.
2. Glass Type: Annealed float glass.
3. Tint: Clear.
4. Thickness: 1/4 inch, nominal.

B. Type G-2 - Monolithic Safety Glazing: Non-fire-rated.
1. Applications:
   a. Glazed lites in doors, except fire doors.
   b. Glazed sidelights to doors, except in fire-rated walls and partitions.
   c. Other locations required by applicable federal, state, and local codes and regulations.
   d. Other locations indicated on drawings.
2. Glass Type: Fully tempered safety glass as specified.
3. Tint: Clear.
4. Thickness: 1/4 inch, nominal.

2.06 GLAZING COMPOUNDS

A. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.07 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

B. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

C. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color as selected.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.06 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Acoustic insulation.

C. Gypsum wallboard.

D. Joint treatment and accessories.

E. Prefabricated Wood Blocking System.

F. Drywall Grid Suspension System.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).

B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.

C. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.

D. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.

E. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

F. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

G. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

I. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

J. ASTM E413 - Classification for Rating Sound Insulation; 2022.

K. GA-214 - Levels of Finish for Gypsum Panel Products; 2021.

L. GA-216 - Application and Finishing of Gypsum Panel Products; 2021.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate the location of all expansion joints in plan and elevation view. Include details at intersections of walls, floors, ceilings, and other construction.

C. Product Data:
   1. Provide data on metal framing, gypsum board, accessories, and joint finishing system.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:

1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
2. Walls indicated to received sound insulation that are not indicated to meet an STC rating are not intended to be constructed as an acoustic assembly.

2.02 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum Company: www.americangypsum.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/#sle.
   3. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
   4. Gold Bond Building Products, LLC provided by National Gypsum Company: www.goldbondbuilding.com/#sle.
   5. PABCO Gypsum: www.pabcogypsum.com/#sle.
   6. USG Corporation: www.usg.com/#sle.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL, or WH listed.
   3. Thickness:
      a. Vertical Surfaces: 5/8 inch.
      b. Ceilings: 5/8 inch.

2.03 GYPSUM BOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 3 or more inches as required to fill wall depth.
   1. ASTM E84 surface burning characteristics: Flame Spread Index 25 or less; Smoke Developed Index 450 or less.

B. Sheet Vapor Retarder: Clear polyethylene film for above grade application, 6 mil thick.

C. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5), galvanized steel sheet ASTM A924/A924M G90, rolled zinc, or rigid plastic, unless noted otherwise.
   1. Types: As detailed or required for finished appearance.
      a. Products for specific applications:
         1) Expansion Joints (V-Groove Joint): Trim-Tex #093V Expansion joint or approved equal shall be used at expansion joints in flat wall or ceiling applications.
         2) Angled Joints: Trim-Tex Magic Corner or approved equal shall be used at angular walls and ceilings.
         3) Wall Termination: Trim-Tex Tear Away XT Extra Tall Masking or approved equal shall be used at all locations where new construction terminates into existing construction or non-gypsum construction.
   2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
   3. Products:
      a. Same manufacturer as framing materials.
      b. Fry Reglet Corporation: www.fryreglet.com/#sle.
      c. Phillips Manufacturing Co: www.phillipsmfg.com/#sle.
      d. Trim-tex, Inc: www.trim-tex.com/#sle.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
   2. Joint Compound: Drying type, vinyl-based, ready or field-mixed.
   3. Joint Compound (Optional): Setting type, field-mixed.

E. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws,

corrosion-resistant.

F. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

G. Prefabricated Blocking Systems: DANBACK 3/4 inch standard/treated plywood or approved equal: www.danback.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Drywall Grid Suspension System Ceilings: Install suspension system in accordance with manufacturers instructions.

B. Blocking: Install wood blocking for support of:
   1. Wall-mounted cabinets.
   2. Plumbing fixtures.
   3. Toilet partitions.
   4. Toilet accessories.
   5. Wall-mounted door hardware.
   6. All other items indicated on the drawings and in the specifications.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Provide solid continuous shims under first layer of gypsum board as necessary to minimize variations in plane. Tolerance of surface shall be as indicated.

C. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
   1. Exception: Tapered edges to receive joint treatment at right angles to framing.

D. Installation on framing: Use screws for attachment of boards.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as follows:
   1. Not more than 30 feet apart on walls, soffits, and ceilings in any direction.
   2. At intersections of soffits and intersecting walls.
   3. At intersection of half height wall and intersecting walls.
   4. At locations indicated on the drawings.
   5. Other locations where cracking may occur due to changes in height and structure.
   6. All jointing locations shall be indicated on shop drawings.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying or setting joint compound and finish with drying or setting joint compound.

B. Finish gypsum board in accordance with levels defined in ASTM C 840 (additional reference guideline; GA-214 - Recommended Levels of Gypsum Board Finish), as follows:

1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas including the following: (Level 5 shall be a thin skim coat of joint compound trowel applied; no spray or roller applied products will be accepted.)
    a. Walls that are perpendicular to large glazed openings where glazed openings are 50% or more of the area of the wall, within the room, in which they are located.
    b. Tall wall 16'-0" and taller.
    c. Long walls and ceilings 30'-0" and longer.
    d. Large wall and ceilings area of 500 square feet and larger.
    e. Walls with glass-mat-faced wallboard products.
    f. Walls, ceilings, and areas specifically indicated on the drawings.
2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
    a. No visible defects should be apparent under normal lighting conditions. Provide Level 5 finish where defects become apparent at no additional cost to the Owner.
    b. Contractors that cannot guarantee their Level 4 finish will be free of visible defects under normal lighting conditions should provide a Level 5 finish.
    c. If the Architect or Owner is unsatisfied with a Level 4 finish due to visible defects under normal lighting conditions then a Level 5 finish shall be installed at no additional cost to the Owner. No exceptions.
3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
4. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.

C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
    1. Feather coats of joint compound so that camber is maximum 1/32 inch.
    2. Tapered edges of gypsum board that are not located at taped and filled joints shall also be filled and sanded smooth to match the plane of the wall.

3.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.

C. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and changes in elevation. Detail each type of junction and elevation change at no less than 1-1/2 inch per 12 inches annotating all related materials.

C. Product Data: Provide data on suspension system components and acoustical units.

D. Samples: Submit two samples 4 by 4 inch in size illustrating material and finish of acoustical units.

E. Samples: Submit two samples each, 6 inches long, of suspension system main runner, cross runner, and perimeter molding.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: Full size units equal to 2% of amount installed or two unopened carton of tile, whichever is greater, for each type of tile specified.

1.05 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

1.06 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

A. Manufacturers:
   1. Armstrong World Industries, Inc; www.armstrongceilings.com/#sle.
   2. CertainTeed Corporation; www.certainteed.com/ceilings-and-walls/#sle.
   3. USG Corporation; www.usg.com/ceilings/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Acoustical Panels: Painted mineral fiber, with the following characteristics:

1. Classification: ASTM E1264 Type III.
    a. Pattern: C, E.
2. Size: 24 by 48 inches.
3. Thickness: 5/8 inch.
4. Panel Edge: Square.
5. Tile Edge: Angled Tegular.
6. Color: White.
7. Suspension System: Exposed grid.
8. Products:
    a. Armstrong World Industries, Inc; Dune 1776: www.armstrongceilings.com/#sle.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Acoustical Panels: Mineral fiber with membrane-faced overlay, with the following characteristics:
1. Classification: ASTM E1264 Type IV.
    a. Pattern: "E" - lightly textured.
2. Size: 24 by 48 inches.
3. Thickness: 5/8 inch.
4. Panel Edge: Square.
5. Suspension System: Exposed grid.
6. Products:
    a. Armstrong World Industries, Inc; Clean Room VL 870: www.armstrongceilings.com/#sle.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SUSPENSION SYSTEM(S)

A. Manufacturers:
1. Same as for acoustical units.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

C. Exposed Suspension System: Hot-dipped galvanized steel grid with aluminum cap.
1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
2. Profile: Tee; 15/16 inch face width.
3. Finish: Baked enamel.
4. Products:
    a. Armstrong World Industries, Inc; Prelude XL 15/16: www.armstrongceilings.com/#sle.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

C. Perimeter Moldings: Same metal and finish as grid.
1. At Non-concealed Grid and Elevation Changes in Grid: Provide extruded aluminum pieces by same manufacturer as grid in height and profile indicated.
    a. Manufactured by same grid manufacturer.
    b. Edge height: As indicated.
2. At Concealed Grid: Provide exposed L-shaped molding.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C 636/C 636M and ASTM C 636/C 636M and as supplemented in this section.

B. Tile to be installed after all other work has been completed above the grid system and inspected by A/E or their representative. Border tile requiring cutting may be installed as long as it permits observation of all work above the ceiling.

C. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

D. Locate system on room axis according to reflected plan.

E. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.

F. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

G. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

H. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

I. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

J. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

K. Do not eccentrically load system or induce rotation of runners.

L. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Lay directional patterned units with pattern parallel to longest room axis.

D. Fit border trim neatly against abutting surfaces.

E. Install units after above-ceiling work is complete.

F. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

G. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.

H. Install hold-down clips on panels within 20 ft of an exterior door.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

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SECTION 09 91 23
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Exposed surfaces of primed and unprimed metal items in finished areas unless specifically indicated to not be painted.
   3. Mechanical and Electrical:
      a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, electrical equipment, and pipes, unless otherwise indicated.
      b. In finished areas, paint shop-primed items.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Floors, unless specifically indicated.
   6. Glass.
   7. Concealed pipes, ducts, and conduits.

1.02 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

D. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
   2. MPI product number (e.g., MPI #47).
   3. Cross-reference to specified paint system products to be used in project; include description of each system.
   4. Manufacturer's installation instructions.
   5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
3. Allow 15 days for approval process, after receipt of complete samples by Architect.
4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as factory finished items, have been approved.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Extra Paint and Finish Materials: 1 gallon of each color, type, and surface texture; store where directed.
3. Label each container with color, type, texture, and room locations in addition to the manufacturer's label.
4. Provide inventory list of extra materials provided.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years documented experience.

1.06 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.

B. Contractor shall provide mock-up on site of each specified interior wall/door/trim color for Owner acceptance.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Provide lighting level of 80 fc measured mid-height at substrate surface.

D. Painting equipment is to be cleaned in Contractor furnished receptacles with waste being properly disposed. The waste is not to be poured down the sanitary sewer, storm sewer or poured out on the ground. Any costs incurred by Owner for cleanup will be charged to the Contractor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
1. If a single manufacturer cannot provide specified products; minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.

B. Paints:
1. Base Manufacturer: Sherwin Williams: www.sherwin-williams.com.
2. Other Manufacturers: Approved products shall meet performance and physical characteristics of base manufacturer (basis of design) product including published ratio of solids by volume, plus or minus two percent.

C. Other Acceptable Manufacturers: Submit product information for each line of paint for Architect's approval. Substitutions of Base Manufacturer's products may not be accepted during the shop drawing process.
1. Behr Paint Company: www.behr.com/#sle.
2. Benjamin Moore & Co: www.benjaminmoore.com.

3. Carboline: www.carboline.com.
4. Diamond Vogel Paints: www.diamondvogel.com/#sle.
5. Hallman Lindsay Paint of Wisconsin: www.hallmanlindsay.com.
6. IdeaPaint: www.ideapaint.com.
7. ICP Group: www.icpgroup.com.
8. PPG Paints: www.ppgpaints.com/#sle.
9. Pratt & Lambert Paints: www.prattandlambert.com/#sle.
10. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
11. Tnemec: www.tnemec.com.
12. Valspar Corporation: www.valsparpaint.com/#sle.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
      a. Spayed finish; is preferred on all metal surfaces; is required on the following surfaces:
         1) Metal doors and frames; prior to hardware installation.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. Provide commercial grade paint systems by approved paint manufacturer for substrates not specifically covered under paint systems.
      a. Consult with Architect/Engineer/Designer for approval of additional products and systems. Provide quantifiable product information.
   4. Supply each paint material in quantity required to complete entire project's work from a single production run.
   5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content:
   1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

D. Sheens: Paint finishes shall be semi-gloss. Flat finish may be used on ceilings only. Verify any other exceptions with Owner.

E. Colors: As indicated on drawings.
   1. Where indicated or scheduled colors do not match the paint product lines indicated below it is anticipated that colors will be color matched; product lines below are intended to set a level of standard for the product lines used for each application.
   2. Locations Not Indicated: Selection to be made by Architect after award of contract.
   3. Extend colors to surface edges; colors may change at any edge as directed by Architect.
   4. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

F. Coats: The number of coats specified, are based on manufacturer’s recommendations. Provide for additional coats, as necessary, for complete coverage and true color. Additional coats due to a lack of coverage shall be provided at no additional cost to the Owner. No exceptions.

G. Coverage: Do not stretch products beyond their recommended coverage rate nor install fewer coats than specified regardless of appearance after previous coats are applied. Thin product application may show surface imperfections or inconsistencies that would otherwise not be visible. Additional coats due to a lack of proper coverage shall be provided at no additional cost to the Owner. No exceptions.

2.03 PAINT SYSTEMS - INTERIOR

A. Paint Product: **Pro Industrial Pre-Catalyzed Waterbased Epoxy (Single-Component)**
   1. Primer: Prime and/or touch up as per Manufacturers recommended Specifications in accordance with specified Product.
   2. Number of Paint Coats Over Primer: Two.
   3. Types of Substrates:
      a. Masonry.
      b. Drywall.
   4. Sheen: As scheduled on the drawings.
   5. Location Types:
      a. Walls and Ceilings in Restrooms as noted.

B. Paint Product: **ProMar 400 Zero VOC Interior Latex**
   1. Primer: Two coat primer sealer in all locations; primer shall be installed under paint products even if product is considered self-priming.
   2. Number of Paint Coats Over Primer: Two.
   3. Types of Substrates:
      a. Drywall.
   4. Sheen: As scheduled on the drawings.
   5. Locations Types:
      a. Ceilings unless noted otherwise.
      b. Soffits unless noted otherwise.
      c. Bulkheads unless noted otherwise.

C. Paint Product: **ProClassic Waterborne Interior Acrylic Enamel**
   1. Primer: Two coat primer sealer in all locations; primer shall be installed under paint products even if product is considered self-priming.
   2. Number of Paint Coats Over Primer: Two.
   3. Types of Substrates:
      a. Masonry.
   4. Sheen: As scheduled on the drawings.
   5. Locations Types:
      a. Walls unless noted otherwise.

D. Paint Product: **Pro Industrial Water Based Alkyd Urethane**
   1. Primer: Pro Industrial Pro-Cryl Primer.
   2. Number of Paint Coats Over Primer: Two.
   3. Types of Substrates:
      a. Galvanized Steel.
      b. Steel.
   4. Sheen: As scheduled on the drawings.
   5. Location Types:
      a. Galvanized Steel.
      b. Hollow metal doors and frames.
      c. Window frames.
      d. Handrails.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
   1. Masonry, Concrete, and Concrete Masonry Units: 12 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. All existing misc. anchoring components (nails, screws, expansion anchors, hangers, etc., shall be removed by Contractor from existing exposed surfaces. All existing or new holes, voids, cracks or otherwise damaged wall surfaces shall be patched and repaired to match existing surfaces prior to application of new finishes.

D. Remove or mask and/or protect all surfaces, appurtenances not affiliated with coating process, including but not limited to electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

E. All data cabling (including concealed or above ceilings) shall be protected from drywall mud or paint overspray or installed after drywall finishing and painting is completed. Paint or drywall mud on data cabling voids the cable manufacturer's warranty. Any data cabling with paint or drywall mud on them shall be replaced by the contractor at no additional cost to the Owner.

F. Seal surfaces that might cause bleed through or staining of topcoat.

G. Masonry:
   1. CMU intended to receive paint finish shall have two coats of block filler. Each coat to be sprayed on and back-rolled.
   2. Fill minor defects with filler compound; review masonry sections to determine the level of preparation required by painter prior to painting. The combination of masonry finish work and painter preparation work shall result in finish that is acceptable to the Owner / Architect. Review substrates and finish a reasonably sized area for Owner / Architect review and approval prior to completing the full scope of the work of painting masonry.

H. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

E. Painting shall be free from paint runs; no exceptions.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 10 21 13.19
PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid plastic toilet compartments.

B. Urinal screens.

1.02 REFERENCE STANDARDS

A. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall and floor supports, door swings.

D. Samples: Submit two samples of partition panels, 4 by 4 inch in size illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special procedures.

1.04 WARRANTIES

A. Provide manufacturer’s 25 year warranty against breakage, corrosion, and delamination under normal conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Scranton Products, Hiny Hiders: www.scrantonproducts.com.

B. Solid Plastic Toilet Compartments:
   1. All American Metal Corp - AAMCO: www.allamericanmetal.com/#sle.
   2. ASI Accurate Partitions: www.asi-accuratepartitions.com/#sle.
   3. ASI Global Partitions: www.asi-globalpartitions.com/#sle.
   4. Hadrian: www.hadrian-inc.com/#sle.
   5. General Partitions Mfg. Corp: www.generalpartitions.com.
   6. Inpro: www.inprocorp.com/#sle.
   7. Metpar Corp: www.metpar.com/#sle.
   8. Partition Systems International of South Carolina: www.psisc.com/#sle.
   9. Scranton Products: www.scrantonproducts.com/#sle.
   10. Substitutions: Not permitted.

2.02 PLASTIC TOILET COMPARTMENTS

A. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286; floor-mounted headrail-braced.
   1. Color: Single color as selected from the manufacturers full range of colors, available color options shall be equivalent to those provided by manufacturer indicated as Basis of Design.

B. Doors:
   1. Thickness: 1 inch.
   2. Width: 24 inch.
   3. Width for Ambulatory Use: 32 inch, out-swinging and self-closing.
   4. Width for Handicapped Use: 36 inch, out-swinging.
   5. Height: 55 inch.

C. Panels:
   1. Thickness: 1 inch.
   2. Height: 55 inch.

D. Pilasters:
   1. Thickness: 1 inch.
   2. Width: As required to fit space; minimum 3 inch.

E. Screens: Without doors; to match compartments; mounted to wall with two panel brackets.

F. Urinal Screens: Wall mounted with continuous satin stainless steel or aluminum angle brackets each side; through bolt with tamper proof type fasteners.

2.03 ACCESSORIES

A. Pilaster Shoes: Stainless steel, satin finish, 3 inches high; concealing floor fastenings.

B. Head Rails: Extruded aluminum, anti-grip profile.
   1. In addition to above partition doors and pilasters provide head rails above partition end walls and any open perimeter edge of the partitions.

C. Wall and Pilaster Brackets: Satin stainless steel or aluminum; continuous type.

D. Strikes: Continuous type, aluminum.

E. Latches: Aluminum or stainless steel.

F. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.
   2. Attach all components to solid blocking or structural substrate.

G. Hardware: Satin stainless steel:
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
      a. Wrap-Around Hinges: 8 inches and fabricated from heavy-duty extruded aluminum. Hinges are through-bolted to pilasters and doors with stainless steel tamper resistant Torx head sex bolts. Hinges operate with field adjustable nylon cams. Cams can be field set in 30, 60 or 90 degree increments.
   2. Door Latch: Slide type .
   3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   4. Coat hook with rubber bumper; one per compartment, mounted on door.
   5. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions rigid, straight, plumb, and level manor, with plastic laid out as shown on shop drawings and manufacturer’s installation instructions.

B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

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SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Commercial shower and bath accessories.

C. Electric hand/hair dryers.

D. Utility room accessories.

1.02 REFERENCE STANDARDS

A. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2017 (Reapproved 2022).

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Products listed are made by Bobrick: www.bobrick.com.

B. Commercial Toilet, Shower, and Bath Accessories:
   1. AJW Architectural Products: www.ajw.com.
   2. ASI - American Specialties, Inc: www.americanspecialties.com.
   3. Bradley Corporation: www.bradleycorp.com.
   4. Bobrick Washroom Equipment, Inc: www.bobrick.com.
   5. Gamco USA: www.gamcousa.com.
   6. Basco Incorporated: www.bascoinc.com.
   7. Substitutions: Section 01 60 00 - Product Requirements.

C. Provide products of each category type by single manufacturer.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.

2.04 COMMERCIAL TOILET ACCESSORIES

A. Provided by Owner and Installed by Contractor:
   1. Soap Dispenser.
   2. And as scheduled on the drawings.

B. Toilet Paper Dispenser: Double roll, surface mounted bracket type, satin finished cast aluminum brackets, eccentric-shaped plastic spindle for 1/2 revolution delivery designed to prevent theft of tissue roll.
   1. Products:
      a. American Specialties, Inc; 264-1A: www.americanspecialties.com/#sle.
      b. Substitutions: Section 01 60 00 - Product Requirements.

C. Grab Bars: Stainless steel, peened surface.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force, minimum.

b. Length and Configuration: As indicated on drawings.
c. Products:
1) American Specialties, Inc; 3400: www.americanspecialties.com/#sle.
2) Substitutions: Section 01 60 00 - Product Requirements.

D. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking panel with full-length stainless steel piano-type hinge, removable receptacle.
1. Products:
a. American Specialties, Inc; 852-SH: www.americanspecialties.com/#sle.
b. Substitutions: Section 01 60 00 - Product Requirements.

2.05 ELECTRIC HAND/HAIR DRYERS

A. Electric Hand Dryers: Traditional fan-in-case type, with downward fixed nozzle.
1. Operation: Automatic, sensor-operated on and off.
2. Mounting: Wall-mounted - surface.
3. Cover: Stainless steel with brushed finish.
a. Tamper-resistant screw attachment of cover to mounting plate.
4. Air Velocity: 19,800 linear feet per minute, minimum, at full power.
5. Heater: 950 w, minimum, at full power.
6. Fan/Heater Control: Field adjustable down to approximately half-speed with corresponding reduction in heat output.
7. Total Wattage: 950 w, maximum.
8. Runtime: Field adjustable or automatic, up to 35 seconds.
9. Air sanitizing and deodorizing without use of chemicals.
10. Accessories:
a. Top-entry surface-mounted conduit.
b. Filter: 93-10496.
11. Electric Hand Dryer Products:
a. World Dryer Corporation; VERDEdri Q-973A2: www.worlddryer.com/#sle.
b. Substitutions: Section 01 60 00 - Product Requirements.

2.06 UTILITY ROOM ACCESSORIES

A. Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, hat-shaped channel.
1. Holders: Three spring-loaded rubber cam holders, and two rag hook holders.
2. Length: Manufacturer's standard length for number of holders.
3. Products:
a. American Specialties, Inc; 1315: www.americanspecialties.com/#sle.

2.07 OTHER MISCELLANEOUS ROOM ACCESSORIES

A. Door Mounted Coat Hook:
1. Product: B-6717 manufactured by Bobrick.
2. Location: Provide one hook at single use restroom doors.
3. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

D. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

3.03 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

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SECTION 12 36 00
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall-hung counters and vanity tops.

1.02 REFERENCE STANDARDS

A. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

B. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
   1. Indicate layout of countertop supports brackets at all locations. Include attachment details to walls and counters. Final bracket layout shall be subject to Architect approval.
   2. For bracket layout unsupported spans of countertops shall not exceed 48 inches. Wall hung or cantilever spans shall resist a 50 lbs per square foot load and not deflect in excess of 1/4 inch in any span or portion thereof.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.05 FIELD 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 manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting self-supporting over structural members.
   1. Flat Sheet Thickness: 3/4 inch, minimum.
   2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
      a. Manufacturers:
         1) Avonite Surfaces: www.avonitesurfaces.com.
         2) Dupont: www.corian.com.
         3) Formica Corporation: www.formica.com.
         4) LG Hausys America, Inc: www.lghausysusa.com/#sle.
         5) Wilsonart: www.wilsonart.com.
         6) InPro Corporation: www.inprocorp.com.
         7) Staron Surfaces: www.staron.com.
         8) Maxstone International, LLC: www.maxstoneusa.com.
         9) Substitutions: See Section 01 60 00 - Product Requirements.

b. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
c. Color and Pattern: To be selected from manufacturer's full line.

3. Other Components Thickness: 1/2 inch, minimum.
4. Exposed Edge Treatment: Built up to minimum 1-1/2 inch thick; as scheduled on the drawings.
5. Back and End Splashes: Same sheet material, radiused top; minimum 4 inches high.

2.02 MATERIALS

A. Counter Support Brackets:
1. Counter support brackets unless noted otherwise shall be 1/8” steel, reversible brackets as manufactured by A&M Hardware, Inc., 2705 Mt. Joy Rd, Manheim, PA 17545. 888-647-0200, Fax 717-664-4582. www.aandmhardware.com.
2. Sizes shall be selected from the manufacturer's standards:
a. 24”x29” (Paint/Primer Finish Only)
b. 24”x24” (Paint/Primer Finish Only)
c. 18”x24” (Available in S.S.)
d. 15”x21” (Available in S.S.)
e. 12”x18” (Paint/Primer Finish Only)
f. 8”x12” (Available in S.S.)
g. 5"x8" (Paint/Primer Finish Only)
3. Brackets finish shall be standard texture powder coat in black, white, gray or almond.
a. To be selected by Architect.
4. Provide 8" Black Oak Park Bracket by Knape & Vogt Mfg Co Model 200OP BLK 8 at all locations indicted on the drawings.
5. Support counters at each end and in the center at a minimum; counter fabricated to determine final bracket quantity, spacing, and locations.
6. Other equivalent brackets are acceptable.

B. Concealed Counter Support Brackets:
1. Counter Support Brackets: Provide Concealed Brackets by A&M Hardware, Inc., 2705 Mt. Joy Rd, Manheim, PA 17545. 888-647-0200, Fax 717-664-4582: www.aandmhardware.com or equivalent.
2. Federal Brace: www.federalbrace.com or equivalent.
3. Bracket Length: Provide maximum allowed length at each location; brackets shall include upper extension at all location where wall extends above counter.
4. Bracket finish shall be standard texture powder coat in black, white, gray or almond.
5. Attachment Hardware: Manufacturers standard.
6. Other equivalent brackets are acceptable.

C. Counter Support Brackets with Skirt/Apron Support:
1. ADA Vanity Bracket by A&M Hardware, Inc, or equivalent.
2. Stone Pro ADA Compliant Countertop Support #3743 by Braxton-Bragg, Rakks EHV-Vanity Supports, or equivalent.
3. Federal Brace: www.federalbrace.com or equivalent.
a. Other equivalent brackets are acceptable.
4. Fasteners: Provide Flat head 1/4" - 20 thread with 4 mm hex drive connector bolts in chrome, black, or oil rubbed bronze. Color as selected by Architect.

D. Counter Support Brackets; Flat Brackets:
1. Centerline Brackets: Countertop Island Support Brackets.
2. Speed Brace Stealth & Stealth HD; and Panel Clips.

E. Steel Support Posts: Manufacturer's standard with factory finish and flush fasteners at base flange. Color and sheen as selected by the Architect from manufacturer's full range of factory applied finishes.

F. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

G. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.03 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.

1. Join lengths of tops using best method recommended by manufacturer.
2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
2. Height: 4 inches, unless otherwise indicated.

C. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings and as recommended by countertop manufacturer. Manufacturer to indicate sizing installation locations material thickness and prefinished color options. Color to be selected by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach wood countertops using screws with minimum penetration into substrate board of 5/8 inch.

C. Seal the exposed front underside edge of plastic laminate countertops with clear solvent based polyurethane at all locations; or wrap with plastic laminate back to face of casework below.

D. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 22 00 10
BASIC MECHANICAL PLUMBING REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Basic Mechanical Plumbing Requirements specifically applicable to Division 22 in addition to Division 1 - General Requirements.

1.02 SCOPE OF WORK

A. The Mechanical Plumbing Contract shall also include furnishing and installing a complete plumbing system for the building remodel/addition and all other related work as called for under the specifications and shown on plans.

1.03 WORK INCLUDED

A. The Mechanical Plumbing Contract shall include all work under the listed Division 22 of the Specifications Index and all related Mechanical work as shown on the Drawings for the project.

B. A Complete table of Mechanical Reference Symbols is shown on the plans.

C. Under this Contract the Mechanical Contractor shall furnish the Owner with two 3-ring binders of all pertinent systems related documents. Submit manuals to the Engineer for his review. The Engineer will then turn books over to the Owner. The books shall contain the following items:
   1. Shop drawings on all major equipment.
   2. Operating Instructions for all major equipment.
   3. Maintenance Instructions for all major equipment.
   4. Wiring diagrams for all equipment.
   5. Test and Balance Reports.

D. The Mechanical Contractor is responsible for contacting the utility companies and coordinating the water, sewer and natural gas connections for the building service. Include all costs in bid.

E. The Mechanical installation to be made under Divisions 22 is set up for contract bidding as follows:
   1. Mechanical Plumbing Contractor is a sub-contractor to the General Contractor.
      a. The Mechanical contractor is responsible for own equipment, such as cranes, lifts, etc. in order to provide a complete installation of mechanical systems.
      b. The Mechanical contractor shall be a sub-contractor to the General Contractor and shall include in his bid, prices from sub-contractors for control wiring, and other trades necessary to complete the entire job.

1.04 SPECIFICATIONS COMPLIANCE

A. The requirements of these specifications shall be complied with in every respect. Therefore, it shall be absolutely mandatory that the job foreman, all lead mechanics, subcontractors and their foreman have completely studied these specifications, be completely knowledgeable as to their entire contents, and maintain a copy at the job-site. Failure to comply with this requirement will be reason to presume the mechanic or subcontractor is not in responsible charge of his work due to ignorance of job requirements, and will be reason for the owner to require dismissal and replacement with approved personnel. Every foreman and lead mechanic shall be provided with a complete copy of this specification.

1.05 INCONSISTENCIES

A. If there is an inconsistency in the quality and/or quantity of Work required by the Contract Documents, either the greater quality and/or quantity of Work indicated shall be provided in accordance with the Engineer/Architect's interpretation without change in the contract sum.

1.06 WORK NOT INCLUDED

A. The following work is not included as part of the Contract.
   1. The removal and storage of any equipment in the building required to be moved or relocated during the construction process.

1.07 CODES, FEES AND LATERAL COSTS

A. The Plumbing Installation shall meet all applicable local, state and federal codes and standards.

B. All permits necessary for a complete plumbing installation shall be paid for by this Contractor.

C. This contractor shall contact the local utilities for gas, water, sanitary and storm sewers, and include in their bid the any costs associated with service installation charges of the utility(s).

D. Except in those municipalities which provide state- approved electrical inspection, all installation of electrical equipment wiring shall be inspected by the State Board of Electricity. Allowance shall be made in the bid and contract for the cost of such inspection.

1. Fees for such inspection will be charged in accordance with the rules and regulations of the State Board of Electricity. Evidence of payment of fees shall be provided by the Contractor with his Request for Payment.

1.08 REFERENCES

A. All equipment, piping, etc., shall be new and shall be installed to meet the approval of the following additional ordinances: ASME Rules for Pressure Tanks, National Board of Fire Underwriter's Rules, American Waterworks and the American Gas Association.

1.09 SUBMITTALS

A. Submit under provisions of Division 01 3000.

B. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal.

C. All documents shall be submitted in .pdf format unless pre-approved by Engineer.

D. The contractor shall not use any equipment or materials that does not have the engineer’s stamped approval.

E. Mark dimensions and values in units to match those specified.

1.10 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

1.11 SEQUENCING AND SCHEDULING

A. Construct Work in sequence under provisions of Division 1.

1.12 PRE-CONSTRUCTION COORDINATION AND VERIFICATION

A. This Contractor shall coordinate his work with other Contractors on this job. Any conflict which cannot be resolved shall be settled by the Architect/Engineer.

B. Field verification of scale dimensions on plans is directed since actual locations, distances and levels will be governed by actual field conditions.

C. The Contractors shall check architectural, structural, plumbing, heating, ventilating and electrical plans to avert possible installation conflicts. Should drastic changes from original plans be necessary to resolve such conflicts this Contractor shall notify the Architect/Engineer and secure written approval and agreement on necessary adjustments before the installation is started.

D. Discrepancies shown on different plans or between plans and actual field conditions or between plans and specifications shall promptly be brought to the attention of the Architect/Engineer for a decision.

E. The Contractor shall consider and review the complete set of documents, etc., Architectural, Structural, Mechanical, Electrical, etc., (Drawings and Specifications) as his complete set. He will be responsible for any and all mechanical work shown or stated (to be by him), to include this work in his bid and install such items even though they are not specifically shown or stated on the Mechanical section of the plans and specifications.

1.13 COORDINATION

A. Contractor shall be responsible for continual coordination of the mechanical work with other trades so as to avoid conflicts in installation. Contractor shall cooperate with other trades to assure that construction proceeds in an orderly and timely manner.

B. Study the civil, structural, electrical, shop and any specialty drawings and specifications to determine required coordination.

1. Anchor bolts, sleeves, inserts and supports that may be required for the mechanical work shall be furnished and installed under the same division of the specifications as the

respective items to be supported. Excluded from this requirement are cast in place anchor bolts.

2. Slots, chases, openings and recesses through floors and walls as specified will be provided by the various trades in their respective materials, but the trade requiring them shall see that they are properly located in zones provided or otherwise approved by the Engineer or Architect and/or Owner.
3. Locations of pipes, panels, equipment, fixtures, etc., shall be adjusted to accommodate interferences encountered. The Project Coordinator shall determine the exact rerouting and location of each pipe and/or duct encountered prior to fabrication.
    a. Right-of-Way: Lines which pitch shall have the right of way over those which do not pitch. Lines whose elevations cannot be changed shall have the right of way over lines whose elevations can be changed.
    b. Offsets, transitions and changes in direction in pipes shall be made as required to maintain proper head room and pitch of sloping lines whether or not indicated on the drawings.
4. Installation of Arrangement: The contractor shall install all mechanical work to permit removal of, and access to, (without damage to other parts) all parts requiring periodic replacement or maintenance.

C. Layout Priority:
1. All trades shall understand that other trades will need to work in the same areas during the project. All final decisions as to the right-of-way and runs of utility lines (pipes, ducts, etc.) shall be made by Owner and/or Architect. In general, priority shall be given as follows:
    a. Sheet metal ductwork
    b. Light Fixtures
    c. Plumbing waste lines, downspouts, and vents
    d. Sprinkler piping
    e. Gravity water lines
    f. Refrigerant lines
    g. Gas and air lines
    h. Plumbing water
    i. Electrical conduit

D. PREPARE DETAILED SHOP DRAWINGS WHERE NECESSARY TO ASSURE PROPER FIT AND NECESSARY CLEARANCE.

1.14 CUTTING, PATCHING AND FIRESTOPPING

A. The Plumbing Contractor shall set all sleeves in construction for their Work.

B. Where cutting is required, it shall be done by the Plumbing Contractor.

C. All patching shall be done by Plumbing Contractor.

D. All cutting of any kind must be done with great care so as not to leave unsightly surfaces which may not be entirely concealed by plates, escutcheons, or their normal concealing construction, if such unsightly conditions occur, Plumbing Contractor will be required, at their own expense, to replace the damaged construction.

E. This Plumbing Contractor shall provide and install firestopping materials per Section 07 8400 - Firestopping.

1.15 ACCESS PANELS REQUIRED BY TRADE

A. Trade requiring access shall provide and install access panels where not shown or specified.

B. The finished appearance and function will be subject to approval by the Architect/Owner.

C. Provide panels that accommodate adjacent finishes in finished spaces.

D. Access panels shall meet all code requirements for each location they are installed and shall be sized appropriately.

1.16 ELECTRICAL

A. Electrical Contractor shall furnish all motor starters and motor controls and provide all wiring for motor control operation, except if specified otherwise.

1.17 ADDITIONAL ELECTRICAL COSTS

A. If the Mechanical Contractor substitutes equipment for specified units, the mechanical contractor shall be responsible for any additional electrical installation costs for this substitution whether the other equipment was listed as equal in the specification or was approved equal after the project was in the bidding process.

1.18 GUARANTEE

A. This Contractor shall be responsible for the proper installation and working of everything in this contract and shall guarantee to remedy free of charge any defects in workmanship and materials that may appear to give or gives rise to trouble of any kind for a period of one year from date of final substantial completion.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 22 05 17
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.

B. Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

E. Structural Considerations:
   1. Do not penetrate building structural members unless indicated.

F. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. Aboveground Piping:
      a. Pack solid using mineral fiber complying with ASTM C592.
      b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
   2. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.
   3. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

G. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tags.

B. Pipe markers.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Piping: Pipe markers.

B. Valves: Tags.

2.02 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.03 PIPE MARKERS

A. Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Color code as follows:
   1. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.
   2. Fire Quenching Fluids: Red with white letters.
   3. Flammable Fluids: Yellow with black letters.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

A. Applicable State Plumbing Code with Amendments

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

E. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).

F. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2019).

G. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

H. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2017 (Reapproved 2023).

I. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

J. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

K. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

L. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

M. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2022.

N. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2022.

O. ASTM C610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation; 2017 (Reapproved 2023).

P. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

Q. ASTM C1410 - Standard Specification for Cellular Melamine Thermal and Sound-Absorbing Insulation; 2017 (Reapproved 2023).

R. ASTM C1695 - Standard Specification for Fabrication of Flexible Removable and Reusable Blanket Insulation for Hot Service; 2022.

S. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber; 2020.

T. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2019.

U. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

V. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

W. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

B. Protect insulation from weather and sunlight, construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.06 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER

A. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

B. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
   1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 650 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.

F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.03 CELLULAR GLASS

A. Insulation: ASTM C552, Type II.
   1. Apparent Thermal Conductivity; 'K' Value: Grade 6, 0.35 at 100 degrees F.
   2. Service Temperature: Up to 800 degrees F.
   3. Water Vapor Permeability: 0.005 perm inch.
   4. Water Absorption: 0.5 percent by volume, maximum.

2.04 JACKETS

A. PVC Plastic.
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 20 mil.
      e. Connections: Brush on welding adhesive.
   2. Covering Adhesive Mastic: Compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

H. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert Location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.

J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces 10 feet and below: Finish with PVC jacket and fitting covers.

3.03 SCHEDULES

A. Plumbing Systems:
   1. Domestic Hot Water Supply (140°F or less):
      a. Glass Fiber Insulation:
         1) Pipe Size Range: 0-1.5 inch.
            (a) Thickness: 1.5 inch.
         2) Pipe Size Range: 2 inch & UP.
            (a) Thickness: 2 inch.
      b. Cellular Glass Insulation:
         1) Pipe Size Range: 0-1.5 inch.
            (a) Thickness: 1.5 inch.
         2) Pipe Size Range: 2 inch & UP.
            (a) Thickness: 2 inch.
   2. Domestic Hot Water Recirculation (140°F or less):
      a. Glass Fiber Insulation:

1) Pipe Size Range: 0-1.5 inch.
(a) Thickness: 1.5 inch.
2) Pipe Size Range: 2 inch & UP.
(a) Thickness: 2 inch.

b. Glass Fiber Insulation:
1) Pipe Size Range: 0-1.5 inch.
(a) Thickness: 1.5 inch.
2) Pipe Size Range: 1.5 inch & UP.
(a) Thickness: 2 inch.

3. Domestic Cold Water:
a. Glass Fiber Insulation:
1) Pipe Size Range: All sizes.
(a) Thickness: 1 inch.

b. Cellular Glass Insulation:
1) Pipe Size Range: All sizes.
(a) Thickness: 1 inch.

END OF SECTION

SECTION 22 08 00
COMMISSIONING OF PLUMBING FIXTURES

PART 1 GENERAL

1.01 SUMMARY

A. See Section 01 9113 - General Commissioning Requirements for overall objectives; comply with the requirements of Section 01 9113.

B. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

C. The Commissioning of this project is not a full blown 3rd party commissioing effort but rather commissioning "light" to review the primary equipment and system functions.

D. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use. The CA is ISG.

E. The entire newly installed Plumbing Fixtures are to be commissioned, including commissioning activities for the following specific items:
   1. Plumbing Fixtures
   2. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

F. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 RELATED REQUIREMENTS

A. Section 01 7800 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

B. Section 01 7900 - Demonstration and Training: Scope and procedures for Owner personnel training.

C. Section 01 9113 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

D. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

E. Section 23 0923 - Direct-Digital Control System for HVAC.

F. Section 23 0993 - Sequence of Operations for HVAC Controls.

1.03 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - The HVAC&R Technical Requirements for the Commissioning Process 2007, with Errata (2012).

1.04 SUBMITTALS PROVIDED BY THE PRIMARY CONTRACTOR

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. All information is to be submitted in PDF format and be indexed.

C. Plumbing Fixtures O&M Manual Requirements.

D. Project Record Documents: See Section 01 7800 for additional requirements.
   1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
   2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

E. Draft Training Plan: In addition to requirements specified in Section 01 7900, include:
   1. Follow the recommendations of ASHRAE Guideline 1.1.
   2. Control system manufacturer's recommended training.
   3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

F. Training Manuals: See Section 01 7900 for additional requirements.
   1. Provide PDF file format of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide any/all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments will NOT become the property of Owner.

PART 3 EXECUTION

3.01 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

3.02 INSPECTING AND TESTING - GENERAL

A. Prefunctional Checklists for each item of equipment or other assembly to be commissioned are provided in this specification Index.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned are provided in this specification Index.

C. Provide two-way radios for use during the testing.

D. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.03 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for Plumbing Fixtures will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.

3.04 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 7800 for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.05 DEMONSTRATION AND TRAINING

A. See Section 01 7900 for additional requirements.

B. Provide the services of manufacturer representatives to assist instructors where necessary.

END OF SECTION

SECTION 22 10 05
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.
   3. Flanges, unions, and couplings.
   4. Pipe hangers and supports.
   5. Valves.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 09 91 23 - Interior Painting.

C. Section 22 07 19 - Plumbing Piping Insulation.

D. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. Applicable State Plumbing Code with Amendments

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

C. ASME B31.1 - Power Piping; 2022.

D. ASME B31.9 - Building Services Piping; 2020.

E. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.

F. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.

G. ASTM B32 - Standard Specification for Solder Metal; 2020.

H. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2020.

I. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

J. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

K. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.

L. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2023.

M. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.

N. AWWA C651 - Disinfecting Water Mains; 2023.

O. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2021.

P. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2020.

Q. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

R. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

S. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

T. NSF 372 - Drinking Water System Components - Lead Content; 2022.

U. ASTM F 2389-06 - Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems

V. CSA B137.11 - Polypropylene (PP-R) Pipe and Fittings for Pressure Applications

W. NSF/ANSI 14 - Plastic Piping System Components and Related Materials

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Project Record Documents: Record actual locations of valves.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.
   3. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF international.

2.03 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.
   3. Joints: Grooved mechanical couplings.
   4. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.

2.04 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch:
   1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.05 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.

B. Plumbing Piping - Water:
   1. Conform to ASME B31.9.
   2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
   3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
   5. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
   6. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   7. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
   8. Vertical Support: Steel riser clamp.
   9. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   10. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.06 BALL VALVES

A. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze body, 304 stainless steel ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 05 16.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not exposed.
   1. Coordinate size and location of access doors with Section 08 31 00.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

J. Provide support for utility meters in accordance with requirements of utility companies.

K. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
   1. Painting of interior plumbing systems and components is specified in Section 09 91 23.

L. Install water piping to ASME B31.9.

M. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

N. Sleeve pipes passing through partitions, walls, and floors.

O. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

P. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   3. Place hangers within 12 inches of each horizontal elbow.
   4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   7. Provide copper plated hangers and supports for copper piping.
   8. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.04 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

B. Install unions downstream of valves and at equipment or apparatus connections.

C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.05 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope. Drain piping 4" and larger allowed to be sloped at 1/8 inch per foot.

B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.

B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SCHEDULES

A. Pipe Hanger Spacing:

TABLE 313.1
HANGERS AND SUPPORTS

MATERIALS	TYPES OF JOINTS	HORIZONTAL	VERTICAL
Cast	Lead and Oakum	5 feet, except 10 feet where 10 foot lengths are installed[1, 2, 3]	Base and each floor, not to exceed 15 feet
	Compression Gasket	Every other joint, unless over 4 feet then support each joint[1, 2, 3]	Base and each floor, not to exceed 15 feet
Cast-Iron Hubless	Shielded Coupling	Every other joint, unless over 4 feet then support each joint[1,2,3,4]	Base and each floor, not to exceed 15 feet
Copper Tube and Pipe	Soldered or Brazed	1½ inches and smaller, 6 feet; 2 inches and larger, 10 feet	Each floor, not to exceed 10 feet[5]
Steel and Brass Pipe for Water or DWV	Threaded or Welded	¾ inch and smaller, 10 feet; 1 inch and larger, 12 feet	Every other floor, not to exceed 25 feet[5]
Steel, Brass, and Tinned Copper Pipe for Gas	Threaded or Welded	½ inch, 6 feet; ¾ inch and 1 inch, 8 feet; 1¼ inches and larger, 10 feet	½ inch, 6 feet; ¾ inch and 1 inch, 8 feet; 1¼ inches every floor level
Schedule 40 PVC and ABS DWV	Solvent Cemented	All sizes, 4 feet; allow for expansion every 30 feet[3,6]	Base and each floor; provide mid-story guides; provide for expansion every 30 feet[6]
CPVC	Solvent Cemented	1 inch and smaller, 3 feet; 1¼ inches and larger, 4 feet	Base and each floor; provide mid-story guides[6]
Lead	Wiped or Burned	Continuous Support	Not to exceed 4 feet
Copper	Mechanical	In accordance with standards acceptable to the Authority Having Jurisdiction	
Steel and Brass	Mechanical	In accordance with standards acceptable to the Authority Having Jurisdiction	
PEX	Cold Expansion, Insert and Compression	1 inch and smaller, 32 inches; 1¼ inches and larger, 4 feet	Base and each floor; provide mid-story guides
PEX-AL-PEX	Metal Insert and Metal Compression	½ inch, ¾ inch, 1 inch } All sizes 98 inches	Base and each floor; provide mid-story guides
PE-AL-PE	Metal Insert and Metal Compression	½ inch, ¾ inch, 1 inch } All sizes 98 inches	Base and each floor; provide mid-story guides
Polypropylene (PP)	Fusion weld (socket, butt, saddle, electrofusion), threaded (metal threads only), or mechanical	1 inch and smaller, 32 inches; 1¼ inches and larger, 4 feet	Base and each floor; provide mid-story guides

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm

Notes:

1 Support adjacent to joint, not to exceed 18 inches (457 mm).

2 Brace not to exceed 40 foot (12 192 mm) intervals to prevent horizontal movement.

3 Support at each horizontal branch connection.

4 Hangers shall not be placed on the coupling.

5 Vertical water lines shall be permitted to be supported in accordance with recognized engineering principles with regard to expansion and contraction, where first approved by the Authority Having Jurisdiction.

6 See the appropriate IAPMO Installation Standard for expansion and other special requirements.

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water closets.

B. Urinals.

C. Lavatories.

D. Electric water coolers.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealing joints between fixtures and walls and floors.

B. Section 22 10 05 - Plumbing Piping.

C. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. Applicable State Plumbing Code with Amendments

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. IAPMO Z124 - Plastic Plumbing Fixtures; 2022, with Editorial Revision.

D. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2014.

E. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2008 (Reaffirmed 2013).

F. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).

G. ASME A112.18.1 - Plumbing Supply Fittings; 2018, with Errata.

H. ASME A112.19.1 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures; 2024.

I. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2018, with Errata.

J. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2022.

K. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2020.

L. IAPMO Z124 - Plastic Plumbing Fixtures; 2022, with Editorial Revision.

M. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

N. NSF 372 - Drinking Water System Components - Lead Content; 2022.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 REGULATORY REQUIREMENTS

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.01 GENERAL

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 REGULATORY REQUIREMENTS

A. Comply with applicable codes for installation of plumbing systems.

B. Provide to Owner certificate of compliance from Authority Having Jurisdiction indicating approval of installation.

2.03 FLUSH VALVE WATER CLOSETS

A. Manufacturers:
   1. Sloan Valve Company: www.sloanvalve.com/#sle.
   2. Zurn Industries, Inc;[____]: www.zurn.com/#sle.

B. See plumbing fixture schedule for requirements.

2.04 FLUSH VALVE WALL HUNG URINALS

A. Manufacturers:
   1. Sloan Valve Company: www.sloanvalve.com.
   2. Zurn Industries, Inc; _____: www.zurn.com/#sle.

B. See plumbing fixture schedule for requirements.

2.05 LAVATORIES

A. Lavatory Manufacturers:
   1. American Standard, Inc: www.americanstandard-us.com.
   2. Kohler Company: www.kohler.com.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. See plumbing fixture schedule for requirements.

2.06 ELECTRIC WATER COOLERS

A. Electric Water Cooler Manufacturers:
   1. Elkay Manufacturing Company: www.elkay.com/#sle.
   2. Haws Corporation: www.hawsco.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. See plumbing fixture schedule for requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics. Coordinate with electrical contractor.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and bolts.

E. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 9200, color to match fixture.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

A. Clean plumbing fixtures and equipment.

B. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

3.07 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 23 00 10
BASIC MECHANICAL HVAC REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Basic Mechanical HVAC Requirements specifically applicable to Division 23 in addition to Division 1 - General Requirements.

1.02 SCOPE OF WORK

A. The Mechanical HVAC Contract shall also include furnishing and installing a complete heating, ventilating and air conditioning system for the building remodel and all other related work as called for under the specifications and shown on plans.

1.03 WORK INCLUDED

A. The Mechanical HVAC Contract shall include all work under the listed Division 23 of the Specifications Index and all related Mechanical work as shown on the Drawings for the project.

B. A Complete table of Mechanical Reference Symbols is shown on the plans.

C. Under this Contract the Mechanical Contractor shall furnish the Owner with two 3-ring binders of all pertinent systems related documents. Submit manuals to the Engineer for his review. The Engineer will then turn books over to the Owner. The books shall contain the following items:
   1. Shop drawings on all major equipment.
   2. Operating Instructions for all major equipment.
   3. Maintenance Instructions for all major equipment.
   4. Wiring diagrams for all equipment.
   5. Test and Balance Reports.
   6. The Mechanical installation to be made under Division 23 is set up for contract bidding as follows:
      a. Mechanical HVAC Contractor is a sub-contractor to the General Contractor.
         1) The Mechanical contractor is responsible for own equipment, such as cranes, lifts, etc. in order to provide a complete installation of mechanical systems.
         2) The Mechanical contractor shall be a sub-contractor to the General Contractor and shall include in his bid, prices from sub-contractors for control wiring, and other trades necessary to complete the entire job.

1.04 SPECIFICATIONS COMPLIANCE

A. The requirements of these specifications shall be complied with in every respect. Therefore, it shall be absolutely mandatory that the job foreman, all lead mechanics, subcontractors and their foreman have completely studied these specifications, be completely knowledgeable as to their entire contents, and maintain a copy at the job-site. Failure to comply with this requirement will be reason to presume the mechanic or subcontractor is not in responsible charge of his work due to ignorance of job requirements, and will be reason for the owner to require dismissal and replacement with approved personnel. Every foreman and lead mechanic shall be provided with a complete copy of this specification.

1.05 INCONSISTENCIES

A. If there is an inconsistency in the quality and/or quantity of Work required by the Contract Documents, either the greater quality and/or quantity of Work indicated shall be provided in accordance with the Engineer/Architect's interpretation without change in the contract sum.

1.06 WORK NOT INCLUDED

A. The following work is not included as part of the Contract.
   1. The removal and storage of any equipment in the building required to be moved or relocated during the construction process.

1.07 CODES, FEES AND LATERAL COSTS

A. The Heating, Ventilation and Air Conditioning Installation shall meet all applicable local, state and federal codes and standards.

B. All permits necessary for a complete heating and ventilation installation shall be paid for by this Contractor.

C. Except in those municipalities which provide state- approved electrical inspection, all installation of electrical equipment wiring shall be inspected by the State Board of Electricity. Allowance shall be made in the bid and contract for the cost of such inspection.
   1. Fees for such inspection will be charged in accordance with the rules and regulations of the State Board of Electricity. Evidence of payment of fees shall be provided by the Contractor with his Request for Payment.

1.08 REFERENCES

A. All equipment, piping, etc., shall be new and shall be installed to meet the approval of the following additional ordinances: ASME Rules for Pressure Tanks, National Board of Fire Underwriter's Rules, American Waterworks and the American Gas Association.

1.09 SUBMITTALS

A. Submit under provisions of Division 01 3000.

B. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal.

C. All documents shall be submitted in .pdf format unless pre-approved by Engineer. The contractor shall not use any equipment or materials that does not have the engineer’s stamped approval.

D. Mark dimensions and values in units to match those specified.

1.10 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

1.11 SEQUENCING AND SCHEDULING

A. Construct Work in sequence under provisions of Division 1.

1.12 PRE-CONSTRUCTION COORDINATION AND VERIFICATION

A. This Contractor shall coordinate his work with other Contractors on this job. Any conflict which cannot be resolved shall be settled by the Architect/Engineer.

B. Field verification of scale dimensions on plans is directed since actual locations, distances and levels will be governed by actual field conditions.

C. The Contractors shall check architectural, structural, plumbing, heating, ventilating and electrical plans to avert possible installation conflicts. Should drastic changes from original plans be necessary to resolve such conflicts this Contractor shall notify the Architect/Engineer and secure written approval and agreement on necessary adjustments before the installation is started.

D. Discrepancies shown on different plans or between plans and actual field conditions or between plans and specifications shall promptly be brought to the attention of the Architect/Engineer for a decision.

E. The Contractor shall consider and review the complete set of documents, etc., Architectural, Structural, Mechanical, Electrical, etc., (Drawings and Specifications) as his complete set. He will be responsible for any and all mechanical work shown or stated (to be by him), to include this work in his bid and install such items even though they are not specifically shown or stated on the Mechanical section of the plans and specifications.

1.13 COORDINATION

A. Contractor shall be responsible for continual coordination of the mechanical work with other trades so as to avoid conflicts in installation. Contractor shall cooperate with other trades to assure that construction proceeds in an orderly and timely manner.

B. Study the civil, structural, electrical, shop and any specialty drawings and specifications to determine required coordination.
   1. Anchor bolts, sleeves, inserts and supports that may be required for the mechanical work shall be furnished and installed under the same division of the specifications as the respective items to be supported. Excluded from this requirement are cast in place anchor bolts.
   2. Slots, chases, openings and recesses through floors and walls as specified will be provided by the various trades in their respective materials, but the trade requiring them

shall see that they are properly located in zones provided or otherwise approved by the Engineer or Architect and/or Owner.

3. Locations of pipes, panels, equipment, fixtures, etc., shall be adjusted to accommodate interferences encountered. The Project Coordinator shall determine the exact rerouting and location of each pipe and/or duct encountered prior to fabrication.
    a. Right-of-Way: Lines which pitch shall have the right of way over those which do not pitch. Lines whose elevations cannot be changed shall have the right of way over lines whose elevations can be changed.
    b. Offsets, transitions and changes in direction in pipes shall be made as required to maintain proper head room and pitch of sloping lines whether or not indicated on the drawings.
4. Installation of Arrangement: The contractor shall install all mechanical work to permit removal of, and access to, (without damage to other parts) all parts requiring periodic replacement or maintenance.

C. Layout Priority:
1. All trades shall understand that other trades will need to work in the same areas during the project. All final decisions as to the right-of-way and runs of utility lines (pipes, ducts, etc.) shall be made by Owner and/or Architect. In general, priority shall be given as follows:
    a. Sheet metal ductwork
    b. Light Fixtures
    c. Plumbing waste lines, downspouts, and vents
    d. Gravity water lines
    e. Refrigerant lines
    f. Gas and air lines
    g. Plumbing water
    h. Electrical conduit

D. PREPARE DETAILED SHOP DRAWINGS WHERE NECESSARY TO ASSURE PROPER FIT AND NECESSARY CLEARANCE.

1.14 CUTTING, PATCHING, AND FIRESTOPPING

A. The Mechanical Contractor shall set all sleeves in construction for their Work.

B. Where cutting is required, it shall be done by the Mechanical Contractor.

C. All patching shall be done by Mechanical Contractor.

D. All cutting of any kind must be done with great care so as not to leave unsightly surfaces which may not be entirely concealed by plates, escutcheons, or their normal concealing construction, if such unsightly conditions occur, Mechanical Contractor will be required, at their own expense, to replace the damaged construction.

E. This Mechanical Contractor shall provide and install firestopping materials per Section 07 8400 - Firestopping.

1.15 ACCESS PANELS REQUIRED BY TRADE

A. Trade requiring access shall provide and install access panels where not shown or specified.

B. The finished appearance and function will be subject to approval by the Architect/Owner.

C. Provide panels that accommodate adjacent finishes in finished spaces.

D. Access panels shall meet all code requirements for each location they are installed and shall be sized appropriately.

1.16 ELECTRICAL

A. Electrical Contractor shall furnish all motor starters and motor controls and provide all wiring for motor control operation, except if specified otherwise.

1.17 ADDITIONAL ELECTRICAL COSTS

A. If the Mechanical Contractor substitutes equipment for specified units, the mechanical contractor shall be responsible for any additional electrical installation costs for this substitution whether the other equipment was listed as equal in the specification or was approved equal after the project was in the bidding process.

1.18 GUARANTEE

A. This Contractor shall be responsible for the proper installation and working of everything in this contract and shall guarantee to remedy free of charge any defects in workmanship and materials that may appear to give or gives rise to trouble of any kind for a period of one year from date of final substantial completion.

PART 2PRODUCTS

2.01 NOT USED

PART 3EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 23 01 30.51
HVAC AIR-DISTRIBUTION SYSTEM CLEANING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cleaning of HVAC duct system, equipment, and related components.

1.02 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements: Additional requirements for testing and inspection agencies.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 22 00 - Unit Prices, for additional unit price requirements.

1.04 DEFINITIONS

A. HVAC System: For purposes of this section, the surfaces to be cleaned include all interior surfaces of the heating, air-conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system, including the inside of air distribution equipment, coils, and condensate drain pans; see NADCA ACR for more details. See drawings for duct layouts.
   1. All remaining supply air duct is required to be cleaned.
   2. All remaining return air duct (both above and below grade) is required to be cleaned.
   3. Makeup air system is required to be cleaned.
   4. Exhaust-only system is required to be cleaned.

1.05 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

B. NADCA ACR - The NADCA Standard for Assessment, Cleaning, and Restoration of HVAC System; 2021.

C. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

D. UL 181A - Closure Systems for Use with Rigid Air Ducts; Current Edition, Including All Revisions.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Qualifications Statement: Submit qualifications of proposed cleaning contractor for approval.

C. Project Cleanliness Evaluation and Cleaning Plan, as specified.

D. Project Closeout Report: Include field quality control reports, evidence of satisfactory cleaning, and documentation of items needing further repair.

1.07 QUALITY ASSURANCE

A. Information Available to Contractor: Upon request, Owner will provide the following:
   1. One copy of original construction drawings of HVAC system.

B. Cleaning Contractor Qualifications: Company specializing in the cleaning and restoration of HVAC systems as specified in this section.
   1. Certified by one of the following:
      a. NADCA, National Air Duct Cleaners Association: www.nadca.com
   2. Employing for this project a supervisor certified as an Air Systems Cleaning Specialist by NADCA.

PART 2 PRODUCTS

2.01 TOOLS AND EQUIPMENT

A. Vacuum Devices and Other Tools: Exceptionally clean, in good working order, and sealed when brought into the facility.

B. Vacuum Devices That Exhaust Air Inside Building, Including Hand-Held and Wet Vacuums: Equipped with HEPA filtration with 99.97 percent collection efficiency for minimum 0.3-micron

size particles and DOP test number.

C. Vacuum Devices That Exhaust Air Outside Building, Including Truck- and Trailer-Mounted Types: Equipped with particulate collection including adequate filtration to contain debris removed from the HVAC system; exhausted in manner that prevents contaminant re-entry to building; compliant with applicable regulations as to outdoor environmental contamination.

2.02 REPLACEMENT PRODUCTS

A. Fibrous Glass Insulation: Provide material complying with UL 181 equivalent to existing material in quality and thickness.

2.03 SURFACE TREATMENTS

A. Anti-Microbial Materials: EPA registered specifically for use on non-porous HVAC system surfaces and applied per manufacturer's instructions.

B. Surface Coating for Fibrous Glass Materials: Water-based, zero VOC; flame spread index less that 25, smoke developed index less than 450, Class A, when tested in accordance with ASTM E84.

PART 3 EXECUTION

3.01 PROJECT CONDITIONS

A. Comply with applicable federal, state, and local requirements.

B. Perform cleaning, inspection, and remediation in accordance with the recommendations of NADCA "Assessment, Cleaning and Restoration of HVAC Systems" (ACR) and as specified herein.

C. Where NADCA ACR uses the terms "recommended", "highly recommended", or "ideally" in regard to a certain procedure or activity, do that unless it is clearly inapplicable to the project.

D. Take precautions to prevent introduction of additional hazards into occupied spaces.

E. Obtain Owner's approval of proposed temporary locations for large equipment.

F. Designate a decontamination area and obtain Owner's approval.

G. When portions of the facility are to remain occupied or in operation during cleaning activities, provide adequate controls or containment to prevent access to spaces being cleaned by unauthorized persons and provide detailed instructions to Owner as to these controls or containment.

H. If unforeseen mold or other biological contamination is encountered, notify Owner and Architect immediately, identifying areas affected and extent and type of contamination.

3.02 EXAMINATION

A. Prior to the commencement of any cleaning work, prepare and submit to Owner and Architect a project evaluation and plan for this project, including considerations recommended in NADCA ACR.

B. Inspect the system as required to determine appropriate methods, tools, equipment, and protection.

C. Start of cleaning work constitutes acceptance of existing conditions.

D. When concealed spaces are later made accessible, examine and document interior conditions prior to beginning cleaning.

E. Document all instances of mold growth, rodent droppings, other biological hazards, and damaged system components.

3.03 PREPARATION

A. When cleaning work might adversely affect life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.

B. Ensure that electrical components that might be adversely affected by cleaning are de-energized, locked out, and protected prior to beginning work.

C. Air-Volume Control Devices: Mark the original position of dampers and other air-directional mechanical devices inside the HVAC system prior to starting cleaning.

D. Access to Concealed Spaces: Use existing service openings and make additional service openings as required to accomplish cleaning and inspection.
   1. Do not cut openings in non-HVAC components without obtaining the prior approval of Owner.
   2. Make new openings in HVAC components in accordance with NADCA Standard 05; do not compromise the structural integrity of the system.
   3. Do not cut service openings into flexible duct; disconnect at ends for cleaning and inspection.

E. Ceiling Tile: Lay-in ceiling tile may be removed to gain access to HVAC systems during the cleaning process; protect tile from damage and reinstall upon completion; replace damaged tile.

3.04 CLEANING

A. Use any cleaning method recommended by NADCA ACR unless otherwise specified; do not use methods prohibited by NADCA ACR, or that will damage HVAC components or other work, or that will significantly alter the integrity of the system.

B. Obtain Owner's approval before using wet cleaning methods; ensure that drainage is adequate before beginning.

C. Ducts: Mechanically clean all portions of ducts.

D. Hoses, Cables, and Extension Rods: Clean using suitable sanitary damp wipes at the time they are being removed or withdrawn from their normal position.

E. Registers, Diffusers, and Grilles: When removing, take care to prevent containment exposure due to accumulated debris.

F. Fibrous Glass Material: Use HEPA vacuuming equipment, under constant negative pressure, do not permit to get wet, and do not damage surfaces; replace material damaged by cleaning operations.

G. Existing Damaged Fibrous Glass Material: Report to Owner and Architect all evidence of damage, deterioration, delaminating, friable material, mold or fungus growth, or moisture that cannot be remedied by cleaning or resurfacing with an acceptable insulation repair coating.
   1. Material with active fungal growth is considered unremediable.
   2. Remove unremediable material and clean underlying surfaces.
   3. Report to Owner and Engineer total area of ducts which can be remedied by resurfacing with an acceptable insulation repair coating. Owner and Engineer shall make final determination of liner which warrants repair coating. Provide unit cost for resurfacing with acceptable insulation repair coating as $/ft^2 of duct.
   4. Replace unremediable material.

H. Collect debris removed during cleaning; ensure that debris is not dispersed outside the HVAC system during the cleaning process.

I. Store contaminated tools and equipment in polyethylene bags until cleaned in the designated decontamination area.

3.05 REPAIR

A. Repair openings cut in the ventilation system so that they do not significantly alter the airflow or adversely impact the facility's indoor air quality.

B. At insulated ducts and components, accomplish repairs in such a manner as to achieve the equivalent thermal value.

C. Reseal new openings in accordance with NADCA Standard 05.

D. Reseal rigid fiber glass duct systems using closure techniques that comply with UL 181 or UL 181A.

E. When new openings are intended to be capable of being re-opened in the future, clearly mark them and report their locations to Owner in project report documents.

3.06 FIELD QUALITY CONTROL

A. Ensure that the following field quality control activities are completed prior to application of any treatments or coatings and prior to returning HVAC system to normal operation.

B. Visually inspect all portions of the cleaned components; if not visibly clean as defined in NADCA ACR, re-clean and reinspect.

C. Notify Owner and Architect when cleaned components are ready for inspection.

D. When directed, re-clean components until they pass.

E. Submit evidence that all portions of the system required to be cleaned have been cleaned satisfactorily.

3.07 ANTI-MICROBIAL TREATMENT

A. When directed, apply anti-microbial treatment to internal surfaces.

B. Apply anti-microbial agent after removal of surface deposits and debris.

C. Apply anti-microbial treatments and coatings in strict accordance with the manufacturer's written recommendations and EPA registration listing.

D. Spray coatings directly onto interior ductwork surfaces; do not "fog" into air stream.

3.08 ADJUSTING

A. After satisfactory completion of field quality control activities, restore adjustable devices to original settings, including, but not limited to, dampers, air directional devices, valves, fuses, and circuit breakers.

3.09 WASTE MANAGEMENT

A. Double-bag waste and debris in 6 mil, 0.006 inch thick polyethylene plastic bags.

B. Dispose of debris off-site in accordance with applicable federal, state and local requirements.

END OF SECTION

SECTION 23 05 17
SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

B. Manufactured sleeve-seal systems.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 23 07 19 - HVAC Piping Insulation.

1.03 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

1.05 QUALITY ASSURANCE

A. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.
   3. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

B. Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Pipe Passing Through Mechanical or Laundry Rooms:
   1. Galvanized steel pipe or black iron pipe with asphalt coating.
   2. Connect sleeve with floor plate except in mechanical rooms.

D. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material in compliance with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

2.02 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Modular/Mechanical Seal:
   1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
   2. Provide watertight seal between pipe and wall/casing opening.
   3. Elastomer element size and material in accordance with manufacturer's recommendations.

4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Provide sleeves when penetrating floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. Aboveground Piping:
      a. Pack solid using mineral fiber in compliance with ASTM C592.
      b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
   2. All Rated Openings: Caulk tight with fire stopping material in compliance with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.
   3. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

E. Manufactured Sleeve-Seal Systems:
   1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
   2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
   3. Locate piping in center of sleeve or penetration.
   4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
   5. Tighten bolting for a water-tight seal.
   6. Install in accordance with manufacturer's recommendations.

F. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

SECTION 23 05 19
METERS AND GAUGES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gages and pressure gage taps.

B. Thermometers and thermometer wells.

C. Static pressure gages.

D. Filter gages.

1.02 RELATED REQUIREMENTS

A. Section 23 09 23 - Direct-Digital Control System for HVAC.

B. Section 23 09 93 - Sequence of Operations for HVAC Controls.

C. Section 23 21 13 - Hydronic Piping.

1.03 REFERENCE STANDARDS

A. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014 (Reapproved 2020).

B. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.05 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 PRESSURE GAGES

A. Pressure Gages: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
   1. Case: Steel with brass bourdon tube.
   2. Size: 4-1/2 inch diameter.
   3. Mid-Scale Accuracy: One percent.
   4. Scale: Psi and KPa.

2.02 PRESSURE GAGE TAPPINGS

A. Gage Cock: Tee or lever handle, brass for maximum 150 psi.

B. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.

2.03 STEM TYPE THERMOMETERS

A. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
   1. Size: 9 inch scale.
   2. Window: Clear Lexan.
   3. Stem: 3/4 inch NPT brass.
   4. Accuracy: 2 percent, per ASTM E77.
   5. Calibration: Degrees F.

2.04 DIAL THERMOMETERS

A. Thermometers - Fixed Mounting: Dial type bimetallic actuated; ASTM E1; stainless steel case, silicone fluid damping, white with black markings and black pointer, hermetically sealed lens, stainless steel stem.
   1. Size: 3 inch diameter dial.
   2. Lens: Clear glass.
   3. Accuracy: 1 percent.
   4. Calibration: Degrees F.

B. Thermometer: ASTM E1, stainless steel case, adjustable angle with front recalibration, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem.
   1. Size: 3 inch diameter dial.
   2. Lens: Clear glass.
   3. Accuracy: 1 percent.
   4. Calibration: Degrees F.

C. Thermometers: Dial type vapor or liquid actuated; ASTM E1; stainless steel case, with brass or copper bulb, copper or bronze braided capillary, white with black markings and black pointer, glass lens.
   1. Size: 3-1/2 inch diameter dial.
   2. Lens: Clear glass.
   3. Length of Capillary: Minimum 5 feet.
   4. Accuracy: 2 percent.
   5. Calibration: Degrees F.

2.05 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.06 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

B. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch diameter pressure gages, one gage adapters with 1/8 inch probes, two 1 inch dial thermometers.

2.07 FILTER PRESSURE GAGES

A. 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.

B. Inclined manometer, red liquid on white background with black figures, front recalibration adjustment, 3 percent of full scale accuracy.

C. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

C. Install thermometers in air duct systems on flanges.

D. Install thermometer sockets adjacent to controls system thermostat, transmitter, or sensor sockets. Refer to Section 23 09 43. Where thermometers are provided on local panels, duct or pipe mounted thermometers are not required.

E. Locate duct mounted thermometers minimum 10 feet downstream of mixing dampers, coils, or other devices causing air turbulence.

F. Coil and conceal excess capillary on remote element instruments.

G. Provide instruments with scale ranges selected according to service with largest appropriate scale.

H. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

I. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

J. Locate test plugs adjacent thermometers and thermometer sockets.

3.02 SCHEDULE

A. Pressure Gage Tappings, Location:
   1. Control valves 3/4 inch & larger - inlets and outlets.
   2. Major coils - inlets and outlets.

B. Stem Type Thermometers, Location and Scale Range:
   1. Coil banks - inlets and outlets, 0 to 250 degrees F.

C. Thermometer Sockets, Location:
   1. Control valves 1 inch & larger - inlets and outlets.

D. Dial Thermometers, Location and Scale Range:
   1. Outside air, 0 to 150 degrees F.

E. Filter Pressure Gages, Location and Scale Range:
   1. Filter sections, 0 to 3 inches W.C..

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SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Adhesive-backed duct markers.

D. Pipe markers.

1.02 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Automatic Controls: Tags. Key to control schematic.

C. Control Panels: Nameplates.

D. Fire or Fire/Smoke Damper Access Panels: Nameplates.

E. Ductwork: Adhesive-backed duct markers..

F. Major Control Components: Nameplates.

G. Piping: Pipe markers.

H. Pumps: Nameplates.

I. Tanks: Nameplates.

J. Thermostats: Nameplate or label from labelmaker.

K. Valves: Tags

L. Water Treatment Devices: Nameplates.

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/2 inch.
   3. Background Color: Black.
   4. Plastic: Comply with ASTM D709.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 ADHESIVE-BACKED DUCT MARKERS

A. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch; printed with UV and chemical resistant inks.

B. Style: Individual Label.

C. Color: Blue/White.

2.05 PIPE MARKERS

A. Color: Conform to ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Color code as follows:
   1. Green with white letters.
   2. Flammable: Yellow with black letters.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 91 23 for stencil painting.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates.

F. Identify control panels and major control components outside panels with plastic nameplates.

G. Identify thermostats relating to terminal boxes or valves with label from labelmaker.

H. Identify valves in main and branch piping with tags.

I. Identify air terminal units with numbered tags.

J. Tag automatic controls, instruments, and relays. Key to control schematic.

K. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

L. Install ductwork with adhesive-backed duct markers. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction. Do not label exposed duct.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic systems.

C. Measurement of final operating condition of HVAC systems.

D. Sound measurement of equipment operating conditions.

E. Vibration measurement of equipment operating conditions.

1.02 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements: Employment of testing agency and payment for services.

B. Section 01 9114 - Commissioning Authority Responsibilities.

C. Section 23 08 00 - Commissioning of HVAC.

1.03 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008, with Errata (2019).

C. NEBB (TAB) - Procedural Standard for Testing Adjusting and Balancing of Environmental Systems; 2019.

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2023.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.
   2. Include at least the following in the plan:
      a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      c. Identification and types of measurement instruments to be used and their most recent calibration date.
      d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      e. Final test report forms to be used.
      f. Detailed step-by-step procedures for TAB work for each system and issue, including:
         1) Terminal flow calibration (for each terminal type).
         2) Diffuser proportioning.
         3) Branch/submain proportioning.
         4) Total flow calculations.
         5) Rechecking.
         6) Diversity issues.
      g. Expected problems and solutions, etc.
      h. Criteria for using air flow straighteners or relocating flow stations and sensors; analogous explanations for the water side.
      i. Details of how TOTAL flow will be determined; for example:
         1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA

flow stations.
2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.

j. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
k. Confirmation of understanding of the outside air ventilation criteria under all conditions.
l. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
m. Method of checking building static and exhaust fan and/or relief damper capacity.
n. Proposed selection points for sound measurements and sound measurement methods.
o. Methods for making coil or other system plant capacity measurements, if specified.
p. False loading of systems to complete TAB work, if specified.
q. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
r. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
s. Procedures for formal progress reports, including scope and frequency.
t. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Field Logs: Submit at least twice a week to the Commissioning Authority and Construction Manager.

D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

E. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
1. Submit under provisions of Section 01 40 00.
2. Submit to the the Commissioning Authority and Construction Manager within two weeks after completion of testing, adjusting, and balancing.
3. Revise TAB plan to reflect actual procedures and submit as part of final report.
4. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
5. Provide reports electronically in PDF form. PDF shall be completely indexed. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
6. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
7. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
8. Units of Measure: Report data in I-P (inch-pound) units only.
9. Include the following on the title page of each report:
a. Name of Testing, Adjusting, and Balancing Agency.
b. Address of Testing, Adjusting, and Balancing Agency.
c. Telephone number of Testing, Adjusting, and Balancing Agency.
d. Project name.
e. Project location.
f. Project Architect.
g. Project Engineer.
h. Project Contractor.
i. Project altitude.
j. Report date.

F. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC (NSTSB), AABC National Standards for Total System Balance.
   2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
   3. SMACNA (TAB).
   4. Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section. TAB Agency shall be independent of mechanical contractor.
   2. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
      b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
      c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
   10. Air outlets are installed and connected.
   11. Duct system leakage is minimized.
   12. Hydronic systems are flushed, filled, and vented.
   13. Pumps are rotating correctly.
   14. Proper strainer baskets are clean and in place.
   15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance prior to beginning work.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
   1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect and Commissioning Agent to facilitate spot checks during testing.

C. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

H. Check and adjust systems approximately six months after final acceptance and submit report.

3.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

M. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.

N. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

3.07 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.08 COMMISSIONING

A. See Sections 01 91 13 - General Commissioning Requirements and 23 08 00 for additional requirements.

B. Perform prerequisites prior to starting commissioning activities.

C. Fill out Prefunctional Checklists for:
   1. Air side systems.
   2. Water side systems.

D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

E. Re-check minimum outdoor air intake flows and maximum and intermediate total airflow rates for 25 percent of the air handlers plus a random sample equivalent to 25 percent of the final TAB report data as directed by Commissioning Authority.
   1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
   2. Use the same test instruments as used in the original TAB work.
   3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
   4. For purposes of re-check, failure is defined as follows:
      a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.
      b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.
      c. Temperatures: Deviation of more than one degree F.
      d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
      e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.
   5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.

F. In the presence of the Commissioning Authority, verify that:
   1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.

2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

3.09 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
1. Manufacturer.
2. Model/Frame.
3. HP/BHP.
4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
6. Service factor.
7. Starter size, rating, heater elements.
8. Sheave Make/Size/Bore.

B. V-Belt Drives:
1. Identification/location.
2. Required driven RPM.
3. Driven sheave, diameter and RPM.
4. Belt, size and quantity.
5. Motor sheave diameter and RPM.
6. Center to center distance, maximum, minimum, and actual.

C. Pumps:
1. Identification/number.
2. Manufacturer.
3. Size/model.
4. Impeller.
5. Service.
6. Design flow rate, pressure drop, BHP.
7. Actual flow rate, pressure drop, BHP.
8. Discharge pressure.
9. Suction pressure.
10. Total operating head pressure.
11. Shut off, discharge and suction pressures.
12. Shut off, total head pressure.

D. Air Cooled Condensers:
1. Identification/number.
2. Location.
3. Manufacturer.
4. Model number.
5. Serial number.
6. Entering DB air temperature, design and actual.
7. Leaving DB air temperature, design and actual.
8. Number of compressors.

E. Cooling Coils:
1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.

6. Entering air DB temperature, design and actual.
7. Entering air WB temperature, design and actual.
8. Leaving air DB temperature, design and actual.
9. Leaving air WB temperature, design and actual.
10. Water flow, design and actual.
11. Water pressure drop, design and actual.
12. Entering water temperature, design and actual.
13. Leaving water temperature, design and actual.
14. Saturated suction temperature, design and actual.
15. Air pressure drop, design and actual.

F. Heating Coils:
1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Water flow, design and actual.
7. Water pressure drop, design and actual.
8. Entering water temperature, design and actual.
9. Leaving water temperature, design and actual.
10. Entering air temperature, design and actual.
11. Leaving air temperature, design and actual.
12. Air pressure drop, design and actual.

G. Air Moving Equipment:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.
14. Fan RPM.

H. Return Air/Outside Air:
1. Identification/location.
2. Design air flow.
3. Actual air flow.
4. Design return air flow.
5. Actual return air flow.
6. Design outside air flow.
7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Required mixed air temperature.
11. Actual mixed air temperature.
12. Design outside/return air ratio.
13. Actual outside/return air ratio.

I. Exhaust Fans:
1. Location.
2. Manufacturer.
3. Model number.

4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.

J. Duct Traverses:
1. System zone/branch.
2. Duct size.
3. Area.
4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.
10. Air correction factor.

K. Duct Leak Tests:
1. Description of ductwork under test.
2. Duct design operating pressure.
3. Duct design test static pressure.
4. Duct capacity, air flow.
5. Maximum allowable leakage duct capacity times leak factor.
6. Test apparatus:
   a. Blower.
   b. Orifice, tube size.
   c. Orifice size.
   d. Calibrated.
7. Test static pressure.
8. Test orifice differential pressure.
9. Leakage.

L. Air Measuring Stations:
1. Identification/location.
2. System.
3. Size.
4. Area.
5. Design velocity.
6. Design air flow.
7. Test velocity.
8. Test air flow.

M. Terminal Unit Data:
1. Manufacturer.
2. Type, constant, variable, single, dual duct.
3. Identification/number.
4. Location.
5. Model number.
6. Size.
7. Minimum static pressure.
8. Minimum design air flow.
9. Maximum design air flow.
10. Maximum actual air flow.
11. Inlet static pressure.

N. Air Distribution Tests:
1. Air terminal number.

2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.

O. Sound Level Reports:
1. Location.
2. Octave bands - equipment off.
3. Octave bands - equipment on.

P. Type 1 Hood:
1. Capture and containment test per IMC 507.6.1

3.10 APPROVAL

A. The commissioning authority shall provide comments to the engineer.

B. The engineer shall review the final test and balance report and the commissioning authority report. The engineer will confirm that the test and balance meets design and will have final review of the test and balance report.

END OF SECTION

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SECTION 23 07 13
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

1.02 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Painting insulation jackets.

B. Section 23 05 53 - Identification for HVAC Piping and Equipment.

1.03 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

D. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

E. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

F. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2019.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather, sunlight, and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Insulation: ASTM C553; flexible, noncombustible blanket.

1. 'K' value: 0.25 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 450 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent by weight.

B. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure sensitive tape.

C. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive acrylic based adhesive.

2.03 GLASS FIBER, RIGID

A. Insulation: ASTM C612; rigid, noncombustible blanket.
1. 'K' Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 450 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent.
4. Maximum Density: 8.0 lb/cu ft.

B. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure sensitive tape.

C. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive acrylic based adhesive.

2.04 DUCT LINER

A. DESCRIPTION
1. NBR/PVC-based closed cell, flexible elastomeric foam thermal and acoustic insulation. Free of CFCs, HFCs, HCFCs, PBDEs, formaldehyde and fibers. EPA registered antimicrobial agent incorporated into the product to provide additional protection against mold, fungal and bacterial growth. UL GREENGUARD Gold Certified for low VOC emissions.

B. APPLICATIONS
1. Service temperatures ranging from -297°F (-182°C) to +220°F (+104°C). When using factory-applied PSA, the low temperature limit is -30°F (-34°C). When the product is installed fully adhered to the insulated surface (via contact adhesive or PSA), the high temperature limit is +180°F (+82°C). The product is used to reduce sound transmission and/or retard heat gain/loss and prevent condensation when used as an internal liner on square, rectangular, round or oval ductwork or equipment.

C. INSTALLATION
1. Install on non-operational systems with clean, dry surfaces in ambient conditions between 40°F and 100°F. For square or rectangular ducts, properly sized insulation sheets shall have 100% coverage of an approved contact adhesive applied to both surfaces. Compression joints should be used on all butt edges. Mechanical fasteners should be used in accordance with SMACNA guidelines. When air stream velocities exceed 4,000 FPM (20.3m/second), metal nosing is recommended to be applied to every leading edge. Nosing may be formed, channeled or zee-attached on duct by screws, rivets or welds. ASTM C1710.

D. FLAME AND SMOKE RATING
1. Thicknesses of 2” (50 mm) and below has a flame spread rating of 25 or less and a smoke development rating of 50 or less as tested to ASTM E84, “Surface Burning Characteristics of Building Materials”. It is acceptable for duct/plenum applications, meeting the requirements of NFPA 90A/B.

E. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

F. Adhesive: Waterproof, fire-retardant type, ASTM C916.

G. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated ducts conveying air below ambient temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated ducts conveying air above ambient temperature:
   1. Provide with or without standard vapor barrier jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Ducts Exposed in Mechanical Equipment Rooms: Rigid Glass Fiber Duct Insulation.

F. Provide metal nosing at all interface connections to existing lined ducts.

3.03 SCHEDULES

A. Exhaust Ducts Within 10 ft of Exterior Openings:
   1. Flexible Glass Fiber Duct Insulation: 1.5 inches thick.
   2. Rigid Glass Fiber Duct Insulation: 1 inches thick.

B. Outside Air Intake Ducts:
   1. Flexible Glass Fiber Duct Insulation: 3 inches thick.
   2. Rigid Glass Fiber Duct Insulation: 2 inches thick.

C. Return and Exhaust Ducts Exposed in Attic:
   1. Flexible Glass Fiber Duct Insulation: 2 inches thick.
   2. Rigid Glass Fiber Duct Insulation: 1.5 inches thick.

D. Supply Ducts:
   1. Flexible Glass Fiber Duct Insulation: 1.5 inches thick.
   2. Rigid Glass Fiber Duct Insulation: 1 inch thick.

E. Supply Ducts in Unconditioned Space:
   1. Flexible Glass Fiber Duct Insulation: 2 inches thick.
   2. Rigid Glass Fiber Duct Insulation: 1.5 inches thick.

F. Transfer Ducts:
   1. Duct Liner: 0.5 inches thick.

END OF SECTION

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SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 09 91 23 - Interior Painting: Painting insulation jacket.

C. Section 23 21 13 - Hydronic Piping: Placement of hangers and hanger inserts.

D. Section 23 23 00 - Refrigerant Piping: Placement of inserts.

1.03 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).

E. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

F. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

G. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2022.

H. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

I. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber; 2020.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

K. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.06 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER

A. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

B. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
   1. Maximum Service Temperature: 650 degrees F.
   2. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.

F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

G. Fibrous Glass Fabric:
   1. Cloth: Untreated; 9 oz/sq yd weight.
   2. Blanket: 1.0 lb/cu ft density.
   3. Weave: 5 by 5.

2.03 CELLULAR GLASS

A. Insulation: ASTM C552, Type II.
   1. 'K' Value: Grade 6, 0.35 at 100 degrees F.
   2. Service Temperature: Up to 800 degrees F.
   3. Water Vapor Permeability: 0.005 perm inch.
   4. Water Absorption: 0.5 percent by volume, maximum.

2.04 POLYETHYLENE

A. Insulation: Flexible closed-cell polyethylene tubing, slit lengthwise for installation, complying with applicable requirements of ASTM D1056.
   1. K Value: ASTM C177; 0.25 at 75 degrees F.
   2. Density: 2 lb/cu ft.
   3. Maximum Moisture Absorption: 1.0 percent by volume.
   4. Moisture Vapor Permeability: 0.05 perm inch, when tested in accordance with ASTM E96/E96M.

2.05 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature:
      a. 1 inch and below = 220F
      b. 1.5 and 2" = 300F
   3. Connection: Waterproof vapor barrier adhesive.

B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.06 JACKETS

A. PVC Plastic.
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 350 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 20 mil.

e. Connections: Brush on welding adhesive.

B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
1. Thickness: 0.016 inch sheet.
2. Finish: Embossed.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids above or below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

E. For all systems, provide and install removable blanket insulation jackets on all fittings and accessories not limited to, but including; valves, unions, flanges, strainers, flexible connections, and expansion joints, that require regular maintenance. Insulation shall be encased in an inner and outer jacket of Teflon impregnated fiberglass fabric rated at a temperature exceeding the pipe system design temperature. Manufacturer: Newtex, Zetex Plus or approved equal.

F. All elbows and fittings shall be pre-formed or mitered fitting and the same materials and thickness as the pipe insulation. Butt joints and seams are to be sealed with the manufacturer’s recommended adhesive. No substitution allowed. Failure to provide the same insulation thickness at elbows and fittings will require replacement by the contractor at no cost to the Owner.

G. All insulation ends shall be sealed waterproof, and end covers shall be stainless steel on systems over 140° F.

H. Elbows, Tees, and Fittings.
1. Provide mitered or nesting preformed insulation, wired in place with 20 gauge stainless wire.
2. Insulation shall be of the same type and thickness as required for the pipe. No substitution allowed. Failure to provide the same insulation at elbows and fittings will require replacement by the contractor at no cost to the Owner.
3. Joints or voids shall be filled and smoothed with insulating cement or tape as recommended by the manufacturer.
4. Deformation of insulation jackets by voids is not allowed and subject to replacement by the contractor at no cost to the owner.

I. Closed Cell insulated pipes conveying fluids below ambient temperature:
1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Pre-fabricated insulation elbows, tees, and fabricated covers for grooved fittings and couplings to reduce complex cutting and assembly of insulation in the field. Provides complete system integrity for thermal performance and controlling condensation drip from below-ambient systems when used as part of an Armaflex pipe insulation system. UL GREENGUARD Gold Certified for low VOC’s and includes Microban® antimicrobial protection from the growth of mold and mildew in the system.

J. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

K. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

L. Glass fiber insulated pipes conveying fluids above ambient temperature.

1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.

M. Inserts and Shields:
1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
6. ArmaFix EcoLight Pipe Supports: Pipe supports with a load-bearing PET core to support and protect the insulation from crushing or damage, maintaining the thermal integrity of the system and preventing thermal bridging. Armacell insulation is located on the outer part for connection to Armacell's Armaflex insulations. Matches all wall thickness and ID dimensions of Armacell's tube insulation offerings.

N. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.

O. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces : Finish with PVC jacket and fitting covers to 10ft above finished floor.

P. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing. 3M Ventureclad system is an acceptable alternatvie for aluminum jacket.

3.03 SCHEDULE

A. Heating Systems:
1. Heating Water Supply and Return (141°F to 200°F):
   a. Glass Fiber Insulation
      1) Pipe Size Range: 0 - 1-1/4 inch
         (a) Thickness: 1.5 inch
      2) Pipe size Range: 1-1/2 inch and up
         (a) Thickness: 2 inch
   b. Cellular Glass Insulation
      1) Pipe Size Range: 0 - 1-1/4 inch
         (a) Thickness: 1.5 inch
      2) Pipe size Range: 1-1/2 inch and up
         (a) Thickness: 2 inch

B. Refrigerant Suction:
1. Polyethylene Insulation
   a. Pipe Size Range: All
      1) Thickness: 1 inch
2. Flexible Elastomeric Cellular Insulation
   a. Pipe Size Range: All
      1) Thickness: 1 inch

END OF SECTION

SECTION 23 08 00
COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 SUMMARY

A. See Section 01 91 13 - General Commissioning Requirements for overall objectives; comply with the requirements of Section 01 91 13.

B. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

C. The Commissioning of this project is not a full blown commissioing effort but rather commissioning "light" to review the primary equipment and system functions.

D. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use. The CA is ISG.

E. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
   1. Building Automation Control system.
   2. Major and minor equipment items.
   3. Air Handling Units
   4. Exhaust Fans
   5. Variable Frequency Drives
   6. CO2 Sensors
   7. Hydronic Piping
   8. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

F. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

B. Section 01 79 00 - Demonstration and Training: Scope and procedures for Owner personnel training.

C. Section 01 91 13 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

D. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

E. Section 23 09 23 - Direct-Digital Control System for HVAC.

F. Section 23 09 93 - Sequence of Operations for HVAC Controls.

1.03 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - HVAC&R Technical Requirements for the Commissioning Process; 2007, with Errata (2012).

1.04 SUBMITTALS PROVIDED BY THE PRIMARY CONTRACTOR

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. All information is to be submitted in PDF format and be indexed.

C. Startup Reports: Submit for approval of Commissioning Authority.

D. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
   1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other

features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
2. Full as-built set of control drawings.
3. Full as-built sequence of operations for each piece of equipment.
4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
    a. Floor.
    b. Room number.
    c. Room name.
    d. Air handler unit ID.
    e. Reference drawing number.
    f. Air terminal unit tag ID.
    g. Heating and/or cooling valve tag ID.
    h. Minimum air flow rate.
    i. Maximum air flow rate.
5. Full print out of all schedules and set points after testing and acceptance of the system.
6. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
7. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
8. Control equipment component submittals, parts lists, etc.
9. Warranty requirements.
10. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
11. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the order given below. Submit as bookmarked PDF file format.
    a. Sequences of operation.
    b. Control drawings.
    c. Points lists.
    d. Controller and/or module data.
    e. Thermostats and timers.
    f. Sensors and DP switches.
    g. Valves and valve actuators.
    h. Dampers and damper actuators.
    i. Program setups (software program printouts).

E. Project Record Documents: See Section 01 78 00 for additional requirements.
1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

F. Draft Training Plan: In addition to requirements specified in Section 01 79 00, include:
1. Follow the recommendations of ASHRAE Guideline 1.1.
2. Control system manufacturer's recommended training.
3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.
4. Schedule two, two hour sessions during the warranty period that DPW engineering will manage and coordinate for the different entities that will be using the building’s BAS on post, namely Training site, DPW maintenance, and DPW engineering.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as

part of the work at no extra cost to Owner; such equipment, tools, and instruments will NOT become the property of Owner.

PART 3 EXECUTION

3.01 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.

D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.
   1. Include cost of sheaves and belts that may be required for testing, adjusting, and balancing.

F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

G. Provide temperature and pressure taps in accordance with Contract Documents.

3.02 INSPECTING AND TESTING - GENERAL

A. Submit startup plans and startup reports. Prefunctional Checklists for each item of equipment or other assembly to be commissioned are provided in this specification Index.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned are provided in this specification Index.

C. Provide two-way radios for use during the testing.

D. Valve/Damper Stroke Setup and Check:
   1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
   2. Set pump/fan to normal operating mode.
   3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
   4. Command valve/damper open; verify position is full open and adjust output signal as required.
   5. Command valve/damper to a few intermediate positions.
   6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).
   7. Closure for Heating Coil Valves - Normally Open:
      a. Set heating setpoint 20 degrees F above room temperature.
      b. Observe valve open.
      c. Remove control air or power from the valve and verify that the valve stem and actuator position do not change.
      d. Restore to normal.
      e. Set heating setpoint to 20 degrees F below room temperature.
      f. Observe the valve close.
      g. Restore to normal.

E. Coil Valve Leak Check:
   1. Coordinate with TAB contractor to accomplish this test.
   2. Method 1 - Water Temperature With 2-Way Valve:
      a. Calibrate water temperature sensors on each side of coil to be within 0.2 degree F of each other.

b. Turn off air handler fans, close outside air dampers. Keep pump running. Make sure appropriate coil dampers are open.
c. Normally closed valves will close.
d. Override normally open valves to the closed position.
e. After 10 minutes observe water delta T across coil. If it is greater than 2 degrees F (, leakage is probably occurring.
f. Reset valve stroke to close tighter.
g. Repeat test until compliance is achieved.

F. Isolation Valve or System Valve Leak Check: For valves not by coils.
1. With full pressure in the system, command valve closed.
2. Test to detect flow or leakage. Coordinate with TAB contractor to accomplish this test.

G. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.03 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of HVAC.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority. Functional testing procedures shall be written by the Commissioning Authority.

D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
1. The scope of trend logging is partially specified; trend log up to 20 percent more points than specified at no extra cost to Owner. Owner shall determine what data they would like to trend and coordinate with contractors as necessary.
2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
1. Setpoint changing features and functions.
2. Sensor calibrations.

G. Demonstrate to the Commissioning Authority:
1. That all specified functions and features are set up, debugged and fully operable.

2. That scheduling features are fully functional and setup, including holidays.
3. That all graphic screens and value readouts are completed.
4. Correct date and time setting in central computer.
5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.
6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.
7. Power failure and battery backup and power-up restart functions.
8. Global commands features.
9. Security and access codes.
10. Occupant over-rides (manual, telephone, key, keypad, etc.).
11. O&M schedules and alarms.
12. Occupancy sensors and controls.
13. All control strategies and sequences not tested during controlled equipment testing.

H. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.05 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 78 00 for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.06 DEMONSTRATION AND TRAINING

A. See Section 01 79 00 for additional requirements.

B. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

D. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the following minimum durations of training:

E. TAB Review: Instruct Owner's personnel for minimum 1 hours, after completion of TAB, on the following:
1. Review final TAB report, explaining the layout and meanings of each data type.
2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
5. Other salient information that may be useful for facility operations, relative to TAB.

F. HVAC Control System Training: Perform training in at least three phases:
1. Phase 1 - Basic Control System: Provide minimum of 1 hour min of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general

hardware architecture and functionality of the system.

a. This training will be held on-site or at an alternate location at Camp Dodge.

2. Phase 2 - Integrating with HVAC Systems (by TCC): Provide minimum of 1 hour min of on-site, hands-on training after completion of Functional Testing. Include instruction on:
   a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.
   b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
   c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.
   d. Every display screen, allowing time for questions.
   e. Point database entry and modifications.
3. Phase 3 - Post-Occupancy: Six months after occupancy conduct minimum of 1 hour of training. Tailor training session to questions and topics solicited beforehand from Owner. Also be prepared to address topics brought up and answer questions concerning operation of the system.

G. Provide the services of manufacturer representatives to assist instructors where necessary.

END OF SECTION

SECTION 23 09 23
DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Complete System of Automatic Controls.

B. Control Devices, Components, Wiring and Material.

C. Instructions for Owners.

D. Remodeling.

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Control Valves.

B. Temperature Sensor Sockets.

C. Gauge Taps.

D. Automatic Dampers.

1.03 REFERENCES

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2018.

B. IEEE 802.3 - IEEE Standard for Ethernet; 2022, with Amendment (2024).

C. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 volts Maximum).

D. ANSI/NFPA 70 - National Electrical Code.

E. ANSI/NFPA 90A - Installation of Air-Conditioning and Ventilation Systems.

F. ASHRAE 85 - Automatic Control Terminology for Heating, Ventilating, Air Conditioning.

G. ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.04 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.

1.05 ACRONYMS

A. Acronyms used in this specification are as follows:

BACnet	Building Automation and Control Networks
B-AAC	BACnet Advanced Application Controller
B-ASC	BACnet Application Specific Controller
BTL	BACnet Testing Laboratories
DDC	Direct Digital Controls
FMCS	Facility Management and Control System
GUI	Graphic User Interface
IBC	Interoperable BACnet Controller
IDC	Interoperable Digital Controller
LAN	Local Area Network
MS/TP	Master-Slave/Token-Passing
ODBC	Open DataBase Connectivity
OOT	Object Oriented Technology
OPC	Open Connectivity via Open Standards
OWS	Operator Workstation
PICS	Product Interoperability Compliance Statement

TCC	Temperature Control Contractor
TCS	Temperature Control System
WAN	Wide Area Network
WBI	Web Browser Interface
NCU	Network Control Unit
TCU	Terminal Control Unit
LCU	Local Control Unit

1.06 SUMMARY

A. Provide new standalone FMCS for this project.

B. The Installer, otherwise identified as the Temperature Controls Contractor (TCC), who is furnishing the Direct Digital Control (DDC) network shall meet with the Installers of the heating, ventilating and air-conditioning (HVAC) equipment and related products which are specified to be equipped with factory furnished unitary controllers to coordinate details between their HVAC equipment's unitary controllers and the DDC network. The Owner or his designated representative shall be present at this meeting. The purpose of this meeting shall be to insure there are no unresolved issues regarding the specified integration of the proposed HVAC equipment into the DDC network and overall control system performance. Each HVAC equipment Installer shall furnish to the Owner and all other Installers the details of their proposed control interfaces including but not limited to the hardware and software identifiers for interface points, control point mapping requirements, wiring requirements, communication speeds and network accessories. Required coordination efforts shall extend to any 3rd party integral control systems which are furnished with a BACnet interface for integration into the DDC system described within. Equipment and DDC controls submittals, including but not limited to those required under Part 3 section – "Sequences of Operation for HVAC" shall not be approved prior to the satisfactory completion of this coordination meeting.

1.07 SYSTEM DESCRIPTION

A. The entire TCS shall be comprised of a network of interoperable, standalone digital controllers communicating via BACnet MS/TP protocol to an NCU. Temperature Control System products shall be as specified below.

B. The FMCS shall include NCUs within each facility. The NCU shall connect to the Owner's local or wide area network, depending on configuration. Provide access to the system, locally in each building through standard Web browsers and/or via local area network. Coordinate all requirements for network access with the Owner.

C. Provide materials and labor necessary to connect factory supplied control components.

D. Provide central and remote hardware, software, and interconnecting wire and conduit. New, manufacturer approved wire shall be used for communication network. Coordinate with Iowa Army National Guard wire and cabling standards.

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. All licenses shall be open and turned over to the Owner. The front end controller shall be fully unlocked to allow programming, scheduling, and set point adjustments by the Owner and to allow the Owner the option to solicit alternate service contractors at the Owner's discretion.

H. 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.

I. TCC to extend CAT5 cable from NCUs to existing server. Coordinate all requirements with Owner.

J. All inputs and outputs (I/O) shall come from field-level controllers. Extended I/O from NCUs will not be allowed. Satellite points (unused I/O re-purposed through network programming) will not

be allowed unless approved by IANG project manager.

K. Field-level communication system shall utilize daisy-chained topography; no tees or star configuration. Communication layout shall be pre-approved by Owner prior to construction.

L. Graphics shall reside in appropriate NCU and shall be pre-approved by Owner. Graphics shall be complete prior to award of substantial completion.

M. This FMCS will communicate back the Distech Web Supervisor located at the Joint Forces Headquarters building in Johnston Iowa. The connection to the Web Supervisor will be performed by the Owner. This contractor shall assist the owner in this process and be responsible for any additional software or licenses necessary for that connection to take place.

N. Niagara version shall be revision 4.4. JACE platform user name and password shall be provided to Owner's HVAC Specialist. Embedded WorkBench shall be loaded and enabled on the system JACE(s).

O. Operating system shall be open ANSI/ASHRAE Standard 135-1995: BACnetTM - A Data Communication Protocol for Building Automation and Control Networks.

P. There is an existing BAS server which resides at JFHQ Camp Dodge. Network topographies that provide a local BAS server will not be allowed. BAS shall be connected to the Camp Dodge server.

Q. To prevent a confusing array of GUIs, standardization of graphics packages is mandatory and shall be DG-lux or Distech Envysion.

R. Graphics shall reside in the local JACE unless directed to save trend data in a separate SQL database. For Owner records JACE MAC address shall be provided. JACE primary port will be for the secure network (Guard network), the secondary port shall be enabled and its IP shall be set to 192.168.100.100.

S. Graphics shall include a time/date stamp for the JACE on the system home page. Graphics shall also include pages for sequence of operation for the equipment, Network topography with device address and location, and on systems with ductwork, a ductwork layout page shall also be included.

T. All installations shall include a point to point checkout with the results signed "verified" by the contractor and the results provided to the Owner."

U. JACE will have a surge protection device installed to protect the hardware in power quality events.

1.08 SUBMITTALS

A. Equipment Coordination:
   1. The Controls Contractor shall obtain approved equipment submittals from other contractors to determine equipment wiring connections, to choose appropriate controllers, and to provide programming.
   2. Control valve selections shall be based on flow rates shown in approved shop drawings.
   3. Coordinate the control interface of all equipment with the equipment manufacturers prior to submittal submission.

B. Shop Drawings:
   1. Submit in accordance with Section 01 33 05 - Electronic Submittal Procedures
   2. Cross-reference all control components and point names in a single table located at the beginning of the submittal with the identical nomenclature used in this section.
   3. Submittal shall also include a trunk cable schematic diagram depicting control panel locations and a description of the communication type, media and protocol.
   4. System Architecture: Provide riser diagrams of wiring between central control unit and all control panels. This shall include specific protocols associated with each level within the architecture. Identify all interface equipment between CPU and control panels.
   5. Diagrams shall include:
      a. Wiring diagrams and layouts for each control panel showing all termination numbers.
      b. Schematic diagrams for all control, communication, and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers' model numbers and functions. Show all interface wiring to the control system.
      c. Schematic diagrams for all field sensors and controllers.

d. A schematic diagram of each controlled system. The schematics shall have all control points labeled. The schematics shall graphically show the location of all control elements in the system.
e. A schematic wiring diagram for each controlled system. Each schematic shall have all elements labeled. Where a control element is the same as that shown on the control system schematic, label it with the same name. Label all terminals.
f. A tabular instrumentation list for each controlled system. The table shall show element name, type of device, manufacturer, model number and product data sheet number.
g. All installation details and any other details required to demonstrate that the system will function properly.
h. All interface requirements with other systems.
i. BAS subnet communication wiring routing.

6. The network infrastructure shall conform to the published guidelines for wire type, length, number of nodes per channel, termination, and other relevant wiring and infrastructure criteria as published. The number of nodes per channel shall be no more than 80% of the defined segment (logical or physical) limit in order to provide future system enhancement with minimal infrastructure modifications.
7. Sequences: Submit a complete description of the operation of the control system, including sequences of operation. The description shall include and reference a schematic diagram of the controlled system. The wording of the control sequences in the submittal shall match verbatim that included in the construction documents to ensure there are no sequence deviations from that intended by the Engineer. Clearly highlight any deviations from the specified sequences on the submittals.
8. Points List Schedule:
   a. Submit a complete points list of all points to be connected to the TCS and FMCS. The points list for each system controller shall include both inputs and outputs (I/O), point number, the controlled device associated with the I/O point, the location of the I/O device, and reference drawings. Where a control point is the same as that shown on the control system schematic, label it with the same name. Points list shall specifically identify alarms, trends, event history, archive, totalization, graphic points, and all mapped points from other systems. Provide point lists, point naming convention, and factory support information for systems provided and integrated into the FMCS.
9. Damper Schedule: Schedule shall include a separate line for each damper and a column for each of the damper attributes:
   a. Damper Identification Tag.
   b. Location.
   c. Damper Type.
   d. Damper Size.
   e. Duct Size.
   f. Arrangement.
   g. Blade Type.
   h. Velocity.
   i. Pressure Drop.
   j. Fail Position.
   k. Actuator Identification Tag.
   l. Actuator Type.
   m. Mounting.
10. Valve Schedule: Valve manufacturer shall size valves and create a valve schedule. Schedule shall include a separate line for each valve and a column for each of the valve attributes:
    a. Valve Identification Tag.
    b. Location.
    c. Valve Type.
    d. Valve Size.
    e. Pipe Size.
    f. Configuration.
    g. Flow Characteristics.

h. Capacity.
i. Valve CV.
j. Design Pressure Drop.
k. Pressure Drop at Design Flow.
l. Fail Position.
m. Close-off Pressure.
n. Valve and Actuator Model Number and Type.

C. Operation and Maintenance Manual:
1. Submit in accordance with Section 01 33 05 - Electronic Submittal Procedures and Section 01 78 00 - Closeout Submittals.
2. Each O&M manual shall include:
a. Table of contents with indexed tabs dividing information as outlined below.
b. Definitions: List of all abbreviations and technical terms with definitions.
c. Warranty Contacts: Names, addresses, and 24-hour telephone numbers of contractors installing equipment and controls and service representatives of each.
d. Licenses, Guarantees, and Warranties: Provide documentation for all equipment and systems.
e. System Components: Alphabetical list of all system components, with the name, address, and telephone number of the vendor.
f. Operating Procedures: Include procedures for operating the control systems; logging on/off; enabling, assigning, and reporting alarms; generating reports; collection, displaying, and archiving of trended data; overriding computer control; event scheduling; backing up software and data files; and changing setpoints and other variables.
g. Programming: Description of the programming language (including syntax), statement descriptions (including algorithms and calculations used), point database creation and modification, program creation and modification, and use of the editor.
h. Engineering, Installation, and Maintenance: Explain how to design and install new points, panels, and other hardware; recommended preventive maintenance procedures for all system components, including a schedule of tasks (inspection, cleaning, calibration, etc.), time between tasks, and task descriptions; how to debug hardware problems; and how to repair or replace hardware. A list of recommended spare parts.
i. Original Software: Complete original issue CDs for all software provided, including operating systems, programming language, and graphics software.
j. Software: One set of CDs containing an executable copy of all custom software created using the programming language, including the setpoints, tuning parameters, and object database.
k. Graphics: A glossary or icon symbol library detailing the function of each graphic icon and graphics creation and modification. One set of CDs containing files of all color graphic screens created for the project.

D. Training Manual:
1. Provide a course outline and training manuals for each training class.
2. TCC shall provide two, two hour training sessions during the warranty period that DPW engineering will manage and coordinate for the different entities that will be using the building’s BAS on post, namely Training site, DPW maintenance, and DPW engineering.

E. Record Documents:
1. Submit record documentation per Section 01 78 00 - Closeout Submittals.
2. Provide a complete set of “as-built” drawings and application software on CDs. Provide drawings as AutoCAD™ or Visio™ compatible files. Provide two copies of the “as-built” drawings with revisions clearly indicated in addition to the documents on compact disk. All as-built drawings shall also be installed on the FMCS server in a dedicated directory. Provide all product data sheets in PDF format.
3. Submit two hard copies and one electronic copy of as-built versions of the shop drawings, including product data and record drawings with revisions clearly indicated. Provide floor plans showing actual locations of control components including panels, thermostats, sensors, and hardware.

4. Testing and Commissioning Reports and Checklists: Provide completed versions of Testing and Commissioning Reports and Checklists, along with trend logs for each system identified in the points list and which are used to satisfy requirements of Part 3 subsection: “Control System Testing, Commissioning, Demonstration and Acceptance.
5. Submit printouts of all graphic screens with current values (temperatures, pressures, etc.) to the A/E verifying completion and proper operation of all points.
6. Installation Operation and Maintenance Manual (IOM): Coordinate if material is desired by Owner prior to submittal.
    a. Operation section of manual shall include detailed procedures for operating control systems such as: logging on and off, handling alarms, adding and modifying schedules, establishing data trending, producing point reports and trend logs, overriding computer controls, and revising set-points and adjustable system variables.
    b. Programming section of manual shall include detailed descriptions of programming languages and syntax for algorithms and calculations used, point database creation and modification, programming subroutines creation and modification and editor usage.
    c. Maintenance and Engineering section of manual shall show instructions on how to design, install, program and implement new points, panels and hardware; how to calibrate sensors, plan and accomplish preventative maintenance; how to diagnose and if needed repair or replace hardware. Preventative maintenance procedures shall include recommended schedules of required tasks such as inspections, cleanings and calibrations.
7. Listings of all initial set-points including allowable ranges of adjustments, initial time of day schedules, and notes for each controlled device.
8. Listing of Names, addresses, phone numbers of installing contractors and service technician representatives for equipment and control systems.

1.09 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 NCU, 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 System Integrator 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. ALL LICENSES OF THE ACTUAL HARDWARE BEING INSTALLED SHALL BE SUBMITTED TO THE OWNER FOR APPROVAL BEFORE ANY CONTROL SYSTEM HARDWARE IS INSTALLED

1.10 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.

1.11 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 QUALITY ASSURANCE

A. All new building automation system products on this project shall be provided by a firm that is a registered ISO 9001:2000 manufacturer at time of bid.

1. The manufacturer of the Building Automation System digital controllers shall provide documentation supporting compliance with ISO 9001:2000 (Model for Quality Assurance in Design/Development, Production, Installation and Servicing).
2. Provide a copy of the registration certificate that contains the ISO 9001:2000 Certification bearing the name of the registered auditor.

B. Control products such as direct digital controllers, control valves, actuators, sensors and transmitters shall be provided from a single manufacturer.

C. Provide product literature that bears the name of the manufacturer on all direct digital controllers, control valves, actuators, sensors and transmitters.

D. The Building Automation System shall be furnished, engineered, installed, tested and calibrated by factory certified technicians qualified for this work. The contractor shall have in place a support facility located within 70 miles, further with approval, of the project site with technical staff, spare parts inventory and all necessary test and diagnostic equipment. The contractor shall be a Factory Authorized System Integrator in good standing with the Manufacturer Factory trained technicians shall provide instruction, routine maintenance, and emergency service within 24 hours upon receipt of request.

E. Upon request, installer shall present records of successful completion of factory training courses including course outlines.

F. Upon request the installer shall provide a letter from the manufacturer that they are a Factory Authorized System Integrator in good standing.

G. The system integrator must employ a field staff of no less than 5 factory certified trained technicians, where their primary daily duties' are working on Building Automation Systems. These technicians must reside in the state of Iowa. Upon request names and addresses of these technicians will be provided before work begins.

H. Provide satisfactory operation without damage at 110% above and 85% below rated voltage and at 3 hertz variation in line frequency. Provide static, transient, and short circuit protection on all inputs and outputs. Communication lines shall be protected against incorrect wiring, static transients and induced magnetic interference. Bus connected devices shall be AC coupled, or equivalent so that any single device failure will not disrupt or halt bus communication.

I. TCC: Company specializing in the work of this section with minimum five years temperature control experience.

J. Technician: Minimum five years' experience installing commercial temperature control systems.

1.13 WARRANTY

A. Refer to Section 01 78 00 - Closeout Submittals 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.

1.14 WARRANTY ACCESS

A. The Owner shall grant to this Contractor reasonable access to the TCS and FMCS during the warranty period.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide a building automation system consisting of Distech EC-NET Tridium Niagara N4 platform with EC-BOS or ECLPYSE line of field controllers supplied by a company regularly engaged in the manufacturing and distribution of building automation systems. The BAS Manufacturer shall meet the following qualifications as a minimum:
1. The manufacturer of the hardware and software components must be primarily engaged in the manufacture of building automation systems as specified herein, and must have

been so for a minimum of five (5) years.

2. The manufacturer of the hardware and software components as well as its subsidiaries must be a member in good standing of BACnet International.
3. At least 75% of the manufacture product line shall be produced under their own direction, including R&D and assembly. Rebranding of another manufacture product shall not qualify.
4. The manufacturer of the hardware and software components shall have a technical support group accessible via a toll free number that is staffed with qualified personnel, capable of providing instruction and technical support service for networked control systems.
5. THIS CONTRACTOR MUST HAVE A DIRECT FACTORY RELATIONSHIP WITH DISTECH CONTROLS

2.02 SYSTEM ARCHITECTURE

A. The Building Automation System (BAS) shall be comprised of Network Control Units (NCU) connected to the Building Automation System local area network (BAS LAN). Access to the BAS, either through a Workstation on the BAS LAN, within the building or remotely through the Internet, shall be accomplished through a standard Web browser. Each NCU shall communicate to BTL Listed BACnet controllers provided under the Programmable Controllers section. The system includes Network Control Unit(s) (NCU), software and programming of the NCU, Operator Workstation(s) (OWS) software and hardware, development of all graphical screens, setup of schedules, trends, logs and alarms, network management and connection of the NCU to the local area network.

B. The system shall consist of a network of Network Control Units (NCUs), interoperable Local Control Units (LCUs) and Terminal Control Units (TCUs) (VAV Box Controllers, Fan Coil Unit Controllers, etc.). All controllers for terminal units, air handling units (AHU) and controllers shall communicate and share data, utilizing BACnet MS/TP communications protocol only and be provided by the DDC contractor. No packaged controllers that need integrated to the BAS will be allowed. Also no IP based point or field controllers will be allowed.
   1. Packaged ECM fan array controllers on AHU shall be allowed for integration of fan controls. Connection to network shall utilize BACnet MS/TP communications protocol only.

C. The intent of this specification is to provide a distributed and networked open Building Automation System, the capability to integrate ANSI/ASHRAE Standard 135, BACnet and ISO/IEC 14908-1: Open Data Communication in Building Automation, Controls and Building Management – Control Network Protocol into a unified system in order to provide flexibility for expansion, maintenance, and service of the system.

D. BACnet system must be tested and listed on BACnet Testing Laboratory (BTL) web site. Systems based on vendor specific proprietary hardware or software will not be considered for this project.

E. Systems utilizing gateways will not be considered for this project. A gateway is considered to be a device or controller where the sole function is mapping of data points from one protocol to another.

F. The BAS shall utilize BACnet/IP (ASHRAE Standard 135, Annex J) for communication between NCUs. Manufacturer specific proprietary protocols, gateways, or protocol converters are not acceptable for this project. The Server and Operator Workstation (OWS) shall communication to the NCUs utilizing standard Ethernet to IEEE 802.3 Standards. Any break in the BAS LAN between NCU and Server or OWS shall result in an alarm notification at the OWS and Server.

G. The supplied system software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI/ASHRAE Standard 135, BACnet to assure interoperability between all system components is required.

H. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a flat single tiered architecture shall not be acceptable. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 10 seconds for network connected user interfaces. 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.

I. User Access - The supplied system must incorporate the ability to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs.

J. 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 shall not be acceptable.

K. Software Tools - All software tools needed for full functional use, including programming of controllers, network management and expansion, and graphical user interface use and development, of the BAS described within these specifications shall be provided to the owner or his designated agent. Any licensing required by the manufacturer now and to the completion of the warranty period, including changes to the licensee of the software tools and the addition of hardware corresponding to the licenses, to allow for a complete and operational system for both normal day to day operation and servicing shall be provided. Any such changes to the designated license holders shall be made by the manufacturer upon written request by the owner or his agent. Any cost associated with the license changes shall be identified within the BAS submittals.

2.03 DYNAMIC DATA ACCESS

A. All operator devices shall have the ability to access all point status and application report data, or execute control functions for any and all other devices via the local area network. Access to data shall be based upon logical identification of building equipment.

2.04 NETWORKS

A. Design for the Network LAN (NCU LAN) shall include the following provisions:
   1. The network LAN shall utilize BACnet/IP (ASHRAE Standard 135, Annex J) for communication between NCUs. Manufacturer specific proprietary protocols, gateways, or protocol converters are not acceptable for this project. The Server shall communicate to the NCUs utilizing standard Ethernet to IEEE 802.3 Standards. Products utilizing BACnet over ARCnet technology are not acceptable for this project.
   2. High-speed data transfer rates for alarm reporting, quick report generation form multiple controllers and upload/download efficiency between network devices.
   3. Support of any combination of controllers directly connected to the local area network. A minimum of 50 devices shall be supported on a single local area network.
   4. Detection and accommodation of single or multiple failures of workstations, controller panels and the network media. The network shall include provisions for automatically reconfiguring itself to allow all operational equipment to perform their designated functions as effectively as possible in the event of single or multiple failures.
   5. Message and alarm buffering to prevent information from being lost.
   6. Error detection, correction, and retransmission to guarantee data integrity.
   7. Default device definition to prevent loss of alarms or data, and ensure alarms are reported as quickly as possible in the event an operator device does not respond.
   8. Commonly available, multiple sourced, networking components shall be used to allow the system to coexist with other networking applications such as office automation. ETHERNET to IEEE 802.3 standard is the only acceptable technology.
   9. Synchronization of the real-time clocks in all NCU panels shall be provided.
   10. The NCU LAN shall be a 100 Megabits/sec Ethernet network supporting BACnet for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Control Units (NCUs), user workstations and where specified, a local server. Local area network minimum physical and media access requirements:
       a. Ethernet; IEEE standard 802.3
       b. Cable; 100 Base-T, UTP-8 wire, category 5
       c. Minimum throughput; 100 Mbps
   11. Provide access to the NCU LAN from a remote location, via the Intranet or Internet. The owner shall provide (in future) a connection to the Internet to enable access via high-speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line, T1 Line or access to an Internet Service Provider (ISP). If required, the owner will provide a switch/firewall between the building LAN and the NCU LAN. Through this connection the

NCU LAN will provide authorized staff with the ability to monitor and control the BAS from a remote location through a web browser, cellular phone, pager, web-enabled media players, or PDA. (Pocket Computer).

B. Design for the Building Automation System LAN (LCU and TCU LAN) shall include either or both of the following BACnet architecture provisions:
   1. The BAS must be based on Open Systems. BAS shall employ the BACnet protocol for communication between controllers. BACnet protocol implementation shall adhere to the ANSI/ASHRAE Standard 135. Communications between BACnet devices shall be 38.4 kbps over approved twisted shielded pair cabling utilizing Master/Slave Toke Passing BACnet protocol. BACnet defines a comprehensive set of object types and application services for communication requirements among all levels of control in a distributed, hierarchical Building Automation System. BACnet is intended to provide a single, uniform standard for the BAS to provide the required interoperability.

2.05 UNINTERRUPTABLE POWER SUPPLIES

A. Provide the OWS and each NCU with individual UPS to provide clean, reliable, noise-filtered power at all times and to protect and maintain systems operation throughout short term power interruptions of up to 15 minutes duration. Approved UPS manufacturer: APC.

2.06 GRAPHIC USER INTERFACE COMPUTER HARDWARE (DESKTOP)

A. Provide a browser workstation with a dual core Intel Pentium processor with a minimum processing speed of 3.0 GHz with 2.0 GB RAM and a 120-gigabyte minimum hard drive. It shall include a DVD-ROM/CD-RW combination drive, one parallel port, one asynchronous serial port and four USB ports. Include a 19" minimum flat panel color monitor, 8 ms response time.

B. Connect to the FMCS network via a 10 Mbps Ethernet network interface card.

C. This workstation shall be connected to the secondary network of the NCU.

2.07 OPERATOR WORKSTATION SOFTWARE

A. Operating System: Provide Operator Workstation software at OWS in the building engineer's office and on the server. The software shall run on Microsoft Windows 10.

B. The software 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-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and 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. Real-Time Displays. The OWS, shall at a minimum, support the following graphical features and functions:
   1. Graphic screens shall be developed using GIF, PNG, JPG or ICO file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.
   2. Graphic screens shall have the capability 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 one a layer. A minimum of six layers shall be supported.

D. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.

E. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.

F. Right-clicking the selected object and using a graphical slider to adjust the value shall make adjustments to analog objects, such as set points. No entry of text shall be required.

G. System Configuration. At a minimum, the OWS shall permit the operator to perform the following tasks, with proper password access:
   1. Create, delete or modify control strategies.
   2. Add/delete objects to the system.
   3. Tune control loops through the adjustment of control loop parameters.
   4. Enable or disable control strategies.
   5. Generate hard copy records or control strategies on a printer.
   6. Select points to be alarm-able and define the alarm state.
   7. Select points to be trended over a period of time and initiate the recording of values automatically.

H. 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 through the use of hypertext. All system documentation and help files hall be in HTML format.

I. Security. Each operator shall be required to log on to that system with a user name and password in order to view, edit add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.

J. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciate to the operator.

K. Alarm Console. The system shall be provided with 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 acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator. 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 shall not be acceptable.

L. Operator's workstation software shall contain an easy-to-operate system; allowing configuration of system-wide controllers, including management and display of the controller programming. This system shall provide the capability to configure controller binary and analog inputs/outputs.

M. The system shall be capable of utilizing third-party Windows-based programs for such things as spreadsheet analysis, graphing, charting, custom report generation, and graphics design packages. Graphics generation shall be done using standard Windows packages. No proprietary graphics generation software shall be needed.

N. Provide software, which enables the non-programmer operator to easily perform, tasks which are likely to be part of his daily routine.

O. The operator's console shall provide facilities for manual entries and visual displays enabling an operator to enter information into the system and obtain displays and logs of system information. All requests for status, analog, graphic displays, logs, and control shall be selected from the operator's console. The operator interface shall minimize the use of typewriter style keyboard by implementing a mouse or similar pointing device and "point and click" approach to command selection. The facility shall be provided to permit the operator to perform the following tasks:
   1. Automatic logging of digital alarms and change of status message.
   2. Automatic logging of all analog alarms.
   3. System changes (alarm limits, set-points, alarm lock-outs, etc.).
   4. Display specific points as requested by the operator.
   5. Provide reports as requested by the operator and on Scheduled basis where so required.
   6. Display graphics as requested by the operator.

7. Display help information.
8. Provide trend logs as required by the operator.
9. Provide manual control of digital and analog outputs as required by the operator.
10. Direct the hard copy output of information to the device selected by the operator.
11. Data displayed on monitor to cyclic update as appropriate.

P. Online changes:
1. Alarm limits
2. Setpoints
3. Deadbands
4. Changes/deletions/additions of points.
5. Control and change of state changes.
6. Time of day, day, month, year.
7. Control loop control description changes for NCU based CDM's.
8. Control loop tuning changes
9. Schedule changes
10. Changes/additions/deletions to system graphics
11. Changes/additions/deletions to total systems

Q. It shall be possible for the OWS operator to initiate analog and digital output commands. Where the BAS software normally originates these outputs, the provision shall exist for the operator to terminate automatic BAS control of any particular output and to originate a manual analog or digital output command. The provision shall exist for the operator to return analog or digital output command functions to automatic BAS software control.

R. It shall be possible for the OWS operator to place any computed system setpoint to a computed basis as and when required.

S. All above functions shall operate under the password protection system.

T. A vocabulary of at least 25 different descriptions using at least six alphanumeric characters to identify engineering units for analog input and output points. Typical description is as follows: %, DegC, KPA, KW, KWH, L/S, CFM, DegF, and PSI. The descriptions shall be alterable from the OWS console with the system on-line.

U. Upon operator's request, the system shall present the condition of any single point, any system, and area or the whole system. The output device shall be by operator's choice (printer or workstation screen). Analog values and status displayed shall be updated whenever new values are received. Points in alarm shall be flagged by blinking, inverse video different color, bracketed, or by some other means to differentiate them from points not in alarm.

V. Error Messages:
1. Inform operator of all errors in data, errors in entry instructions, failure of equipment to respond to requests or commands, or failure of communications between components of FMCS.
2. Error messages to be comprehensive and communicate clearly to operator precise nature of problem.

W. Password Protection:
1. Provide security system that prevents unauthorized use unless operator is logged on. Access shall be limited to operator’s terminal functions unless user is logged on. This includes displays as outlined above.
2. Each operator’s workstation shall provide security for 100 users minimum. Each user shall have an individual User ID, User Name and Password. Entries are alphanumeric characters only and are case sensitive (except for User ID). User ID shall be 8 characters, User Name shall be 29 characters, and Password shall be 8 characters long. Each system user shall be allowed individual assignment of only those control functions and menu items to which that user requires access. All passwords, user names, and access assignments shall be adjustable online at the operator’s terminal. Each user shall also have a set security level, which defines access to displays and individual objects the user may control. System shall include 10 separate and distinct security levels for assignment to users.

X. Trend Data:

1. System shall periodically gather historically recorded selected samples of object data stored in the field equipment (global controllers, field controllers) and archive the information on the operator's workstation (server) hard disk. Archived files shall be appended with new sample data, allowing samples to be accumulated over several years. Systems that write over archived data shall not be allowed, unless limited file size is specified. Samples may be viewed at the operator's terminal in a trend log. Logged data shall be stored in spreadsheet format. Operator shall be able to scroll through all trend log data. System shall automatically open archive files as needed to display archived data when operator scrolls through the data vertically. All trend log information shall be displayed in standard engineering units.
2. Software shall be included that is capable of graphing the trend logged object data. Software shall be capable of creating two-axis (x,y) graphs that display up to six object types at the same time in different colors. Graphs shall show object type value relative to time.

Y. Operator shall be able to change trend log setup information as well. This includes the information to be logged as well as the interval at which it is to be logged. All input, output, and value object types in the system may be logged. All operations shall be password protected. Setup and viewing may be accessed directly from any and all graphics object is displayed on.

Z. Alarms:
1. Operator's terminal shall provide audible, visual, and printed means of alarm indication. The alarm dialog box shall always become the top dialog box regardless of the application(s), currently running (such as a word processor). Printout of alarms shall be sent to the assigned terminal and port.
2. System shall provide log of alarm messages. Alarm log shall be archived to the hard disk of the system operator's terminal. Each entry shall include a description of the event-initiating object generating the alarm, time and date of alarm occurrence, time and date of object state return to normal, and time and date of alarm acknowledgement.
3. Alarm messages shall be in user-definable text English or other specified language) and shall be entered either at the operator's terminal or via remote communication.

AA. Scheduling:
1. Operator's terminal display of weekly schedules shall show all information in easy-to-read 7-day (weekly) format for each schedule. This includes all ON/OFF times (to the minute) for each day's events.
2. Exception schedules (non-normal schedules, such as holidays or special events) shall display all dates that are an exception to the weekly schedules. These specialty schedules shall be displayed at the operator's terminal in a format similar to the weekly schedules, again allowing easy data entry. Exception schedule data is entered by the following methods: date entries (one day entries), date-to-date (a range or span of days), and by weekday (for example, a given day of a given week each month). User shall be able to scroll easily through the months for each year as a minimum.
3. At the operator's terminal, the system user shall be able to change all information for a given weekly or exception schedule if logged on with the appropriate security access.

BB. Archiving:
1. Store backup copies of all controller databases in at least one OWS and the server.
2. Provide continuous supervision of integrity of all controller databases. If controller loses database, system to automatically download new copy of database to restore proper operation.
3. Data base back up and downloading to occur over LAN without operator intervention. Operator to be able to manually download entire controller database or parts thereof.

CC. Reports:
1. Provide a report facility to generate and format for display, printing, or permanent storage, as selected by the operator, the reports as specified in this section. If display output is requested, it shall be scrollable; scroll bars will be used to allow easy and flexible movement within the report. Output to be sorted by area, system point.
2. Periodic/Automatic Report: Provide the software to automatically generate any report specified, the user will be able to specify the type of report, start time and date, interval between reports (hourly, daily, weekly, monthly) and output device. The software will

allow the operator to modify the periodic/automatic reporting profile at any time.

3. As a minimum, the following reports shall be configured on the system:
   a. Dynamic Reports: To allow operator to request a display of the dynamic value for the user specified points which shall indicate the status at the time the request was entered and updated at an operator modifiable scan frequency. It shall be possible to select points on the following basis:
      1) All points in all areas
      2) Area (all points in area)
      3) Area system (all points in system)
      4) Area system point (individual point)
      5) System (all points by system and point type)
      6) System point (all points by system and point type)
      7) Area point (all points by area and point type).
   b. Summary Report: To permit the display or printing the dynamic value for the user specified points which shall indicate the status at the time the CLM was entered. Reports to be available on same basis as dynamic reports. Output will be to the user selected output device.
   c. Trend Reports: To permit the trending of points selected by the operator, including as a minimum digital input and output, analog input and output, set points, and calculated values.
   d. Historical Data Collection: Provision shall be made to ensure historical data is not lost. The ability to off-load historical data to removable media, and to later load data previously backed-up, will be provided. Historical data values, for an operator specified time range and for operator specified points, may be output the same as for trend data.
   e. Critical Alarm Summary: Provide a summary of those points in the critical alarm state and include as a minimum; point acronym, point description, alarm type, limit exceed, current value, alarm type, time and date of occurrence.
   f. Maintenance Alarm Summary: Provide a summary of those points in maintenance alarm and include as a minimum; point acronym, point description, current value, alarm type, limit exceed, time and date of occurrence.
   g. Alarm Summary: Provide a summary of all points in alarm and include as a minimum; point acronym, point description, current value, alarm type, limit exceeded, and time and date of occurrence.
   h. Disable Point Summary: Provide a summary of all points in the disabled state and include as a minimum point acronym and point description.
   i. Run Time Summary: Provide a summary of the accumulated running time of selected pieces of equipment with point acronym and description, run time to date, alarm limit setting. The run time shall continue to accumulate until reset individually by means of suitable operator selection.
   j. Schedule Summary: Provide a summary of all schedules and indicate as a minimum, which days are holidays and, for each section, the day of the week, the schedule times and associated values; for digital schedules value will be on or off; for analog schedules value will be an analog value.
   k. User Record Summary: Provide a summary of all user records to include as a minimum; user name, password, initials, command access level and point groups assigned.

2.08 UTILITY SOFTWARE

A. Supply and install software products to allow the owner to access and manipulate the control schematic diagrams, and to access product data sheets in an electronic format.

B. Enter all soft copy submissions; including "Record" drawings as specified herein Shop Drawings, Product Data and Review Process in OWS.

2.09 GRAPHICAL USER INTERFACE SOFTWARE

A. A software tool that provides for the development and management of the end user’s Graphical User Interface (GUI) and as the primary point of access to the BAS for the end user. All Distech EC-NET Tridium Niagara AX JACE products installed must incorporate the embedded workbench toolset and open licenses.

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-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and 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. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:
   1. Graphic screens shall be developed using any drawing package capable of generating or assembling objects from a GIF, JPG, PNG or ICO file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.
   2. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.
   3. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
      a. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
      b. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
   4. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
   5. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.

D. System Configuration. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:
   1. Create, delete, or modify control strategies.
   2. Add/delete objects to the system.
   3. Enable or disable control strategies.
   4. Control loop tuning through the adjustment of control loop parameters.
   5. Generate hard copy records or control strategies on a printer.
   6. Select points to be alarm-able and define the alarm state.
   7. Select points to be trended over a period of time and initiate the recording of values automatically.

E. 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 through the use of hypertext. All system documentation and help files shall be in HTML format.

F. Security. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.

G. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.

H. Alarm Console and Alarms:
   1. The system will be provided with 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 acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator.

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 shall not be acceptable.

2.10 WEB BROWSER CLIENTS

A. The primary means of access to the BAS for day to day operation from any PC connected to the LAN (and or remote via the Internet if so required) without the need for any proprietary software.

1. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Microsoft Edge or Mozilla Firefox™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable. As a minimum provide the capability of 32 web browser clients that can simultaneously access the system.
2. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the Building Automation System (BAS), shall not be acceptable.
3. 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 Graphical User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.
4. The Web browser client shall support at a minimum, the following functions:
    a. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
    b. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.
    c. HTML programming shall not be required to display system graphics or data on a Web page
    d. Storage of the graphical screens shall be in the Network Control Unit (NCU), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
    e. Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.
    f. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
        1) Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
        2) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
        3) Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
        4) Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
        5) View logs and charts
        6) View and acknowledge alarms
    g. The system shall provide the capability 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 their 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.

h. 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.

2.11 BUILDING AUTOMATION SYSTEM CONTROLLERS - NETWORK CONTROL UNIT (NCU)

A. The Network Control Unit (NCU) shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NCU.

B. The NCU shall be capable of executing application control programs to provide:
   1. Calendar functions
   2. Scheduling
   3. Trending
   4. Alarm monitoring and routing
   5. Time synchronization
   6. Integration of BACnet MS/TP and BACnet/IP controllers as well as their BACnet objects
   7. Network Management functions for all BACnet MS/TP and BACnet/IP based devices
   8. Host graphics

C. The Network Control Unit must provide the following hardware features as a minimum:
   1. One Ethernet Port -10 / 100 Mbps
   2. One RS-485 port
   3. Battery Backup
   4. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a Type SSD (Solid State Drive) hard disk with at least 1 terabyte (TB) storage capacity)
   5. The NCU must be capable of operation over a temperature range of 32 to 122°F
   6. The NCU must be capable of withstanding storage temperatures of between 32 to 140°F and a humidity range of 5 to 95% RH, non-condensing
   7. A modem port and 56K modem. Exempt if remote access is provided via the Internet

D. The NCU shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the NCU shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.

E. Provide multiple Network Control Units as necessary. The NCU shall support a minimum of 128 BACnet controllers. In order to maintain peak performance of the network, no more than 110 BACNet controllers may be connected to a single NCU. In any event no more than 80% of the available resources of the NCU (as indicated by the resource meter of the programming tools for the NCU) shall be committed. In the event that the available resources are less than 20%, the number of nodes connected to the NCU shall be reduced in order to maintain a 20% or greater buffer of resources within the NCU.

F. The NCU shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 32 simultaneous users.

G. Event Alarm Notification and actions - The NCU shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers. The NCU shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up, telephone connection, or wide-area network.
   1. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:
      a. To alarm
      b. Return to normal
      c. To fault
   2. Provide for the creation of a minimum of eight of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
   3. Provide timed (schedule) routing of alarms by class, object, group, or node.
   4. 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. Control equipment and network failures shall be treated as alarms and annunciated.

5. Alarms shall be annunciated in any of the following manners as defined by the user:
    a. Screen message text
    b. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
        1) Day of week
        2) Time of day
        3) Recipient
    c. Pagers via paging services that initiate a page on receipt of email message
    d. Graphic with flashing alarm object(s)
    e. Printed message, routed directly to a dedicated alarm printer
6. The following shall be recorded by the NCU for each alarm (at a minimum):
    a. Time and date
    b. Location (building, floor, zone, office number, etc.)
    c. Equipment (air handler #, access way, etc.)
    d. Acknowledge time, date, and user who issued acknowledgement.
    e. Number of occurrences since last acknowledgement.
7. Alarm actions may be initiated by user defined programmable objects created for that purpose.
8. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
9. A log of all alarms shall be maintained by the NCU and/or a server (if configured in the system) and shall be available for review by the user.
10. Provide a “query” feature to allow review of specific alarms by user defined parameters.
11. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
12. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

2.12 DATA COLLECTION AND STORAGE

A. The NCU shall have the ability to collect data for any property of any object and store this data for future use.

B. The data collection shall be performed by log objects, resident in the NCU that shall have, at a minimum, the following configurable properties:
    1. Designating the log as interval or deviation.
    2. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
    3. For deviation logs, the object shall be configured 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.

C. All log data shall be stored in a relational database in the NCU and the data shall be accessed from a server (if the system is so configured) or a standard Web Browser. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements. All log data shall be available to the user in the following data formats:
    1. HTML
    2. XML
    3. Plain Text
    4. Comma or tab separated values

D. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.

E. The NCU shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NCU on the network. Provide the ability to configure the following archiving properties, at a minimum:
    1. Archive when the log has reached its user-defined capacity of data stores

2. Archive on time of day
3. Archive on user-defined number of data stores in the log (buffer size)
4. Provide ability to clear logs once archived

F. Audit Log - Provide and maintain an Audit Log that tracks all activities performed on the NCU. 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 NCU), to another NCU 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.

2.13 DATABASE BACKUP AND STORAGE

A. The NCU shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval. Copies of the current database and, at the most recently saved database shall be stored in the NCU. The age of the most recently saved database is dependent on the user-defined database save interval. The NCU database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

B. Provide three (3) copies of all tools necessary for the development, maintenance, expansion and use of the BAS described within these specifications. All software tools shall be compatible with Microsoft Windows 7 or XP Professional. For the purpose of this specification software tools shall be divided into the following categories and meet these specified requirements.

2.14 NCU PROGRAMMING WIZARDS FOR LCU/TCU CONTROLLERS

A. Provide Wizards or objects that facilitate the programming and configuration of the Local Control Unit (LCU) and Terminal Control Unit (TCU) Controllers sequence of operation through a menu driven wizard. The programming and configuration tools shall perform the following functions:
1. LCU Controllers programming shall be accomplished by Graphical Programming Language (GPL) where objects are used to define different portions of the control sequence. All control sequences programmed into the controller shall be stored in non-volatile memory. Systems that only allow selection of sequences from a library or table are not acceptable. All code must be exportable to a library for future use.
2. TCU Controllers – Provide for the programming of the required sequence of operation through an intuitive menu driven selection process. The configuration tools menu shall define items such as I/O configurations, set point, delays, PID loops, optimum start stops, and network variables settings. The configuration tool must indicate the device status and allow system override. Or, provide for the programming of the required sequence of operation through Graphical Programming Language (GPL) where objects are used to define different portions of the control sequence. All control sequences programmed into the controller shall be stored in non-volatile memory. Systems that only allow selection of sequences from a library or table are not acceptable. All code must be exportable to a library for future use.
3. Wizards shall be openly available and be compatible with the current published versions of the network management tool that is provided as part of this project. The wizard software shall be available for public access from the manufacturer's web site. These wizard programming or configuration tools shall be compatible with at least 3 other manufactures Building Automation System (BAS). The System Integrator shall demonstrate as part of their prequalification as to how they intend to comply with these requirements. Should wizards as specified herein not be available then the System Integrator shall provide the following:
4. Provide three copies of the programming or configuration tools along with any manufacture specific software tools required to operate the programming or configuration tools. Such tools shall be provided with a permanent and operating system transferable license.
5. Provided free of charge to the owner or his designated agent for a period of 10 years the latest manufacturer's updates to the software described herein.

2.15 NCU NETWORK MANAGEMENT SOFTWARE TOOLS

A. Provide a complete set of Network Management tools that provides for the development and management of BACnet networks.

B. Provide a complete set of integrated BACnet network management tools for working with these networks. These tools shall manage a database for all BACnet devices by type and revision, and shall provide a software mechanism for identifying each device on the network. Systems requiring the use of third party BACnet network management tools shall not be accepted.

C. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.

D. The network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.

E. These tools shall provide the ability to “discover” existing BACnet networks, regardless of what network management tool(s) were used to install the existing network, so that existing BACnet devices and newly added devices are part of a single network management database.

F. The network management database shall be resident in the NCU with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, within the control system, shall not be accepted.

G. Provide for the ability to access all of the Network Management tool functions including controller programming from a Web Browser.

2.16 NCU PROGRAMMING SOFTWARE

A. Provide programming software for the Network Control Unit that allows for the development of the NCU control logic, point management, global properties such as alarm, trend and scheduling.

B. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Access to these functions shall be provided through Graphical User Interface software (GUI). Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is 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. Systems requiring separate software tools or processes to create applications and user interface displays shall not be acceptable.

C. Programming Methods - Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user’s application. Objects shall be linked by a graphical 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; i.e., internal, external, hardware, etc.
   1. Configuration of each object will 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 will not be accepted.
   2. The software shall provide the ability to view the logic in an 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.
   3. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database objects shall not be allowed.
   4. The system shall support object duplication within a customer’s database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

D. NCU Object Library:

1. A standard library of software objects that represent functions and applications for the 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 supplier of the system 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.
    a. All control objects shall conform to the control objects specified in the ANSI/ASHRAE Standard 135-2008 BACnet specification.
    b. The library shall include applications or objects for the following functions, at a minimum:
        1) Scheduling Object. The schedule must conform to the schedule object as defined in the BACnet specification, providing 7-day plus holiday & temporary scheduling features and a minimum of 10 on/off events per day. Data entry to be by graphical sliders to speed creation and selection of on-off events.
        2) 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 graphical "point-and-click" selection. This object must be "linkable" to any or all scheduling objects for effective event control.
        3) Duty Cycling Object. Provide a universal duty cycle object to allow repetitive on/off time control of equipment as an energy conserving measure. Any number of these objects may be created to control equipment at varying intervals
        4) Temperature Override Object. Provide a temperature override object that is capable of overriding equipment turned off by other energy saving programs (scheduling, duty cycling etc.) to maintain occupant comfort or for equipment freeze protection.
        5) Start-Stop Time Optimization Object. Provide a start-stop time optimization object to provide the capability of starting 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 un-occupancy 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 the previous day's performance.
    c. The library shall include control objects for the following functions. All control objects shall conform to the objects as specified in the BACnet specification.
        1) 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.
        2) Analog Output Object - Minimum requirement is to comply with the BACnet standard for data sharing. The BACnet Command Prioritization priority scheme shall be incorporated to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide sixteen levels of priority as a minimum. Systems not employing the BACnet method of contention resolution shall not be acceptable.
        3) 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.
        4) 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 inter-start delay must be provided. The BACnet Command Prioritization priority scheme shall be incorporated to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide sixteen levels of priority as a minimum. Systems not employing the BACnet method of contention resolution shall not be acceptable.

5) Multi-State Input Object - Minimum requirement is to comply with the BACnet standard for data sharing.
6) Multi-State Output Object - Minimum requirement is to comply with the BACnet standard for data sharing. The BACnet Command Prioritization priority scheme shall be incorporated to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide sixteen levels of priority as a minimum. Systems not employing the BACnet method of contention resolution shall not be acceptable.
7) PID Control Loop Object - Minimum requirement is to comply with the BACnet standard for data sharing. Each individual property must be adjustable as well as to be disabled to allow proportional control only, or proportional with integral control, as well as proportional, integral and derivative control.
8) 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. Allow a minimum of two analog objects to be compared using comparators and return a True/False value. The following comparators shall be supported as a minimum: equal, not equal, greater than, less than, greater or equal, less or equal. Also, allow limits to be applied to the output value for alarm generation.
9) 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. Allow mathematical operation on a minimum of two analog objects. The following mathematical operators shall be supported as a minimum: add, subtract, multiply, divide, sine, cosine, tangent, logarithm, natural logarithm, square root, power and absolute value.
10) Logic Object - Allow a minimum of two binary objects to be compared using Boolean comparator. The following comparators shall be supported as a minimum: And, Or, X or and Not.
11) 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 standard programming language that is used to define object behavior. Provide a library of functions including math and logic functions, string manipulation, and e-mail as a minimum. 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 re-use.
12) 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.
13) The object library shall include objects to support the integration of devices connected to the Network Control Unit (NCU). At a minimum, provide the following as part of the standard library included with the programming software:
    (a) For BACnet devices, provide the following objects at a minimum:
        (1) Analog Input
        (2) Analog Output
        (3) Analog Value
        (4) Binary Input
        (5) Binary Output
        (6) Binary Value
        (7) Multi-State Input
        (8) Multi-State Output
        (9) Multi-State Value

(10) Schedule Export
(11) Calendar Export
(12) Trend Export
(13) Device
(14) Loop

(b) For each BACnet object, provide the ability to assign the object a BACnet device and object instance number.

(c) For BACnet devices, provide the following services 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 Routing

2.17 BUILDING AUTOMATION SYSTEM CONTROLLERS - GENERAL

A. Refer to Building Automation System PART 1 – GENERAL REQUIREMENTS with the following clarifications and additions.

B. Performance requirements of the Programmable Controllers are specified in this section.

C. All controllers provided as part of this system and used for indoor applications shall operate under ambient environmental conditions of 32°F to 122°F dry bulb and 5% to 90% relative humidity, non-condensing as a minimum.

D. All controllers provided as part of this system and used for outdoor applications shall operate under ambient environmental conditions of -40°F to 158°F dry bulb and 5% to 90% relative humidity, non-condensing as a minimum.

2.18 BUILDING AUTOMATION SYSTEM CONTROLLERS - SYSTEM DESIGN

A. Local Control Units (LCU) shall be utilized for primary mechanical and electrical systems such as Air handling equipment, Make-up Air Unit, Boiler System Control, and Chiller System Control type of applications.

B. Terminal Control Units (TCU) shall be utilized for terminal equipment, such as Variable Air Volume, Fan Coil, and Rooftop Units, etc.

C. Each LCU and TCU controller shall have a minimum of 10% spare capacity of each point type for future points. As a minimum, each controller shall have one spare of each point type available on the controller.

D. Each NCU and each LAN shall have the capability of accepting 20% additional LCU/TCU(s) without the necessity of adding additional LAN controllers or LAN wiring.

E. The LCU and TCU controller programming or configuration tools shall be fully accessible through the Web Browser Client through the use of Wizards.
   1. Provide Wizards or objects as specified in NCU section, that facilitate the programming and configuration of the LCU and TCU through a menu driven wizard.

2.19 CONTROLLER LOCAL AREA NETWORK (BAS SUB LAN)

A. Provide a network of stand-alone, distributed direct digital controllers that operate on the following protocol using the specified physical layers:
   1. ANSI/ASHRAE Standard 135 BACnet Master/Slave Token Passing (MS/TP) at 76.8 kbps.
   2. BACnet IP devices will be allowed.

B. Strict adherence to industry standards including ANSI/ASHRAE Standard 135, BACnet, certified by BACnet Testing Laboratory (BTL listed) to assure interoperability between all system components. Controllers that are not BTL listed are unacceptable.

C. Provide BAS Controllers that conform to ANSI/ASHRAE Standard 135, BACnet. Controllers using proprietary protocols or protocols other than the two listed herein are unacceptable.

D. The design of the BAS sub LAN shall network Local Control Unit (LCU) and Terminal Control Unit (TCU) to a Network Control Unit (NCU).

E. This level of communication shall support a family of application specific controllers and shall communicate bi-directionally with the network through DDC Controllers for transmission of global data.

F. Terminal Control Unit (TCU) shall be arranged on the BAS sub LAN's in a functional relationship manner with Local Control Unit (LCU). Ensure that a Variable Air Volume (VAV) Terminal Control Unit (TCU) is logically on the same LAN or segment as the Local Control Unit (LCU) that is controlling its corresponding Air Handling Unit (AHU).

2.20 LOCAL CONTROL UNITS (LCU) (PRIMARY SYSTEMS SUCH AS AHU, MAU, CHILLER, BOILER, WATER SYSTEM)

A. The Local Control Units (LCU) shall be 32 bits microprocessor-based. They shall also be multi-tasking, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements of this specification and the attached point list.

B. Each LCU shall have sufficient memory, to support its own operating system and databases, including:
   1. Control processes
   2. Energy management applications
   3. Alarm management applications
   4. Historical/trend data for points specified
   5. Maintenance support applications
   6. Custom processes
   7. Manual override monitoring

C. Each LCU shall support:
   1. Monitoring of the following types of inputs, without the addition of equipment outside the DDC Controller cabinet:
      a. Analog inputs of 4-20 mA, 0-10 Vdc, 10,000 ohm thermistor or 1000 ohm RTD.
      b. Digital inputs from dry contact closure, pulse accumulators, voltage sensing.
      c. Each LCU shall be capable of providing the following control outputs without the addition of equipment outside the DDC controller cabinet:
      d. Digital outputs (contact closure for motor starters up to size 4).
      e. Analog outputs of 4-20 mA or 0-10 Vdc.

D. The LCU analog or universal input shall use a 16 bit A/D converter.

E. The LCU analog or universal output shall use a 10 bit D/A converter. Each output shall have supervised manual override switch and a potentiometer.

F. Each LCU shall have a minimum of 10% spare capacity for each point type for future point connection. Provide all processors, power supplies and communication controllers complete so that the implementation of a point only requires the addition of the appropriate point input/output

termination module and wiring. As a minimum, provide one of each type of point available on the controller.

G. Provide sufficient internal memory for the specified control sequences and have at least 25% of the memory available for future use.

H. The LCU shall provide local LED status indication for each output for constant, up-to-date verification of all point conditions without the need for an operator output device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output. Status indication shall be visible without opening the panel door.

I. The LCU shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.

J. Should the LCU memory be lost for any reason, the user shall have the capability of reloading the controller software via the BAS LAN or Server. Controller requiring a local port to reload the controller software is not acceptable.

K. Provide an onboard network communication jack for connection to the BACnet Network.

2.21 LCU PROGRAMMING SOFTWARE

A. Provide programming software for the Local Control Unit (LCU) that allows for the development of the LCU control logic and point management.

B. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Access to these functions shall be provided through Graphical User Interface software (GUI). Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is 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. Systems requiring separate software tools or processes to create applications and user interface displays shall not be acceptable.

C. Programming Methods - Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user’s application. Objects shall be linked by a graphical 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.
   1. Configuration of each object will 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 will not be accepted.
   2. The software shall provide the ability to view the logic with value being inputted/outputted of the graphical blocks (debug mode),
   3. The system shall support object duplication within a customer’s database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

D. Provides function to compare and calculate from multiple values from networked controllers (NCU, TCU and/or LCU). As a minimum, the function shall calculate and compared the values and return the average, sum, highest, lowest, 3 highest and 3 lowest values.

2.22 TERMINAL CONTROL UNITS (TCU) (SECONDARY SYSTEMS SUCH AS VAV, FAN POWERED VAV, FAN COIL, RADIATION, REHEAT)

A. Provide Terminal Control Units (TCU) for control of each piece of terminal equipment.

B. The Terminal Control Units (TCU) shall be 8 bits microprocessor-based. They shall also be multi-tasking, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements of this specification and the attached point list.

C. Each TCU shall have sufficient memory, to support its own operating system and databases, including:
   1. Control processes
   2. Maintenance support applications
   3. Custom processes
   4. Manual override monitoring

D. Each TCU shall support:
   1. Monitoring of the following types of inputs, without the addition of equipment:
      a. Analog inputs of 4-20 mA, 0-10 Vdc, 10,000 ohm thermistor or 1000 ohm RTD.
      b. Digital inputs from dry contact closure, pulse accumulators, voltage sensing.
      c. Each TCU shall be capable of providing the following control outputs without the addition of equipment:
      d. Digital outputs (contact closure for motor starters up to size 4).
      e. Analog outputs of 4-20 mA or 0-10 Vdc.

E. The TCU analog or universal input shall use a 16 bit A/D converter.

F. The TCU analog or universal output shall use a 10 bit D/A converter.

G. Controllers shall include all point inputs and outputs necessary to perform the specific control sequences. As a minimum, 25% of the point outputs shall be of the universal type; that is, the outputs may be utilized either as modulating or two-state, allowing for additional system flexibility. Analog outputs shall be industry standard signals such as 24V floating control, allowing for interface to a variety of modulating actuators.

H. Each TCU controller performing space temperature control shall be provided with a matching room temperature sensor. Each room temperature sensor shall include a terminal jack integral to the sensor assembly. The terminal jack shall be used to connect a portable operator's terminal to control and monitor all hardware and software points associated with all controllers on the Network.

I. Each room sensor shall also include the following auxiliary devices:
   1. Setpoint Adjustment: The setpoint adjustment dial shall allow for modification of the temperature by the occupant. Setpoint adjustment may be locked out, overridden or limited as to time or temperature through software by an authorized operator at the central workstation, DDC controller, or via the portable operator's terminal.
   2. Temperature Indicator: Required
   3. Override Switch: None required

J. Each controller shall perform its primary control function independent of other NCU controller LAN communication, or if LAN communication is interrupted. Reversion to a fail-safe mode of operation during LAN interruption is not acceptable. The controller shall receive its real-time data from the NCU controller time clock to insure LAN continuity. Each controller shall include algorithms incorporating proportional, integral, and derivative (PID) gains for all applications. All PID gains and biases shall be field-adjustable by the user via terminals as specified herein. This functionality shall allow for tighter control of space conditions and shall facilitate optimal occupant comfort and energy savings.

K. Provide each TCU with sufficient memory to accommodate point databases, operating programs, local alarming and local trending. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM. The controllers shall be able to return to full normal operation without user intervention after a power failure of unlimited duration. Operating programs shall be field selectable for specific applications. In addition, specific applications may be modified to meet the user's exact control strategy requirements, allowing for additional system flexibility. Controllers that require factory changes of all applications are not acceptable.

L. Variable Air Volume (VAV) Terminal Control Units (TCU):
   1. The VAV box TCU controllers shall be powered from a 24 VAC source and shall function normally under an operating range of 20 to 28 VAC (±15%), allowing for power source fluctuations and voltage drops. The BAS contractor shall provide a dedicated power source and separate isolation transformer for each controller unable to function normally under the specified operating range. The controllers shall also function normally under ambient conditions of 32°F to 122°F and 5% to 90% RH (non-condensing). Provide each controller with a suitable cover or enclosure to protect the intelligence board assembly.

2. The Variable Air Volume (VAV) Terminal Control Unit (TCU) shall include a built-in differential pressure transducer that shall connect to the VAV terminal unit manufacturer's standard differential pressure sensor to measure the average and amplify differential pressure in the duct. The controller shall convert this value to actual air flow. Single point differential pressure sensing device is not acceptable. The VAV TCU differential pressure transducer shall have a measurement range of 0 to 1 in. W.C. and measurement accuracy of ±5% at 0.1 to 1 in. W.C. and a minimum resolution of 0.0001 in. W.C., ensuring primary air flow conditions shall be controlled and maintained to within ±5% of setpoint at the specified minimum and maximum air flow parameters. The VAV TCU differential pressure transducer shall have a zero value air flow measurement repeatability of 0.001 in. W.C., VAV TCU differential pressure transducer requiring periodic zero value air flow calibration is not acceptable. The BAS contractor shall verify the type of differential pressure sensors used in the existing boxes, and ensure compatibility with the VAV TCU controllers.
3. The Variable Air Volume (VAV) Terminal Control Unit (TCU) shall include provision for air flow balancing using a local air flow balancing interface. A portable air flow balancing interface or an Intelligent Space Sensor (ISS) capable of balancing air flow is acceptable. The portable air flow balancing interface shall connect to the VAV TCU or the matching room temperature sensor.
4. The Variable Air Volume (VAV) Terminal Control Unit (TCU) shall also provide a web browser based air flow balancing tool. This tool shall allow the air balancer to manually control the action of the actuator including the following function: open VAV damper, close VAV damper, open all VAV dampers, and close all VAV dampers.
5. Systems not able to provide a web based air balance tool or a portable air flow balancing interface or an Intelligent Space Sensor (ISS) capable of balancing air flow as part of the VAV TCU controller shall provide an individual full time technician during the air flow balancing process to assure full balance compliance.
6. The VAV box controller shall interface to a matching room temperature sensor as previously specified. The controller shall function to maintain space temperature to within ±1.5°F of setpoint at the room sensor location. Each controller shall also incorporate an algorithm that allows for resetting of the associated air handling unit discharge temperature if required to satisfy space requirements. This algorithm shall function to signal the respective DDC controller to perform the required discharge temperature reset in order to maintain space temperature setpoint.
7. It shall be possible to view and reset the space temperature, temperature setpoint, maximum airflow setting, minimum airflow setting, and actual airflow, through the BAS LAN.

2.23 TCU PROGRAMMING SOFTWARE

A. Provide programming software for the Terminal Control Unit (TCU) that allows for the development of the TCU control logic and point management.

B. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Access to these functions shall be provided through Graphical User Interface software (GUI). Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is 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. Systems requiring separate software tools or processes to create applications and user interface displays shall not be acceptable.

C. Programming Methods - Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user’s application. Objects shall be linked by a graphical 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.
   1. Configuration of each object will 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 will not be

accepted.

2. The software shall provide the ability to view the logic with value being inputted/outputted of the graphical blocks (debug mode),
3. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

D. Provides function to compare and calculate from multiple values from networked controllers (NCU, TCU and/or LCU). As a minimum, the function shall calculate and compared the values and return the average, sum, highest and lowest values.

2.24 TCU CONFIGURATION SOFTWARE

A. Configuration of the TCU controller shall be done through the configuration tool using fill-in the blank fields, list boxes, and selection buttons.

B. The configuration tool menu shall define items such as I/O configurations, set point, delays, PID loops, optimum start stops, and network variables/object settings. The configuration tool shall indicate the device status and allows system override.

C. The Configurable Controller shall allow the use of its spare I/O as dumb I/O to be shared over the network to other Controllers such as Programmable Controllers, where a sequence of operation can be applied to the I/O. Such applications shall include but not be limited to exhaust fan control, heaters, etc.

2.25 CONTROLLERS – BACNET PROTOCOL

A. Provide BACnet Controllers that BACnet Testing Laboratory listed as specified herein:
1. BACnet Building Controller (B-BC)
2. BACnet Advanced Application Controller (B-AAC)
3. BACnet Application Specific Controller (B-ASC)

B. All BACnet Controllers shall use the following communication specifications and achieve performance as specified herein:
1. All controllers shall be able to communicate peer-to-peer without the need for a Network Control Unit (NCU). Any controller on the MS/TP Data Link/Physical layer shall be able to act as a Master to allow for the exchange and sharing of data variables and messages with any other controller connected on the same communication cabling. Slave controllers are not acceptable.
2. Performance – Each BACnet controller shall have a minimum of 64Kb of RAM and 384Kb of non-volatile flash memory. Each controller shall have a 32-bit microprocessor operating at 68 MHz and support a BACnet protocol stack in accordance with the ANSI/ASHRAE Standard 135-2008 and the BACnet Device Profile supported. Each BACnet controller shall provide a loading characteristic of minimum 1/4th Load on the BACnet MS/TP communications trunk. Manufacturers, who wish to supply LCU and TCU controllers with less than a 32-bit microprocessor and/or a MS/TP loading characteristic of greater than 1/4th Load, may do so as long as only they provide a maximum of 32 controllers on a single bus segment per NCU.
3. BACnet Controllers shall be provided for Fan Coils, Variable Air Volume (VAV) Terminals and other applications as shown on the drawings. The application control program shall be resident within the same enclosure as the input/output circuitry, which translates the sensor signals.
4. All Local Control Unit (LCU) and Terminal Control Units (TCUs) shall be fully programmable and the programming software shall have a library of pre-built, tested, and user re-definable control sequences for a wide range of typical HVAC applications. LCU and TCU controllers that are not fully programmable are not acceptable.
5. BACnet Controllers shall communicate with the Network Control Unit (NCU) via a BACnet/IP connection at a baud rate of not less than 100 Mbps or via the RS485 MS/TP connection at a baud rate of not less than 76.8 kbps.
6. BACnet TCU matching room temperature and/or humidity sensor shall connect directly to the TCU and shall not utilize any of the I/O points of the Controller. The TCU matching room temperature sensor shall provide a communications jack for connection to the BACnet communication trunk to which the TCU is connected. The TCU matching room temperature sensor, the connected TCU, and all other devices on the BACnet bus shall be accessible from this communications jack.

C. All BACnet LCU and TCU shall be fully application programmable. All control sequences programmed into the LCU and TCU shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.

D. The network router shall be used to route messages from a segment, sub-net, or domain in full duplex communication mode. Routers shall utilize BACnet protocol transport, network, and session layers to transparently route messages bound for a device instance in another network. The routers, shall be capable of DIN rail or panel mounting and be equipped with status LED lights for Network traffic and power. A router may not manage more than 60 nodes on any single channel so as to allow for future expansion. Equip each router with a network transceiver on each network port (inbound and outbound) as dictated by the network type

E. A repeater or signal booster may only be used to increase the signal strength of the communications. Under no circumstances may it be used in the place of a router.

F. The System Integrator supplying the BACnet Controllers shall provide documentation for each device, with the following information at a minimum:
   1. BACnet Device; MAC address, name, type and instance number
   2. BACnet Objects; name, type and instance number

G. It is the responsibility of the System Integrator to ensure that the proper BACnet objects are provided in each BACnet controller, as required by the Point List located in the POINTS LIST section of this specification.

2.26 CONTROL PANELS, ENCLOSURES & SUB-PANELS

A. Provide wall or base mounted enclosures to house all controllers, transformers, relays, etc… associated with system, mechanical room or area. Enclosures shall conform to the following requirements:

B. Minimum 16 gauge steel or aluminum, totally enclosed on all sides and painted with a baked enamel finish.

C. Enclosures located outdoors shall meet NEMA 4X.

D. Enclosures located in all other locations including but not limited to mechanical or electrical rooms not requiring NEMA 2, occupied spaces, above ceilings and plenums shall be the same NEMA classification as all other enclosures located in the same environment, except if location requires additional protection due to potential vandalism or environmental conditions and shall at a minimum meet NEMA 1 requirements.

E. Provide a hinged door, keyed locking latch and removable sub-panel. A single key shall be common to all control enclosures.

F. Provide each DDC panel with on/off control, 120VAC convenience outlet, high/low voltage separation, control fuse(s), control transformer(s), terminal blocks and DC power supplies as necessary.

2.27 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-D.
   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 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.
   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: 9 cfm 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"x24" damper (2000 fpm).
13. Maximum Pressure Drop for Parallel Blade Damper: 0.08" for 8,000 cfm through a 24"x24" damper (2000 fpm).

2.28 DAMPER ACTUATORS

A. Damper Actuators - Electronic - Spring Return:
1. Damper actuators shall be UL listed, electronic direct coupled with spring return to normal position for modulating or two-position control as noted in the sequence of control. Actuator shall be 24 VAC with proportional control, electronic overload protection to prevent actuator damage due to over-rotation and “V” bolt clamp with matching “V” toothed cradle (single bolt or setscrew fasteners not acceptable).
2. Following power interruption, spring return mechanism shall close the damper. Mechanical spring shall be rated for a minimum of 60,000 full cycles. Provide breathable membrane in actuator housing to compensate for pressure differential and allow for 95% non-condensing relative humidity in the airstream.
3. Mount actuators with motor outside of airstream whenever possible. Unit casings shall have housing with proper weather, corrosive, or explosion-proof construction as required by application.
4. Actuators shall be rated for 60,000 full cycles at rated torque with 2-year unconditional warranty. Size actuators per damper manufacturer’s recommendations.
5. Provide end switches as required for the sequence of operation.
6. Provide analog feedback signal for positive position indication. Refer to FMCS points list.

2.29 HYDRONIC CONTROL VALVES

A. General:
1. Two-position valves shall be a minimum of line size with a maximum allowable pressure drop of 2 psi.
2. Size two-way and three-way modulating valves to provide a pressure drop at full flow of 1 to 4 psi, except boiler three-way and cooling tower bypass valves shall not have a pressure drop over 2 psi.
3. Two-way valves shall be 100% tight-closing. Three-way valves shall be 100% tight-closing in both extreme positions.
4. Modulating two-way valves shall have equal percentage flow characteristics.
5. Modulating three-way valves shall have linear flow characteristics.
6. Piping geometry correction factors for Cv ratings shall be used and stated for ball valves, butterfly valves, or non-characterized valves.

B. Two-position:
1. Ball 2” and under:
   a. Design Pressure: 400 psi
   b. Design Temperature:212ºF
   c. Design Flow Differential Pressure Rating: 150 psi
   d. Bronze or brass body, stainless steel stem, chrome plated brass or stainless steel full port ball, PTFE or RTFE seats and seals, screwed ends (solder ends are acceptable only if rated for soldering in line with 470ºF melting point of 95-5 solder).
2. Ball 3” to 6”:
   a. Design Pressure: 200 psi
   b. Design Temperature: 212ºF
   c. Design Flow Differential Pressure Rating: 35 psi
   d. Cast iron body, stainless steel stem, stainless steel full port ball, PTFE or RTFE seats and seals, flanged ends.

3. Butterfly 2-1/2” to 12”:
    a. Design Pressure: 125 psi
    b. Design Temperature: -20 to 212ºF
    c. Design Flow Differential Pressure Rating: 50 psi
    d. Cast iron body, stainless steel stem with extended neck, aluminum-bronze or nickel-plated iron disc, EPDM seats and seals, fully lugged ends.

C. Modulating:
1. Globe 1/2" to 2”:
    a. Design Pressure: 250 psi
    b. Design Temperature: 212ºF
    c. Design Flow Differential Pressure Rating: 35 psi
    d. Bronze or brass body, trim and plug; stainless steel stem; stainless steel or bronze seat; EPDM or PTFE packing; threaded ends.
2. Globe 2-1/2” to 6”:
    a. Design Pressure: 125 psi
    b. Design Temperature: 250ºF
    c. Design Flow Differential Pressure Rating: 25 psi
    d. Cast iron body, bronze or brass trim and plug; stainless steel stem; bronze seat; EPDM or PTFE packing; flanged ends.
3. Ball 2” and under:
    a. Design Pressure: 400 psi
    b. Design Temperature: 212ºF
    c. Design Flow Differential Pressure Rating: 35 psi
    d. Bronze or brass body, stainless steel stem, chrome plated brass or stainless steel full port ball, PTFE or RTFE seats and seals, screwed ends (solder ends are acceptable only if rated for soldering in line with 470ºF melting point of 95-5 solder).
4. Ball 3” to 6”:
    a. Design Pressure: 200 psi
    b. Design Temperature: 212ºF
    c. Design Flow Differential Pressure Rating: 35 psi
    d. Cast iron body, stainless steel stem, stainless steel full port ball, PTFE or RTFE seats and seals, flanged ends.
5. Butterfly 2-1/2” to 12”:
    a. Design Pressure: 125 psi
    b. Design Temperature: -20 to 212ºF
    c. Design Flow Differential Pressure Rating: 50 psi
    d. Cast iron body, stainless steel stem with extended neck, aluminum-bronze or nickel-plated iron disc, EPDM seats and seals, fully lugged ends.

2.30 VALVE ACTUATORS

A. General:
1. Actuators shall be sized to operate the valve through its full range of motion and shall close against pump shutoff pressure without producing audible noise at any valve position.
2. Provide visual position indication.
3. Mount actuator directly on valve or provide linear motion assembly as required for valve type.

B. Valve Actuators - Electronic:
1. Actuator shall be UL listed and provided with NEMA housing for applicable environment, electronic overload protection to prevent actuator damage due to over-rotation, and “V” bolt clamp with matching “V” toothed cradle (single bolt or setscrew fasteners not acceptable).
2. Actuators shall be rated for 60,000 full stroke cycles at rated torque. Stall motor not acceptable.
3. Tri-state/floating actuators shall have auto-zeroing function for realigning valve position.
4. Proportional actuator position shall be proportional to analog or pulse width modulating signal from electronic control system.

5. Spring return actuators shall have an internal spring return mechanism. Non-mechanical forms of fail-safe operation are not acceptable.
6. Provide analog feedback signal for positive position indication. Refer to Valve Schedule and FMCS points list.

C. Valve Schedule

Equipment Type		Power Failure Position	Positive Feedback Position Required
AHU Hot Water Coil	Proportional	NO	No
VAV Hot Water Coil	Proportional	NC	No

2.31 CONTROL INSTRUMENTATION

A. Temperature Measuring Devices:
1. 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 is capable of triggering 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 15ºF to 55ºF with a permanent stop at 35ºF.
e. Differential shall be fixed at approximately 5ºF and supplied with manual reset.

B. Temperature Sensors:
1. Room Temperature Sensor:
a. Sensor with Setpoint Adjustment and Override: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45°F to 90°F operating range, ± 0.50°F accuracy, with exposed single setpoint adjustment (no numeric temperature scale – provide with a warmer/cooler or red/blue visual scale), occupied/unoccupied override button with LED.
2. Duct Temperature Sensor:
a. Thermistor or RTD type. Pneumatic transmitters with transducers are not acceptable.
3. Water Temperature Sensor:
a. Install in immersion wells. Separate thermometers as specified elsewhere, also of the immersion well type, shall be installed within 2 feet of each temperature sensor. Strap-on temperature sensors are not acceptable.

C. Humidity Measuring Devices:
1. Humidity Sensors:
a. Humidity Sensors: Fully electronic with no moving parts or parts requiring periodic service. Accuracy shall be ± 2% of reading.

D. 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 ± 3% of full scale maximum throughout entire range at 70ºF.
3) Provide mounting brackets, probes, and shut-off 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.
b. High Pressure Switches (Manual Reset):
1) Differential pressure switch with single pole, double-throw snap switch and enclosure.
2) Rated for pressure specified in sequence of control.

3) Electrical rating shall be 15 amps at 120-480 volts.
4) Setpoint adjustment shall be screw type located inside enclosure.
5) Provide optional manual reset for overpressure protection with all tubing, brackets, and adapters.
6) Repeatability: ± 3%.

2. Pressure Transmitters/Transducer:
   a. Select device suitable for intended application; water or air, static or differential.
   b. Select for appropriate range, including negative if applicable.
   c. 100% solid state device, temperature compensated, suitable for pressures of 200% rated range with averaging to stabilize output, accuracy of ± 1% full scale, and a 4-20 mA output.
   d. Provide a NEMA 4 enclosure unless panel mounted.
   e. Air service shall have a minimum of three field selectable ranges.
   f. When used for room pressure control, the transducer shall be bidirectional with a range of ± 0.1" W.C.
   g. Provide pressure line outlet cover on both sides of the wall when used for room pressure control.
   h. Furnish with integral LED's to indicate Zero Pressure, Pressure In Range, and Pressure Out Of Range as a diagnostic aid.

E. 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 under current conditions on variable or constant volume loads, self-calibrating, positive status indication, LED indicator lamps, 600 VAC rms isolation, and induced power from the monitored load with N.O. 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.

F. Miscellaneous Devices:
   1. Control Relays:
      a. Form "C" contacts rated for the application with "push-to-test" contact transfer feature and an integral LED to indicate coil energization.
      b. Mount all relays and power supplies in a NEMA 1 enclosure beside the FMCS panel or controlled device and clearly label their functions.
   2. 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. Coordinate locations with Owner prior to install.
      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.
   3. Drip Pan Water Detector
   4. 1" wide sensing type, installed entire length of pan.
   5. Dwyer WD or equal.

G. Door Alarm Siren
   1. Heavy duty die-cast housing, 24 VAC, maximum 2 1/8" projection from mounting surface, adjustable output of 78-103 dB.
   2. Edwards 874-G5 or equal.

H. Status Light
   1. Green and red signal tower with LED light source. 24 VAC. Provide with wall mount accessory.
   2. Kombisign 71 or equal.

2.32 WIRING, CABLE, AND RACEWAYS

A. Conduit Types:
   1. Electrical Metallic Tubing (EMT) and Fittings: ANSI C80.3
      a. Fittings and conduit bodies: Compression or steel set screw type of steel or malleable iron design for their specific application.
   2. Flexible Metallic Conduit (FMC) and Fittings: FS-WW-C-566
      a. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel.
      b. Fittings and conduit bodies: Threadless hinged clamp type, galvanized zinc coated cadmium plated malleable cast iron that shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
      c. Maximum allowable length 6'-0".

B. Wire and Cable Types:
   1. Building Wire:
      a. Control Circuits: Copper, stranded conductor 600 volt insulation, THHN/THWN.
   2. Remote Control and Signal Cable:
      a. 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.
      b. 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.
      c. 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

3.01 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 48”.

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, calibrate and adjust as required all control equipment including sensors. This includes but is not limited to factory installed sensors which may be part of any HVAC equipment served by factory furnished unitary controllers.

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 controls associated with the proper operation of air handling units, pumps, or other mechanical equipment served by emergency power shall be connected to the emergency power system. Control components shall not be powered from the life safety branch of the emergency power system. Coordinate emergency power source connections with the Engineer.

L. 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.

M. Remodeling:
   1. All room devices as indicated on the drawings shall be removed by this Contractor. The Contractor shall also prepare the wall for finishes. Preparing the wall shall include patching old anchor holes (after the anchoring device has been removed) and sanding the wall to remove old paint outlines remaining from original devices. The wall shall be painted to match the existing wall prior to the installation of the new room device. In the event that wall covering requires patching, the Contractor shall furnish new wall covering to match existing. If new wall covering is not available to match existing, the Contractor shall furnish a white acrylic or Plexiglas plate, 1/4” thick and sized to cover the void.

N. Labels For Control Devices:
   1. Provide labels indicating service of all control devices in panels and other locations.
   2. Use engraved labels for items outside panel such as outside air thermostats.

O. VFD’s:
   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.

3.02 GRAPHIC DISPLAY

A. Create a customized graphic for each piece of equipment indicated on the itemized points list.

B. Components shall be arranged on graphic as installed in the field.

C. Include each graphic point listed in the itemized points list using real time data.

D. Provide a graphic representation of the following:
   1. Where there are multiple buildings, color code the campus map by the systems serving that building. The building graphic shall be linked to the graphic for that building’s systems.
   2. Where there are multiple floors, provide color codes/designations for the areas served by each AHU and TAB by floor.
   3. Where multiple AHUs serve one floor, color code the areas served by each AHU. The area shall be linked to the graphic for that area’s AHU.

4. Provide an overall floor plan of each floor of the building color coded by zone linked to the TAB for that zone. The zone shall be linked to the graphic for that zone's TAB graphic.
5. Show the location of each thermostat on the floor plan.
6. Provide separate graphics showing the chilled and heating water system flow diagram. Show temperatures and flows on the flow diagram. Each piece of equipment shown on the flow diagram shall be linked to the graphic for that piece of equipment.
7. Provide a graphic showing the steam system flow diagram. Show pressures and flows on the flow diagram. Each piece of equipment shown on the flow diagram shall be linked to the graphic for that piece of equipment.

E. The FMCS shall include full graphic operator interface to display the following graphics as a minimum:
1. Home page to include a minimum of six critical points: Outside Air Temperature, Outside Air Relative Humidity, Enthalpy, KWH, KW, etc.
2. Graphic floor plans accurately depicting rooms, walls, hallways, and showing accurate locations of space sensors and major mechanical equipment.
3. Detailed graphics for each mechanical system including AHUs, ERUs, EFs, chillers, and boilers, as a minimum.
4. Access corresponding system drawings, technical literature, and sequences of operations directly from each system graphic.

F. The FMCS shall include individual graphical buttons to access the following data stored in PDF format:
1. Project control as-built documentation including all TCS drawings, diagrams and sequences of operation.
2. TCS Bill of Material for each system, e.g. AHU, RTU, FCU, boiler, etc.
3. Technical literature specification data sheets for all components listed in the TCS Bill of Material.

G. The operator's workstation shall display all data associated with the project. The operator's terminal software shall accept, GIF, PNG, JPG and ICO format graphic files for display purposes. Graphic files shall be created using scanned, full color photographs of system installation, AutoCAD or Visio drawing files of field installation drawings and wiring diagrams from as-built drawings. Operator's terminal shall display all data using 3-D graphic representations of all mechanical equipment.

H. System shall be capable of displaying graphic file, text, and dynamic object data together on each display. Information shall be labelled with descriptors and shall be shown with the appropriate engineering units. All information on any display shall be dynamically updated without any action by the user. Terminal shall allow user to change all field-resident BAS functions associated with the project, such as setpoints, weekly schedules, exception schedules, etc. from any screen no matter if that screen shows all text or a complete graphic display. This shall be done without any reference to object addresses or other numeric/mnemonic indications.

I. All displays shall be generated and customized in such a manner by the local DDC system supplier that they fit the project as specified. Canned displays shall not be acceptable. Displays shall use standard English for labelling and readout. Systems requiring factory programming for graphics or DDC logic are specifically prohibited. The installing contractor without factory dependency or assistance shall support all graphics and DDC programming locally.

J. Binary objects shall be displayed as ON/OFF/NULL or with customized text. Text shall be justified left, right or center as selected by the user. Also, allow binary objects to be displayed as individual change-of-state bitmap objects on the display screen such that they overlay the system graphic. Each binary object displayed in this manner shall be assigned up to three bitmap files for display when the point is ON, OFF or in alarm. For binary outputs, toggle the objects commanded status when the bitmap is selected with the system digitizer (mouse). Similarly, allow the terminal operator to toggle the object's status by selecting (with the mouse) a picture of a switch or light, for example, which then displays a different picture (such as an ON switch or lighted lamp). Additionally, allow binary objects to be displayed as an animated graphic.

K. Animated graphic objects shall be displayed as a sequence of multiple bitmaps to simulate motion. For example: when a pump is in the OFF condition, display a stationary picture of the

pump. When the operator selects the pump picture with the mouse, the represented objects status is toggled and the picture of the pumps impeller rotates in a time-based animation. The operator shall be able to click on an animated graphical object or switch it from the OFF position to ON, or ON to OFF. Allow operator to change bitmap file assignment and also create new and original bitmaps online. System shall be supplied with a library of standard bitmaps, which may be used unaltered or modified by the operator. Systems that do not allow customization or creation of new bitmap objects by the operator (or with third-party software) shall not be allowed.

L. Analog objects shall be displayed with operator modifiable units. Analog input objects may also be displayed as individual bitmap items on the display screen as an overlay to the system graphic. Each analog input object may be assigned to a minimum of five bitmap files, each with high/low limits for automatic selection and display of the bitmaps. As an example, a graphic representation of a thermometer would rise and fall in response to either the room temperature or its deviation from the controlling setpoint. Analog output objects, when selected with the mouse, shall be displayed as a prompted dialog (text only) box. Selection for display type shall be individual for each object. Analog object values may be changed by selecting either the increase or decrease arrow in the analog object spinner box without using the keypad. Pressing the button on the right side of the analog object spinner box allows direct entry of an analog value and accesses various menus where the analog value may be used, such as trend logs.

M. Analog objects may also be assigned to an area of a system graphic, where the color of the defined area would change based on the analog objects value. For example, an area of a floor-plan graphic served by a single control zone would change color with respect to the temperature of the zone or its deviation from setpoint. All editing and area assignment shall be created or modified online using simple icon tools.

N. A customized menu label (push-button) shall be used for display selection. Menu items on a display shall allow penetration to lower level displays or additional menus. Dynamic point information and menu label push buttons may be mixed on the same display to allow sub-displays to exist for each item. Each display may be protected from viewing unless operator has appropriate security level. A separate security level may be assigned to each display and system object.

O. A mouse, or other form of digitizer, shall be used to move the pointer arrow to the desired item for selection of new display or to allow the operator to make changes to object data.

P. Displays may be modified on site or via remote communications.

Q. Entire system shall operate without dependency on the operator's terminal. Provide graphic generation software at each workstation.

3.03 CONDUIT, WIRING, AND CABLE INSTALLATION

A. Conduit Sizing and Installation:

1. Conduit and conductor sizing shall be coordinated to limit conductor fill to less than 40%. Maintain conductor ampere capacity as required by the National 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.
2. Minimum conduit size shall be 1/2" above grade, 3/4" below grade less than 5 feet from building foundation, and 1-1/4" below grade more than 5 feet from building foundation, unless noted otherwise.
3. Supports for metallic conduit shall be as near to 5 feet intervals as possible. A greater interval may be used if convenient because of building construction, but in no event shall support spans exceed the National Electric Code requirements.
4. Conduit runs installed above ceilings shall be properly supported. In no case shall conduit rest on the ceiling construction or the ceiling support system be used for conduit support.
5. Conduit shall not be supported from ductwork, water or sprinkler piping, etc., unless approved by the Engineer. All supports shall be from the building structure, unless noted otherwise and coordinated with all other applicable contractors.
6. Install expansion/deflection joints where conduit crosses structure expansion/seismic joints.
7. 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 bonding conductor is routed within the conduit. All metallic conduit shall be grounded per

the National Electrical Code.

8. Thermostats/temperature sensors shall be installed in junction boxes, flush with the wall, and shall be coordinated for orientation with Engineer.
9. All conduit shall be concealed in walls and above ceilings unless noted otherwise.

B. Wire Installation Methods:
1. Use no wire smaller than 14 AWG for line voltage (120V) wiring.
2. Use no wire smaller than 18 AWG for low voltage (24V) control wiring.
3. Splice and tap only in accessible junction or outlet boxes.
4. Neatly train and lace wiring inside boxes, equipment, and panelboards.
5. All conductors shall be continuous from device to their termination.
6. Install wire in conduit after interior of building has been physically protected from the weather and all mechanical work likely to damage conductors has been completed.
7. Thoroughly clean wires before installing lugs and connectors.
8. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
9. Terminate spare conductors with electrical tape, unless otherwise indicated on the drawings.

C. Cable Installation Methods:
1. Provide protection for exposed cables where subject to damage.
2. Use suitable cable fittings and connectors.
3. Run all open cable in a neat and symmetrical manner.
4. Open cable shall be supported by the appropriate size bridle rings. Wire and cable from different systems shall not be installed in the same bridle rings.
5. Open cable installed above suspended ceilings shall not rest on the suspended ceiling construction or use the ceiling support system for wire and cable support.
6. Where open cables are grouped, they shall be neatly bundled and held together with nylon tie wraps placed every 2.5 feet on the bundle. Where tie bundle passes through a bridle ring, it shall be fastened to the ring with a tie wrap.
7. Bridle ring supports shall be installed at five-foot intervals. All rings shall be installed where completely accessible and not blocked by piping, ductwork, inaccessible ceilings, etc.
8. Open cable shall only be installed where specifically identified in these specifications.

D. Wire and Cable Installation in Conduit:
1. Pulling shall be continuous without unnecessary stops and starts with wire or cable only partially through conduit.
2. Reels of cable or wire shall be set up close to the point where the wire or cable enters the conduit so that the cable or wire may be unreeled and run into the conduit with a minimum of change in the direction of the bend.
3. Cables or wires shall not be laid out on the ground before pulling.
4. Cables or wires shall not be dragged over earth or paving.
5. 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.
6. 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.
7. At least six (6) inch loops or ends shall be left at each device for installation connection.
8. Completely and thoroughly swab conduit system before installing conductors.

E. 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.

F. 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 liquid tight flexible metallic conduit. Terminations in hazardous areas, as defined in the National Electrical Code, shall be connected using flexible conduit rated for the environment.

Location	Conduit Type Required for Building Wire and Cable
Dry Mechanical Spaces	EMT, FMC, or Cable Tray
Wet or Damp Locations	RGS or LFMC
Interior Locations Below Accessible Ceilings	EMT
Above Non-Accessible Ceilings	EMT
Above Accessible Ceilings	None, Plenum Cable Required
Exterior Locations	RGS or LFMC
Below Accessible Floor	EMT
Hazardous Locations as Defined by the National Electric Code	RGS conduit complete with screwed fittings and conduit seals
In Walls, Bulkheads, Soffits, or other enclosed areas	EMT

3.04 FMCS INSTALLATION

A. Coordinate voltage and ampacity of all contacts, relays, and terminal connections of equipment being monitored or controlled. Voltage and ampacity shall be compatible with equipment voltage and be rated for full ampacity of wiring or overcurrent protection of circuit controlled.

B. Naming Conventions: Coordinate all point naming conventions with Owner standards. In the absence of Owner standards, naming conventions shall use equipment designations shown on plans.

3.05 CONTROL SYSTEM TESTING, COMMISSIONING, DEMONSTRATION AND ACCEPTANCE

A. The Contractor shall furnish all labor, tooling and test equipment as needed to fully test, calibrate and commission all controls, sensors, instruments, hardware, wiring, software, equipment and related accessories. Testing and Commissioning including furnish required documentation thereof shall be completed prior to Demonstration and Acceptance.

B. Verify that all control wiring is properly terminated, connected and free of shorts and ground faults. Verify all terminal connections are secure and tight.

C. 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.

D. 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.

E. Contractor shall verify the system operation achieves the sequences of operation. Simulate all modes of operation by overriding and varying input set-points and schedules. Tune all DDC algorithms and control loops as needed to optimize start/stop routines and minimize energy consumption.

F. Contractor shall test all alarms, safeties and interlocks. Simulate each alarm condition and test alarm activation thresholds and reactions by using a simulation signal which will activate the alarm condition. Once alarm conditions are activated test acknowledgment, communication and remediation steps and features.

G. 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.

H. 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.

I. 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.

3.06 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.

3.07 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.

3.08 TESTING AND BALANCING 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. The Contractor shall provide a qualified technician to assist with the Testing, Adjusting and Balancing processes.

D. The tools used during the test and balance process shall be returned at the completion of the testing and balancing.

3.09 DEMONSTRATION AND ACCEPTANCE

A. At completion of installation, provide 4 hours minimum instruction for operators. Demonstrate operation of all controls and systems. Describe the normal operation of all equipment.

B. Acceptance:
   1. The system shall not be considered accepted until which time that all forms, checklists, trends and logs completed as part of the demonstration are submitted and approved by the Engineer and Owner's designated representative.
   2. Acceptance that the control system meets the requirements of the project will be awarded only after all tests and demonstrations included in this Specification Section, related Sections or as notified in writing, have been satisfactorily performed and completed to the satisfaction of both the Engineer and Owner's representative.
   3. Any tests or demonstrations which cannot be performed due to circumstances or conditions determined to be beyond the control of the Contractor may be exempted from compliance requirements if proposed in writing to the Engineer and Owner's representative for consideration. Such tests and demonstrations, if exempted, shall be expeditiously performed by Contractor and at no additional cost as part of the system warranty.

3.10 TRAINING

A. On-Site:
   1. After completion of commissioning, the manufacturer shall provide 2 hours of training on consecutive days for 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. Alarms and procedures: alarm classes, criticality, latching enabling and disabling, acknowledgements, silencing, status and notifications.
   10. Recognize malfunctions of the system by observation of the printed copy and graphic visual signals.
   11. Understand system drawings and Operation and Maintenance manual.
   12. Understand the job layout and location of control components.
   13. Access data from FMCS controllers and ASC's.
   14. Operate portable operator's terminals.

C. 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.

3.11 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. Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.

D. 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.

E. 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.

F. All pipe-mounted temperature sensors shall be installed in immersion wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.

G. Install outdoor air temperature sensors on exterior of north wall, complete with sun shield at designated location approved by Engineer. TCC shall prime and paint the device enclosure. Color selection by Owner.

END OF SECTION

SECTION 23 09 93
SEQUENCE OF OPERATIONS FOR HVAC AND DOOR CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. See plan sheets for equipment control sequences. Equipment, devices, and system components required for control systems are specified in other sections.

1.02 RELATED SECTIONS

A. Section 01 9114 - Commissioning Authority Responsibilities.

B. Section 23 0800 - Commissioning of HVAC Systems

C. Section 23 09 23 - Direct-Digital Control System for HVAC.

D. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Sequence of Operation Documentation: Submit written sequence of operation for entire HVAC system and each piece of equipment.
   1. Preface: 1 or 2 paragraph overview narrative of the system describing its purpose, components and function.
   2. State each sequence in small segments and give each segment a unique number for referencing in Functional Test procedures; provide a complete description regardless of the completeness and clarity of the sequences specified in the contract documents.

C. Control System Diagrams: Submit graphic schematic of the control system showing each control component and each component controlled, monitored, or enabled.
   1. Label with settings, adjustable range of control and limits.
   2. Include flow diagrams for each control system, graphically depicting control logic.
   3. Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.
   4. Include all monitoring, control and virtual points specified in elsewhere.
   5. Include a key to all abbreviations.

D. Points List: Submit list of all control points indicating at least the following for each point.

E. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. All outdoor, return and relief motorized dampers shall be spring return. Outdoor and relief dampers shall fail closed and the return damper shall fail open.

B. Program Trends for all motors that are monitored, and all AHU sensor inputs, space temperatures, humidity and pressures, heating and cooling plant inputs and outside air temperature and relative humidity.
   1. Coordinate Trending requirements with Commissioning Agent for the validation process.

3.02 HVAC SEQUENCE OF OPERATION

A. Refer to plan sheets for sequences of operation.

END OF SECTION

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SECTION 23 11 23
NATURAL GAS PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Indoor and outdoor piping for new natural gas service.

B. Related Requirements
   1. Section 22 0553 – Identification for Plumbing and Piping Equipment
   2. Section 22 1005 – Plumbing Piping

1.02 REFERENCES

A. American National Standards Institute (ANSI)
   1. ANSI B16.33: Manually Operated Metallic Gas Valves for Use in Gas Piping Systems up to 125 psig (Sizes 1/2 Through 2)
   2. ANSI B18.2.1: Square and Hex Bolts and Screws Inch Series

B. American Society of Mechanical Engineers (ASME)
   1. ASME B1.1: Unified Inch Screw Threads (UN and UNR Thread Form)
   2. ANSI/ASME B1.20.1: Pipe Threads, General Purpose (Inch)
   3. ANSI/ASME B16.3: Malleable Iron Threaded Fittings
   4. ASME/ANSI B16.5: Pipe Flanges and Flanged Fittings
   5. ASME/ANSI B16.9: Factory-Made Wrought Steel Buttwelding Fittings
   6. ASME B16.11: Forged Fittings, Socket-Welding and Threaded
   7. ASME/ANSI B16.39: Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
   8. ASME/ANSI B18.2.2: Square and Hex Nuts (Inch Series)
   9. ASME B31.8: Gas Transmission and Distribution Piping Systems
   10. ASME BPVC SEC VIII D1: Boiler and Pressure Vessel Code: Section VIII Pressure Vessels, Division 1

C. American Society for Testing and Materials (ASTM)
   1. ASTM A 53: Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
   2. ASTM A 194/A 194M: Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
   3. ASTM D 2683: Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing

D. Manufacturer’s Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
   1. MSS SP-58: Pipe Hangers and Supports - Materials, Design and Manufacture
   2. MSS SP-69: Pipe Hangers and Supports - Selection and Application
   3. MSS SP-89: Pipe Hangers and Supports - Fabrication and Installation Practices

E. National Fire Protection Association (NFPA)
   1. NFPA 54: (2015) National Fuel Gas Code

1.03 DEFINITIONS

A. See Specification Section 22 0010 - BASIC MECHANICAL PLUMBING REQUIREMENTS

1.04 SUBMITTALS

A. Manufacturer's Catalog Data
   1. Pipe and fittings
   2. Hangers and supports
   3. Pressure regulator
   4. Valves
   5. Paint sample on steel coupon

B. Instructions
   1. Pipe and fittings; Submit manufacturer's installation instructions and manufacturer's visual joint appearance chart.

C. Statements
   1. Welder's qualifications

2. Welder's identification symbols; Submit a copy of a certified ASME B31.8 qualification test report for each welder and welding operator. Submit the assigned number, letter, or symbol that will be used in identifying the work of each welder.

D. Certificates
   1. Pipe and fittings
   2. Transition fittings

1.05 QUALITY ASSURANCE

A. Welder's Qualifications
   1. Comply with ASME B31.8. The steel welder shall have a copy of a certified ASME B31.8 qualification test report. Contractor shall also conduct a qualification test. Submit each welder's identification symbols, assigned number, or letter, used to identify work of the welder. Affix symbols immediately upon completion of welds. Welders making defective welds after passing a qualification test shall be given a re-qualification test and, upon failing to pass this test, shall not be permitted to work this contract.

B. Safety Standards
   1. 49 CFR PT 192 and 49 CFR PT 195.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle, transport, and store plastic pipe and fittings carefully. Plug or cap pipe ends during transportation or storage to minimize dirt and moisture entry. Do not subject to abrasion or concentrated external loads. Discard pipe sections and fittings that have been damaged.

B. See Specification Section 22 0010 - BASIC MECHANICAL PLUMBING REQUIREMENTS

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Conform to NFPA 54 and with requirements specified herein. Supply piping to appliances or equipment shall be at least as large as the inlets thereof.

2.02 PIPE AND FITTINGS

A. Aboveground and Within Buildings and Roof
   1. Pipe: Seamless carbon steel in accordance with ASTM A106, Grade B, Schedule 40, 80, plain end beveled for butt welding. See piping schedule M-0.2.
   2. Threaded Fittings. Sizes ½” to 1-1/2”, 3000# threaded, ASTM A 105, from isolation valve to equipment connections.
   3. Socket-Welding Fittings. Sizes ½” to 1-1/2”, 3000# socket weld, ASTM A 105 for branch and header connections.
   4. Butt-Welding Fittings. Sizes 2” to 6”, butt-weld, ASTM A 234, Grade WPB.
   5. Unions. Sizes ½” to 1-1/2”, 150# threaded, brass seats ASTM A 105.
   6. Flanges and Flanged Fittings: ASME/ANSI B16.5 steel flanges or convoluted steel flanges conforming to ASME BPVC SEC VIII D1. Flange faces shall have integral grooves of rectangular cross sections that afford containment for self-energizing gasket material.

B. Paint
   1. All gas piping shall be painted yellow and marked with appropriate labels. Paint to be Carboline 890 or 893 – Yellow 6666 OR DuPont 25P Safety Yellow 23663 with surface preparation per paint manufacturing requirements. See Section 09 9113, “Exterior Painting" and Section 09 9123 "Interior Painting".
   2. Labels of piping shall comply with ANSI A13.1 – “Scheme for Identification of Piping Systems”

2.03 VALVES, ABOVEGROUND

A. Shutoff Valves, Sizes 2” and Larger
   1. Valve shall be flanged end in accordance with ANSI B16.1, and with a single end lockable wrench handle. Body and plug material shall be in accordance with ASTM A126 Grade B. Valve shall be lubricated type, with reinforced Teflon seal on the stem and spring-loaded ball and lubricant sealed check valve to prevent leakage. Manufacturer: Homestead Valve or approved equal.

B. Shutoff Valves, Sizes ½” to 1-1/2”

1. Plug valve shall be threaded end with a single end lockable wrench handle. Body and plug material shall be in accordance with ASTM A 126 Grade B. Valve shall be lubricated type, with reinforced Teflon seal on the stem and spring-loaded ball and lubricant sealed check valve to prevent leakage. Manufacturer: Homestead Valve or approved equal.

C. Pressure Regulator
1. Self-contained with spring-loaded diaphragm pressure regulator, 60 psig to inches water reduction, pressure operating range as required for the pressure reduction indicated in pressure reducing schedule volume capacity not less than indicated, and threaded ends for sizes 1-1/2 inches and smaller, otherwise flanged.

2.04 GAS EQUIPMENT CONNECTORS

A. Flexible Connectors: ANSI Z21.45.

B. Semi-Rigid Tubing and Fittings: ANSI Z21.69.

2.05 HANGERS AND SUPPORTS

A. MSS SP-58, as required by MSS SP-69.

B. See Specification Section 23 0529 – Hangers and Supports

2.06 WELDING FILLER METAL

A. ASME B31.8.

2.07 PIPE-THREAD TAPE

A. Anti-seize and sealant tape of polytetrafluoroethylene (PTFE).

2.08 BOLTING (BOLTS AND NUTS)

A. Bolting Size ½" to 1-1/2". ASTM A 193 Grade B7 alloy hex head bolts with ASTM A 194, Grade "A" heavy hex nuts, coarse threads. Bolts, nuts and washers shall be cadmium plated or zinc electroplated. Washer shall be applied between nut and flange, also between bolt head and flange. Anti-seize thread compound shall be applied to bolt threads to minimize seizure.

B. Bolting Size 2" to 6". ASTM A 194, Grade B7 alloy steel stud bolts with ASTM A 563, Grade "A" heavy hex nuts, coarse threads. Studs, nuts and washers shall be cadmium plated or zinc electroplated. Washer shall be applied between each nut and flange. Anti-seize thread compound shall be applied to stud threads to minimize seizure.

2.09 GASKETS

A. Ring type, 1/8" compressed thickness, 304 stainless steel non-asbestos filled, Flexitallic CG or approved equivalent.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install gas piping, appliances, and equipment in accordance with NFPA 54.

B. Piping
1. Cut pipe to actual dimensions and assemble to prevent residual stress. Provide supply connections entering the buildings as indicated. Within buildings, run piping parallel to structure lines and conceal in finished spaces. Terminate each vertical supply pipe to burner or appliance with tee, nipple and cap to form a sediment trap. To supply multiple items of gas-burning equipment, provide manifold with inlet connections at both ends.
2. Cleanliness
a. Clean inside of pipe and fittings before installation. Blow lines clear using 80 to 100 psig clean dry compressed air. Rap steel lines sharply along entire pipe length before blowing clear. Cap or plug pipe ends to maintain cleanliness throughout installation.
3. Aboveground Steel Piping
a. Painting: Paint new ferrous metal piping, including supports, in accordance with Section 09 9113, "Exterior Painting" and Section 09 9123 "Interior Painting" Do not apply paint until piping tests have been completed.
b. Identification of Piping: Identify piping aboveground in accordance with Section 22 0553 – Identification for Plumbing and Piping Equipment

C. Valves

1. Install valves approximately at locations indicated. Orient stems vertically, with operators on top, or horizontally. Provide support for valves to resist operating torque.

D. Pressure Regulator
   1. Provide plug cock or ball valve ahead of regulator. Install regulator outside of building and 18 inches aboveground on riser. Install regulator inside building and extend a full-size vent line from relief outlet on regulator to a point outside of building. Install gas meter in conjunction with pressure regulator. On outlet side of regulator meter, provide a union and a 3/8-inch gage tap with plug.

E. Stop Valve and Shutoff Valve
   1. Provide stop valve on service branch at connection to main and shut-off valve on riser outside of building.

F. Piping Hangers and Supports
   1. Selection, fabrication, and installation of piping hangers and supports shall conform to MSS SP-69 and MSS SP-89, unless otherwise indicated. See Specification Section 23 0529 – Hangers and Supports

G. Final Connections
   1. Make final connections to equipment and appliances using rigid pipe and fittings, except for the following:

3.02 FIELD QUALITY CONTROL

A. General
   1. Testing, inspection, and purging in compliance with NFPA 54 and ASME B31.8.
   2. All testing and inspection shall be provided with piping exposed. Replace, repair, and then re-inspect defective welds.

B. Pressure Tests
   1. Include pressure test results in closeout documentation. Owner to be present for pressure testing and be given a minimum of 48 hours notice prior to scheduled testing time.
   2. ASME B31.8 Scope: "802.11... This code covers the design, fabrication, installation, inspection, testing and safety aspects of operation and maintenance of gas transmission and distribution systems, including gas pipelines, gas compressor stations, gas metering and regulation stations, gas mains, and service lines up to the outlet of the customer's meter set assembly...802.14. This code does not apply to...(c) piping beyond the outlet of the customers meter set assembly..."
   3. Use test pressure of 1-1/2 times maximum working pressure, but in no case less than 50 psig. Do not test until every joint has set and cooled at least 8 hours at temperatures above 10°C/ 50°F. Test system gas tight in accordance with NFPA 54 or ASME B31.8.
   4. Use clean dry air or inert gas, such as nitrogen or carbon dioxide, for testing. Systems that may be contaminated by gas shall first be purged as specified. Make tests on entire system or on sections that can be isolated by valves. After pressurization, isolate entire piping system from sources of air during test period. Maintain test pressure for at least 8 hours between times of first and last reading of pressure and temperature. Take first reading at least one hour after test pressure has been applied.
   5. Do not take test readings during rapid weather changes. Provide temperature same as actual trench conditions. There shall be no reduction in the applied test pressure other than that due to a change in ambient temperature. Allow for ambient temperature change in accordance with the relationship PF + 101.32 = (P1 + 101.32)(T2 + 273) T1 + 273) PF + 14.7 = (P1 + 14.7) (T2 + 460) / T1 + 460), in which "T" and "PF" represent Centigrade/Fahrenheit temperature and gage pressure, respectively, subscripts "1" and "2" denote initial and final readings, and "PF" is the calculated final pressure. If "PF" exceeds the measured final pressure (final gage reading) by 1/2 psi or more, isolate sections of the piping system, retest each section individually, and apply a solution of warm soapy water to joints of each section for which a reduction in pressure occurs after allowing for ambient temperature change. Repair leaking joints and repeat test until no reduction in pressure occurs. In performing tests, use a test gage calibrated in 1 psi increments and readable to 1/2 psi.

C. System Purging
   1. After completing pressure tests, and before testing a gas-contaminated line, purge line with nitrogen at junction with main line to remove all air and gas.

2. Clear completed line by attaching a test pilot fixture at capped stub-in line at building location and let gas flow until test pilot ignites.
3. Procedures shall conform to NFPA 54 and ASME B31.8.
4. -CAUTION-Failure to purge may result in explosion within line when air-to-gas is at correct mixture.

END OF SECTION

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SECTION 23 21 13
HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water and glycol piping, above grade.

C. Pipe and pipe fittings for:
   1. Heating water piping system.
   2. Equipment drains and overflows.
   3. Pipe hangers and supports.
   4. Unions, flanges, mechanical couplings, and dielectric connections.

D. Valves:
   1. Globe or angle valves.
   2. Ball valves.
   3. Butterfly valves.
   4. Check valves.

E. Flow controls.

1.02 RELATED REQUIREMENTS

A. Section 08 31 00 - Access Doors and Panels.

B. Section 22 07 19 - Plumbing Piping Insulation.

C. Section 23 05 53 - Identification for HVAC Piping and Equipment.

D. Section 23 07 19 - HVAC Piping Insulation.

E. Section 23 21 14 - Hydronic Specialties.

F. Section 23 25 00 - HVAC Water Treatment: Pipe cleaning.

G. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

D. ASME B31.9 - Building Services Piping; 2020.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

F. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service; 2019a.

G. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.

H. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).

I. ASTM B32 - Standard Specification for Solder Metal; 2020.

J. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

K. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

L. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 2024.

M. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007 (Reapproved 2019).

N. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

O. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

P. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.

Q. AWWA C606 - Grooved and Shouldered Joints; 2022.

R. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

1.04 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Use grooved mechanical couplings and fasteners in accessible locations.

C. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

D. Use non-conducting dielectric connections whenever jointing dissimilar metals.

E. Provide pipe hangers and supports in accordance with ASME B31.9 unless indicated otherwise.

F. Use ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

G. Use globe valves for throttling, bypass, or manual flow control services.

H. Use spring loaded check valves on discharge of pumps.

I. Use plug cocks for throttling service. Use non-lubricated plug cocks only when shut-off or isolating valves are also provided.

J. Use 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest floor drain.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

C. Welders Certificate: Include welders certification of compliance with ASME BPVC-IX.

D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

E. Project Record Documents: Record actual locations of valves.

F. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.

B. Date stamp all castings used for coupling housings, fittings, valve bodies, etc. for quality assurance and traceability.

C. Welder Qualifications: Certify in accordance with ASME BPVC-IX.

1.07 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 code for installation of piping system.

B. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of welders.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:
   1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
   2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
   3. Grooved mechanical joints may be used in accessible locations only.
      a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Architect.
      b. Grooved mechanical connections and joints comply with AWWA C606.
         1) Ductile Iron: Comply with ASTM A536, Grade 65-45-12.
         2) Steel: Comply with ASTM A106/A106M, Grade B or ASTM A53/A53M.
      c. Use rigid joints unless otherwise indicated.
   4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
   1. Where grooved joints are used in piping, provide grooved valve/equipment connections if available; if not available, provide flanged ends and grooved flange adapters.

D. Valves: Provide valves where indicated:
   1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch ball valves with cap; pipe to nearest floor drain.
   2. For throttling, bypass, or manual flow control services, use globe valves.
   3. In heating water systems, butterfly valves may be used interchangeably with gate and globe valves.
   4. For shut-off and to isolate parts of systems or vertical risers, use ball valves.

2.02 HEATING WATER AND GLYCOL PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
   1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
   2. Grooved Joints:
      a. Pipe/Grooved (Standard/Lightwall): Carbon Steel, A-53B/A-106B - Roll or cut grooved-ends as appropriate to pipe material, wall thickness, pressures, size and method of joining. Pipe ends to be grooved in accordance with Victaulic current listed standards conforming to ANSI/AWWA C-606.
      b. Victaulic Standard Mechanical Couplings, 2 inch (DN50) through 12 inch (DN300): Manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets shall be pressure-responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000. (Gaskets used for potable water applications shall be UL classified in accordance with ANSI/NSF-61 for potable water service.) Mechanical Coupling bolts shall be zinc plated (ASTM B-633) heat treated carbon steel track head conforming to ASTM A-449 and ASTM A-183, minimum tensile strength 110,000 psi (758450 kPa) as provided standard Victaulic.

B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn, using one of the following joint types:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
    a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
    b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.
2. Grooved Joints: AWWA C606 grooved tube, fittings of same material, and copper-tube-dimension mechanical couplings.
3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
4. PRO PRESS or ANVIL International are acceptable alternates to solder joints

2.03 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn; using one of the following joint types:
    1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

2.04 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
    1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

B. Conform to ASME B31.9.

C. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.

D. Hangers for Cold Pipe Sizes 2 Inches and Greater: Carbon steel, adjustable, clevis.

E. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.

F. Hangers for Hot Pipe Sizes 6 Inches and Greater: Adjustable steel yoke, cast iron roll, double hanger.

G. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

H. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Greater: Steel channels with welded spacers and hanger rods, cast iron roll.

I. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

J. Wall Support for Pipe Sizes 4 Inches and Greater: Welded steel bracket and wrought steel clamp.

K. Wall Support for Hot Pipe Sizes 6 Inches and Greater: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.

L. Vertical Support: Steel riser clamp.

M. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

N. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

O. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

P. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

Q. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

R. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

2.05 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe 2 Inches and Less:
    1. Ferrous Piping: 150 psig malleable iron, threaded.
    2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe 2 Inches and Greater:
    1. Ferrous Piping: 150 psig forged steel, slip-on.
    2. Copper Piping: Bronze.

3. Gaskets: 1/16 inch thick preformed neoprene.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
   1. Dimensions and Testing: In accordance with AWWA C606.
   2. Mechanical Couplings: Comply with ASTM F1476.
   3. Housing Clamps: Malleable iron galvanized to engage and lock, designed to permit some angular deflection, contraction, and expansion.
   4. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
   5. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
   6. When pipe is field grooved, provide coupling manufacturer's grooving tools.
   7. Manufacturers:
      a. Grinnell Products, a Tyco Business: www.grinnell.com.
      b. Victaulic Company: www.victaulic.com.
      c. Anvil International

2.06 GLOBE OR ANGLE VALVES

A. Manufacturers:
   1. Tyco Flow Control: www.tycoflowcontrol.com.
   2. Conbraco Industries: www.apollovalves.com.
   3. Nibco, Inc: www.nibco.com.
   4. Milwaukee Valve Company: www.milwaukeevalve.com.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Up To and Including 2 Inches:
   1. Bronze body, bronze trim, screwed bonnet, rising stem and handwheel, inside screw with backseating stem, renewable composition disc and bronze seat, solder ends.

C. Over 2 Inches:
   1. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, rotating plug-type disc with renewable seat ring and disc, flanged ends.

2.07 BALL VALVES

A. Manufacturers:
   1. Tyco Flow Control: www.tycoflowcontrol.com.
   2. Nibco, Inc[<>]: www.nibco.com.
   3. Milwaukee Valve Company: www.milwaukeevalve.com.
   4. Victaulic Company: www.victaulic.com.
   5. Anvil International
   6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Up To and Including 2 Inches:
   1. Bronze two piece body, stainless steel ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder or threaded ends with union.

C. Over 2 Inches:
   1. Cast steel body, stainless steel ball, teflon seat and stuffing box seals, lever handle, flanged.

2.08 BUTTERFLY VALVES

A. Manufacturers:
   1. Hammond Valve: www.hammondvalve.com.
   2. Milwaukee Valve Company[<>]: www.milwaukeevalve.com.
   3. Victaulic Company: www.victaulic.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck.

C. Disc: Construct of aluminum bronze, chrome plated ductile iron, stainless steel, ductile iron with EPDM encapsulation, or Buna-N encapsulation.

D. Operator: Infinite position lever handle with memory stop.

2.09 SPRING LOADED CHECK VALVES

A. Manufacturers:
   1. Victaulic Company: www.victaulic.com.
   2. Anvil International
   3. Titan Flow Control
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

2.10 FLOW CONTROLS

A. Manufacturers:
   1. Tyco Flow Control: www.tycoflowcontrol.com.
   2. ITT Bell & Gossett: www.bellgossett.com.
   3. Griswold Controls: www.griswoldcontrols.com.
   4. Taco, Inc: www.taco-hvac.com.
   5. Victaulic
   6. Anvil International
   7. Substitutions: See Section 01 60 00 - Product Requirements.

B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare piping connections to equipment using jointing system specified.

E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

F. After completion, fill, clean, and treat systems. Refer to Section 23 25 00 for additional requirements.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install heating water, glycol, chilled water, condenser water, and engine exhaust piping to ASME B31.9 requirements.

C. Route piping in orderly manner, parallel to building structure, and maintain gradient.

D. Install piping to conserve building space and to avoid interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Sleeve pipe passing through partitions, walls, and floors.

G. Slope piping and arrange to drain at low points.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.

I. Grooved Joints:
   1. Gaskets to be suitable for the intended service, molded, and produced by the coupling manufacturer.

J. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

K. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.
9. Prime coat exposed steel hangers and supports. Refer to Section 09 9123. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

L. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 07 19.

M. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 00 .

N. Use eccentric reducers to maintain top of pipe level.

O. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

P. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Section 09 91 23.

Q. Install valves with stems upright or horizontal, not inverted.

R. Install pressure independant control valve on all coils 15 GPM and greater.

3.03 FIELD TESTS AND INSPECTIONS

A. Verify and inspect systems according to requirements by the Authority Having Jurisdiction. In the absence of specific test and inspection procedures proceed as indicated below.

B. Hydronic Water Systems:
1. Include pressure test results in closeout documentation. Owner to be present for pressure testing and be given a minimum of 48 hours notice prior to scheduled testing time.
2. Perform hydrostatic testing for leakage.
3. Test Preparation: Close each fixture valve or disconnect and cap each connected fixture.
4. General:
   a. Fill the system with water and raise static head to 10 psi above service pressure. Minimum static head of 50 to 150 psi. As an exception, certain codes allow a maximum static pressure of 80 psi.
5. Metal Piping Systems Subject to Freezing Conditions:
   a. Inject 40 psi of compressed air into piping to spot check for leaks with liquid soap. Document and repair leaks as necessary.
   b. Raise injected compressed air pressure to 1.5 times rated service pressure or minimum pressure of 100 psi for a duration of 2 hours and verify with a gauge that no perceptible pressure drop is measured.

C. Test Results: Document and certify successful results, otherwise repair, document, and retest.

3.04 SCHEDULES

A. Hanger Spacing for Copper Tubing.
1. 1/2 inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. 1 inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. 1-1/2 inch and 2 inch: Maximum span, 8 feet; minimum rod size, 3/8 inch.

4. 2-1/2 inch: Maximum span, 9 feet; minimum rod size, 3/8 inch.
5. 3 inch: Maximum span, 10 feet; minimum rod size, 3/8 inch.
6. 4 inch: Maximum span, 12 feet; minimum rod size, 1/2 inch.
7. 6 inch: Maximum span, 14 feet; minimum rod size, 1/2 inch.
8. 8 inch: Maximum span, 16 feet; minimum rod size, 5/8 inch.

B. Hanger Spacing for Steel Piping.
1. 1/2 inch, 3/4 inch, and 1 inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
3. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. 2 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. 2-1/2 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. 3 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
7. 4 inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.
8. 6 inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.
9. 8 inches: Maximum span, 19 feet; minimum rod size, 5/8 inch.

END OF SECTION

SECTION 23 21 14
HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air vents.

B. Strainers.

C. Pressure-temperature test plugs.

D. Balancing valves.

E. Relief valves.

F. Glycol system.

G. Glycol specialties.

H. Glycol system maintenance.

1.02 RELATED REQUIREMENTS

A. Section 23 21 13 - Hydronic Piping.

B. Section 23 25 00 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.

C. Certificates: Inspection certificates for pressure vessels from authority having jurisdiction.

D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

E. Maintenance Contract.

F. Project Record Documents: Record actual locations of flow controls.

G. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 AIR VENTS

A. Manufacturers:
   1. Armstrong International, Inc: www.armstronginternational.com.
   2. ITT Bell & Gossett: www.bellgossett.com.
   3. Taco, Inc: www.taco-hvac.com.

4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

C. Float Type:
1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

D. Washer Type:
1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

2.02 STRAINERS

A. Manufacturers:
1. Armstrong International, Inc: www.armstronginternational.com.
2. Green Country Filtration: greencountryfiltration.com.
3. WEAMCO: www.weamco.com.
4. Anvil International, Inc[<>]: www.anvilintl.com.
5. Titan Flow Control
6. Victaulic; Model Series 732: www.victaulic.com
7. Substitutions: See Section 01 60 00 - Product Requirements.

B. Size 2 inch and Under:
1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 2-1/2 inch to 4 inch:
1. Flanged iron body for 175 psi working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

2.03 PRESSURE-TEMPERATURE TEST PLUGS

A. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F.

B. Application: Use extended length plugs to clear insulated piping.

2.04 BALANCING VALVES

A. Manufacturers:
1. Armstrong International, Inc: www.armstronginternational.com.
2. ITT Bell & Gossett: www.bellgossett.com.
3. Taco, Inc: www.taco-hvac.com.
4. Griswold
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Size 2 inch and Smaller:
1. Provide ball or globe style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and NPT threaded or soldered connections.
2. Metal construction materials consist of bronze or brass.
3. Non-metal construction materials consist of Teflon, EPDM, or engineered resin.

C. Size 2.5 inch and Larger:
1. Provide ball or globe style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and flanged, grooved, or weld end connections.
2. Valve body construction materials consist of cast iron, carbon steel, or ductile iron.
3. Internal components construction materials consist of brass, aluminum bronze, bronze, Teflon, EPDM, NORYL, or engineered resin.

2.05 PRESSURE INDEPENDENT VALVES

A. Manufacturers:

1. Griswold Controls LLC; PIC-V: www.griswoldcontrols.com/#sle.
2. Belimo
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Size 2 inch and Smaller:
1. Provide ball or globe style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and NPT threaded or soldered connections.
2. Metal construction materials consist of bronze or brass.
3. Non-metal construction materials consist of Teflon, EPDM, or engineered resin.

C. Size 2.5 inch and Larger:
1. Provide ball, globe, or butterfly style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and flanged, grooved, or weld end connections.
2. Valve body construction materials consist of cast iron, carbon steel, or ductile iron.
3. Internal components construction materials consist of brass, aluminum bronze, bronze, Teflon, EPDM, NORYL, or engineered resin.

2.06 AUTOMATIC FLOW LIMITING VALVES

A. Manufacturers:
1. Griswold Controls LLC; Isolator R Valve: www.griswoldcontrols.com/#sle.
2. Hays Fluid Controls; _____: www.haysfluidcontrols.com/#sle.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Size 0.50 inch to 14 inch:
1. Provide ball or globe style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and NPT threaded or soldered connections.
2. Metal construction materials consist of bronze or brass.
3. Non-metal construction materials consist of Teflon, EPDM, or engineered resin.

2.07 GLYCOL SYSTEM

A. Tank Pumping System
1. Manufacture
a. Neptune Chemical Pump Co., Inc:
b. Axiom
c. ITT
d. Wessels
2. Pump mounted under the 50 gal tank, tank lid hinged, stand, PVC suction valve, Poly "Y" strainer with plug in cord.
3. Pipe system to expansion tank, include ball valve, check, and pressure gauge.

B. Expansion Tank: Closed type with vent fitting with air separator, and automatic air vent.

C. Glycol Solution:
1. Hot Water Systems
a. Inhibited propylene glycol and water solution mixed 30 percent glycol - 70 percent water by volume, suitable for operating temperatures from 0 degrees F to 250 degrees F. Burst Protection to -10F.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Where large air quantities can accumulate, provide enlarged air collection standpipes.

C. Provide manual air vents at system high points and as indicated.

D. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

E. Provide valved drain and hose connection on strainer blow down connection.

F. Support pump fittings with floor mounted pipe and flange supports.

G. Clean and flush glycol system before adding glycol solution. Refer to Section 23 25 00.

H. Feed glycol solution to system through make-up line with backflow preventer, pressure regulator, venting system high points.

I. Perform tests determining strength of glycol and water solution and submit written test results.

3.02 MAINTENANCE

A. See Section 01 70 00 - Execution Requirements, for additional requirements relating to maintenance service.

B. Provide service and maintenance of glycol system for one year from date of Substantial Completion at no extra charge to Owner.

C. Perform monthly visit to make glycol fluid concentration analysis on site with refractive index measurement instrument. Report findings in detail in writing, including analysis and amounts of glycol or water added.

D. Explain corrective actions to Owner's maintenance personnel in person.

3.03 SCHEDULES

A. See Schedules on Plans.

END OF SECTION

SECTION 23 21 23
HYDRONIC PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vertical in-line pumps.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 23 07 19 - HVAC Piping Insulation.

C. Section 23 21 13 - Hydronic Piping.

D. Section 23 21 14 - Hydronic Specialties.

E. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.04 PERFORMANCE REQUIREMENTS

A. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

D. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Pump Seals: One set for each type and size of pump.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.

B. Alignment: Base mounted pumps shall be aligned by qualified millwright.

1.07 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by UL 778 as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Armstrong Pumps Inc: www.armstrongpumps.com.

B. Bell & Gossett, a Xylem Inc. brand: www.bellgossett.com.

C. Taco

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 HVAC PUMPS - GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent

of midpoint of published maximum efficiency curve.

B. Minimum Quality Standard: UL 778.

C. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to Authority Having Jurisdiction as suitable for the purpose specified and indicated.

D. Controls
   1. See Specification Section 23 0993 - Sequence of Operations for HVAC Controls

2.03 VERTICAL IN-LINE PUMPS

A. Type: Vertical, single stage, close coupled, radially or horizontally split casing, for in-line mounting, for 175 psi working pressure.

B. Casing: Cast iron, with suction and discharge gage port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.

C. Impeller: Bronze, fully enclosed, keyed directly to motor shaft or extension.

D. Shaft: Stainless steel with stainless steel impeller cap screw or nut and stainless steel sleeve.

E. Seal: Mechanical seal, 225 degrees F maximum continuous operating temperature.

F. Electrical Characteristics:
   1. Refer to Section 26 05 83.

G. Controls
   1. See Schedules on Plans.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches and over.

D. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.

E. Provide drains for bases and seals, piped to and discharging into floor drains.

F. Lubricate pumps before start-up.

G. Provide side-stream filtration system for closed loop systems. Install across pump with flow from pump discharge to pump suction from pump tappings.

3.03 SCHEDULES

A. Pumps: See Schedules on Plans.

END OF SECTION

SECTION 23 23 00
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

E. Strainers.

F. Filter-driers.

G. Solenoid valves.

H. Expansion valves.

1.02 RELATED REQUIREMENTS

A. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AHRI 710 - Performance Rating of Liquid-Line Driers; 2009.

B. AHRI 750 - Thermostatic Refrigerant Expansion Valves; 2007.

C. AHRI 760 - Performance Rating of Solenoid Valves for Use With Volatile Refrigerants; 2007.

D. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2022, with Addendum (2024).

E. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.

F. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

G. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2018.

H. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2022.

I. ASME B31.9 - Building Services Piping; 2020.

J. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

K. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

L. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

M. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2023.

N. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

O. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

P. UL 429 - Electrically Operated Valves; Current Edition, Including All Revisions.

1.04 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

C. Liquid Indicators:
   1. Use line size liquid indicators in main liquid line leaving condenser.
   2. Use line size on leaving side of liquid solenoid valves.

D. Valves:

1. Use service valves on suction and discharge of compressors.
2. Use gauge taps at compressor inlet and outlet.

E. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.

F. Strainers:
1. Use line size strainer upstream of each automatic valve.
2. Use shut-off valve on each side of strainer.

G. Pressure Relief Valves: Use on ASME receivers and pipe to outdoors.

H. Filter-Driers:
1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.
2. Use filter-driers for each solenoid valve.

I. Solenoid Valves:
1. Use in liquid line of single or multiple evaporator systems.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide general assembly of specialties, including manufacturers catalogue information for piping and accessories. Provide manufacturers catalog data including load capacity.

C. Design Data: Submit design data indicating pipe sizing. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

D. Test Reports: Indicate results of leak test, acid test.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Extra Filter-Dryer Cartridges: One of each type and size.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with ASME B31.9 for installation of piping system.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

C. Welders Certification: In accordance with ASME BPVC-IX.

D. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

2.02 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
1. Fittings: ASME B16.22 wrought copper.
2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.

B. Copper Tube to 7/8 inch OD: ASTM B88 (ASTM B88M), Type K (A), annealed.
1. Fittings: ASME B16.26 cast copper.
2. Joints: Flared.

C. Pipe Supports and Anchors:
1. Provide hangers and supports that comply with MSS SP-58.
a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
5. Vertical Support: Steel riser clamp.
6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
7. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
8. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
9. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
   a. Bases: High density, UV tolerant, polypropylene or reinforced PVC.
   b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
   c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
   d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
   e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.

2.03 REFRIGERANT

A. Refrigerant: R-32 or R-454B.

2.04 MOISTURE AND LIQUID INDICATORS

A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.05 VALVES

A. Ball Valves:
   1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

B. Service Valves:
   1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

2.06 FILTER-DRIERS

A. Performance:
   1. Flow Capacity - Liquid Line: As indicated in schedule, minimum, rated in accordance with AHRI 710.
   2. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
   3. Design Working Pressure: 350 psi, minimum.

B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

C. Construction: UL listed.
   1. Connections: As specified for applicable pipe type.

2.07 SOLENOID VALVES

A. Valve: AHRI 760 I-P, pilot operated, copper, brass or steel body and internal parts, synthetic seat, stainless steel stem and plunger assembly (permitting manual operation in case of coil failure), integral strainer, with flared, solder, or threaded ends; for maximum working pressure of 500 psi. Wired by TCC.

B. Coil Assembly: UL 429 UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box with pilot light.

C. Voltage: 24 V

2.08 EXPANSION VALVES

A. Angle or Straight Through Type: AHRI 750; design suitable for refrigerant, brass body, internal or external equalizer, bleed hole, adjustable superheat setting, replaceable inlet strainer, with non-replaceable capillary tube and remote sensing bulb and remote bulb well.

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 degrees F superheat. Select to avoid being undersized at full load and excessively oversized at part load.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

E. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.5.
   2. Support horizontal piping as indicated.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   6. Provide copper plated hangers and supports for copper piping.

F. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

G. Provide clearance for installation of insulation and access to valves and fittings.

H. Flood piping system with nitrogen when brazing.

I. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

J. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

K. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

L. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

M. Fully charge completed system with refrigerant after testing.

N. Provide electrical connection to solenoid valves. Coordinate with electrical contractor for final electrical requirements. Refer to Section 26 05 83.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Test refrigeration system in accordance with ASME B31.5.

C. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test to no leakage.

3.04 SCHEDULES

A. Hanger Spacing for Copper Tubing.

1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 1/4 inch.

END OF SECTION

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SECTION 23 25 00
HVAC WATER TREATMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Materials.
   1. System cleaner.
   2. Closed system treatment (water).

B. By-pass (pot) feeder.

1.02 RELATED REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Owner furnished treatment equipment.

B. Section 23 21 13 - Hydronic Piping.

C. Section 23 21 14 - Hydronic Specialties.

D. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.

D. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.

E. Certificate: Submit certificate of compliance from Authority Having Jurisdiction indicating approval of chemicals and their proposed disposal.

F. Project Record Documents: Record actual locations of equipment and piping, including sampling points and location of chemical injectors.

G. Operation and Maintenance Data: Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Sufficient chemicals for treatment and testing during required maintenance period.

PART 2 PRODUCTS

2.01 MATERIALS

A. System Cleaner:
   1. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodiumtripoly phosphate and sodium molybdate.
   2. Biocide chlorine release agents such as sodium hypochlorite or calcium hypochlorite or microbiocides such as quarternary ammonia compounds, tributyltin oxide, methylene bis (thiocyanate).

B. Closed System Treatment (Water):
   1. Sequestering agent to reduce deposits and adjust pH; polyphosphate.
   2. Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
   3. Conductivity enhancers; phosphates or phosphonates.

2.02 BY-PASS (POT) FEEDER

A. Manufacturers:
   1. Griswold Controls; _____: www.griswoldcontrols.com/#sle.
   2. J. L. Wingert Company; _____: www.jlwingert.com/#sle.
   3. Neptune, a brand of the Dover Company; _____: www.neptune1.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. 6.3 gal quick opening cap for working pressure of 200 psi with 20 micron integral filter bag.

PART 3 EXECUTION

3.01 PREPARATION

A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.

B. Place terminal control valves in open position during cleaning.

C. Verify that electric power is available and of the correct characteristics.

3.02 CLEANING SEQUENCE

A. Concentration:
   1. As recommended by manufacturer.

B. Hot Water Heating Systems:
   1. Apply heat while circulating, slowly raising temperature to 180 degrees F and maintain for 12 hours minimum.
   2. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.
   3. Circulate for 6 hours at design temperatures, then drain.
   4. Refill with clean water and repeat until system cleaner is removed.

C. Use neutralizer agents on recommendation of system cleaner supplier and approval of Architect.

D. Flush open systems with clean water for one hour minimum. Drain completely and refill.

E. Remove, clean, and replace strainer screens.

F. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.04 CLOSED SYSTEM TREATMENT

A. Provide one bypass feeder on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.

B. Introduce closed system treatment through bypass feeder when required or indicated by test.

3.05 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation and maintenance of chemical treatment system.
   1. Provide minimum of two hours of instruction for two people.
   2. Have operation and maintenance data prepared and available for review during training.
   3. Conduct training using actual equipment after treated system has been put into full operation.

3.06 MAINTENANCE

A. Perform maintenance work using competent and qualified personnel under the supervision and in the direct employ of the equipment manufacturer or original installer.

B. Provide service and maintenance of treatment systems for one year from Date of Substantial Completion.

C. Provide laboratory and technical assistance services during this maintenance period.

D. Provide on-site inspections of equipment during scheduled or emergency shutdown to properly evaluate success of water treatment program, and make recommendations in writing based upon these inspections.

END OF SECTION

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

1.02 RELATED REQUIREMENTS

A. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

B. Section 23 07 13 - Duct Insulation

C. Section 23 33 00 - Air Duct Accessories.

D. Section 23 37 00 - Air Outlets and Inlets.

1.03 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

D. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

E. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

G. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

H. SMACNA (DCS) - HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE; 2020.

I. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012.

J. UL 1978 - Grease Ducts; Current Edition, Including All Revisions.

K. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies; Current Edition, Including All Revisions.

1.04 PERFORMANCE REQUIREMENTS

A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for air handling systems systems.

C. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK). Grease duct liquid-tight test performance, following IMC.

D. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.06 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A standards.

1.07 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 MATERIALS

A. Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, ASTM A 653/A 653M FS Type B, with G60/Z180 coating.

B. Steel Ducts: ASTM A 1008/A 1008M, Designation CS, cold-rolled commercial steel.

C. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. VOC Content: Not more than 250 g/L, excluding water.
   3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.

D. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

E. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
   1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
   2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
   3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
   4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
   5. Other Types: As required.

F. Insulated Flexible Ducts:
   1. Multiple layers of aluminum laminate supported by helically wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.
      a. Pressure Rating: 10 inches WG positive and 1.0 inches negative.
      b. Maximum Velocity: 4000 fpm.
      c. Temperature Range: -20 degrees F to 210 degrees F.

G. Grease Exhaust: -2 inch w.g. pressure class, stainless steel.
   1. Construct of 18 gage, 0.0500 inch stainless steel.
   2. Construction:
      a. Liquid tight with continuous external weld for all seams and joints.
      b. Where ducts are not self draining back to equipment, provide low point drain pocket with copper drain pipe to sanitary sewer.
   3. Access Doors:
      a. Provide for duct cleaning inside horizontal duct at drain pockets, every 20 feet and at each change of direction.
      b. Use same material and thickness as duct with gaskets and sealants rated 1500 degrees F for grease tight construction.
   4. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E 84.

2.02 DUCTWORK FABRICATION

A. Transfer Air and Sound Boots: 1/2 inch w.g. pressure class.

B. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

D. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

E. Provide air foil turning vanes in all mitered 90 degree elbows.

F. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

G. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

H. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

I. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

2.03 MANUFACTURED METAL DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Transverse Duct Connection System: SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Kitchen Hood Exhaust: Provide residue traps at base of vertical risers with provisions for clean out.

E. Kitchen hood exhasut shall be tested to be liquid tight in accordance with NFPA 96 and the IMC. Test shall be witnessed by qualified owner's representative and report of test results shall be required.

F. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

G. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

H. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

J. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

K. Use double nuts and lock washers on threaded rod supports.

L. All duct shall meet SMACNA Seal Class A:
   1. All transverse joints and longitudinal seams and duct wall penetrations shall be sealed. Pressure sensitive tape shall not be used as primary sealant. Max. 2 to 5 percent total system leakage.

3.02 SCHEDULES

A. Ductwork Material:
   1. Low Pressure Supply (Heating Systems): Steel..
   2. Low Pressure Supply (System with Cooling Coils): Steel.
   3. Return and Relief: Steel.
   4. General Exhaust: Steel.
   5. Kitchen Hood Exhaust: Stainless Steel.
   6. Outside Air Intake: Steel.

B. Ductwork Pressure Class:
   1. Supply: +2 inch.
   2. Return and Relief: -2 inch..
   3. General Exhaust: -2 inch.
   4. Transfer Duct: 1 inch.
   5. Outside Air Intake: +2 inch.

END OF SECTION

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air turning devices/extractors.

B. Backdraft dampers - metal.

C. Combination fire and smoke dampers.

D. Duct access doors.

E. Duct test holes.

F. Fire dampers.

G. Flexible duct connections.

H. Volume control dampers.

I. Low leakage (Class 1A) control dampers.

J. Miscellaneous products:
   1. Damper operators.

1.02 RELATED REQUIREMENTS

A. Section 23 31 00 - HVAC Ducts and Casings.

B. Section 23 36 00 - Air Terminal Units: Pressure regulating damper assemblies.

C. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

B. NFPA 92 - Standard for Smoke Control Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

D. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

E. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers on duct shop drawing submittal.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Fusible Links: One of each type and size.

1.05 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 BACKDRAFT DAMPERS

A. Motorized Backdraft Dampers: 18 ga. galvanized steel with pre-punched mounting holes, roll formed aluminum damper blades and 24 VAC actuator.
   1. Maximum Leakage Allowed: 4 cfm/sq ft at 1 in wg.

2.02 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
   1. Ruskin Company: www.ruskin.com.
   2. United Enertech: www.unitedenertech.com/#sle.
   3. Greenheck
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

C. Provide factory sleeve and collar for each damper.

D. Multiple Blade Dampers: Fabricate with 16 gage, 0.0598 inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.

E. Operators: UL listed and labeled spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on interior of duct and link to damper operating shaft.

F. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure. Stainless steel springs with locking devices to ensure positive closure for units mounted horizontally.

G. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

H. Momentary Test Switch: Test switch to cycle test the damper with LED open and close indicator lights.

2.03 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.
   1. Less Than 12 inches Square: Secure with sash locks.
   2. Up to 18 inches Square: Provide two hinges and two sash locks.
   3. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.

B. Access doors with sheet metal screw fasteners are not acceptable.

2.04 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.05 FIRE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

B. Horizontal Dampers: Galvanized steel, 22 gage frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

C. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.

D. Multiple Blade Dampers: 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

E. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.06 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.

C. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame

with suitable hardware.

D. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

2.07 LOW LEAKAGE (CLASS 1) CONTROL DAMPERS

A. Maximum Leakage Allowed: 4 cfm/sq ft at 1 in wg.

B. Frame:
   1. Material: 6063 T6 aluminum.

C. Blade:
   1. Type: Multi-blade airfoil for high pressure.
   2. Operation: Opposed type.
   3. Maximum Individual Blade Height: 8 inches.
   4. Material: 6063 T6 aluminum.
   5. Authority: Opposed type, 5 to 50 percent (typically 10 percent).

D. Insulation: Thermally-broken blade and frame.

E. Temperature Service Range: -45 to 185 degrees F..

PART 3 EXECUTION

3.01 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 31 00 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Maximum damper leakage rate to meet applicable state Energy Code requirements

D. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, in front and behind airflow measuring stations, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

E. Provide duct test holes where indicated and required for testing and balancing purposes.

F. Provide fire dampers and combination fire and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

G. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.

H. Demonstrate re-setting of fire dampers to Owner's representative.

I. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

J. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

K. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

L. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

M. Provide stand-offs tall enough to clear required insualtion for all balancing dampers located in insulatated duct.

N. Max flex duct length of 5'-0".

O. All outdoor, return and relief motorized dampers shall be spring return. Outdoor and relief dampers shall fail closed and the return damper shall fail open.

END OF SECTION

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SECTION 23 34 23
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof exhausters.

B. Ceiling exhaust fans.

C. Inline centrifugal fans.

D. Kitchen hood upblast roof exhausters.

1.02 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

B. AMCA 99 - Standards Handbook; 2016.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2020.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016, with Errata (2018).

E. AMCA 300 - Reverberation Room Methods of Sound Testing of Fans; 2024.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

H. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

I. UL 762 - Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Greenheck Fan Corporation; _____: www.greenheck.com/#sle.

B. Loren Cook Company; _____: www.lorencook.com/#sle.

C. Twin City Fan & Blower; _____: www.tcf.com/#sle.

D. CaptiveAire.

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.

B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.

D. Fabrication: Comply with AMCA 99.

E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

F. Kitchen Hood Exhaust Fans: Comply with requirements of NFPA 96 and UL 762.

G. Provide Hand/Off/Auto fan controller for all ECM motors to allow for local fan control and connection to BAS. Remote mount controller in nearest mechanical room and label controller with associated fan information.

2.03 ROOF EXHAUSTERS

A. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets. Paint grip finish. Paint to match existing roof curbs.

B. Roof Curb: 18 inch high self-flashing of aluminum with continuously welded seams, fully insulated, built-in cant strips, integral cricket, and paint grip finish. Paint to match existing roof curbs.

C. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor and unit mounted speed controller.

D. Backdraft Damper: Motorized actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.

E. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.04 CEILING EXHAUST FANS

A. Centrifugal Fan Unit: Direct driven with galvanized steel housing lined with acoustic insulation, fan mounted speed controller, resilient mounted motor, gravity backdraft damper in discharge.

B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch. Switch shall be same switch used to turn on/off room lights.

C. Grille: Molded white plastic.

2.05 INLINE CENTRIFUGAL FANS

A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, motorized backdraft damper in discharge.

B. Backdraft Damper: Motorized actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.

C. Disconnect Switch: Factory mounted and wired and and unit mounted speed controller

D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.06 KITCHEN HOOD UPBLAST ROOF EXHAUSTERS

A. Performance Ratings:
   1. Fan shall be UL 762 listed and comply with all requirements of NFPA 96 and IMC.

B. Belt or Direct Drive Fan:
   1. Fan Wheel:
      a. Type: Non-overloading, backward inclined centrifugal.
      b. Material: Aluminum.
   2. Statically and dynamically balanced.
   3. Motors:
      a. Open drip-proof (ODP).
      b. Heavy duty ball bearing type.
      c. Mount on vibration isolators or resilient cradle mounts, out of air stream.
      d. Fully accessible for maintenance.
   4. Housing:
      a. Construct of heavy gage aluminum including curb cap, windband, and motor compartment.
      b. Rigid internal support structure.
      c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
      d. Provide breather tube for fresh air motor cooling and wiring.

C. Shafts and Bearings:

1. Fan Shaft:
    a. Ground and polished steel with anti-corrosive coating.
    b. First critical speed at least 25 percent over maximum cataloged operating speed.
2. Bearings:
    a. Permanently sealed or pillow block type.
    b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
    c. 100 percent factory tested.

D. Drive Assembly:
1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
2. Belts: Static free and oil resistant.
3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
4. Motor pulley adjustable for final system balancing.
5. Readily accessible for maintenance.

E. Disconnect Switches:
1. Factory mounted and wired.
2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    a. Outdoor Locations: Type 3R.
3. Finish for Painted Enclosures: Provide paint to match other rooftop mechanical equipment. Color by owner unless otherwise indicated.
4. Positive electrical shutoff.
5. Wired from fan motor to junction box installed within motor compartment.

F. Drain Trough: Allows for single-point drainage of water, grease, and other residues.

G. Options/Accessories:
1. Clean Out Port: Removable grease repellent compression rubber plug allows access for cleaning wheel through windband.
2. Roof Curb Extension: Vented curb extension where required for compliance with minimum clearances required by NFPA 96.
3. Dampers: Provide motorized type.
4. Drain Connection:
    a. Aluminum construction.
    b. Allows single-point drainage of grease, water, or other residues.
5. Finishes: Factory primed.
6. Grease Trap:
    a. Aluminum.
    b. Includes drain connection.
    c. Collects grease residue.
7. Hinge Kit:
    a. Aluminum hinges.
    b. Hinges and restraint cables mounted to base (sleeve) per NFPA 96.
    c. Allows fan to tilt away for access to wheel and ductwork for inspection and cleaning.
8. Provide speed controller and temperature probe to allow for kitchen demand control ventilation sequence of operation.
    a. If speed controlled via VFD, provide shaft grounding rings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Replace existing curbs or provide curb adaptors as necessary to accommodate new fans in existing fan locations.

C. Secure roof exhausters with cadmium plated steel lag screws to roof curb.

D. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

END OF SECTION

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SECTION 23 36 00
AIR TERMINAL UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable volume terminal units.

1.02 RELATED REQUIREMENTS

A. Section 23 21 13 - Hydronic Piping: Connections to heating coils.

B. Section 23 21 14 - Hydronic Specialties: Connections to heating coils.

C. Section 23 31 00 - HVAC Ducts and Casings.

D. Section 23 33 00 - Air Duct Accessories.

E. Section 23 37 00 - Air Outlets and Inlets.

F. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2017 (Reaffirmed 2023).

B. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. ASHRAE Std 130 - Laboratory Methods of Testing Air Terminal Units; 2016.

D. ASTM A492 - Standard Specification for Stainless Steel Rope Wire; 1995 (Reapproved 2019).

E. ASTM A603 - Standard Specification for Metallic-Coated Steel Structural Wire Rope; 2019.

F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

G. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.

H. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.

D. Project Record Documents: Record actual locations of units and locations of access doors required for access of valving.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant-volume regulators.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for air terminal units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Titus

B. Price

C. Nailor

D. Daikin

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SINGLE DUCT VARIABLE VOLUME UNITS

A. Basic Assembly:
   1. Casings: Minimum 22 gage galvanized steel.
   2. Lining: Minimum 1/2 inch thick neoprene or vinyl coated fibrous glass insulation, 1.5 lb/cu ft density, meeting NFPA 90A requirements and UL 181 erosion requirements. Face lining with mylar film.
   3. Air Inlets: Round stub connections for duct attachment.
   4. Air Outlets: S slip and drive connections.

B. Basic Unit:
   1. Configuration: Air volume damper assembly inside unit casing. Locate control components inside protective metal shroud.
   2. Volume Damper: Construct of galvanized steel with peripheral gasket and self lubricating bearings; maximum damper leakage: 2 percent of design air flow at 1 inches rated inlet static pressure.

C. Attenuator Section: Manufacturer's engineered attenuator

D. Hot Water Heating Coil:
   1. Construction: 1/2 inch copper tube mechanically expanded into aluminum plate fins, leak tested under water to 200 psig pressure, factory installed.
   2. Capacity: Based on 180 degree F entering 20% propelyne glycol solution, max cooling cfm listed in the schedule.

E. Controls:
   1. Field mounted by TCC.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.

C. Provide ceiling access doors or locate units above easily removable ceiling components.

D. Support units individually from structure with wire rope complying with ASTM A492 and 16 CFR 1201 in accordance with SMACNA (SRM).

E. Do not support from ductwork.

F. Connect to ductwork in accordance with Section 23 31 00.

G. Install to provide minimum clearances as indicated by manufacturer and code.

3.02 ADJUSTING

A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to zero percent full flow. Set units with heating coils for minimum 50 percent full flow.

END OF SECTION

SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rectangular ceiling diffusers.

B. Round ceiling diffusers.

C. Registers/grilles.
   1. Exhaust and return register/grilles.
   2. Supply register/grilles.

D. Roof hoods.

1.02 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Painting of ducts visible behind outlets and inlets.

1.03 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.

B. ARI 890 - Standard for Air Diffusers and Air Diffuser Assemblies; Air-Conditioning and Refrigeration Institute; 2001.

C. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets; 2023.

D. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
   1. Include complete performance data and descriptive literature including finish and accessory items.

C. Project Record Documents: Record actual locations of air outlets and inlets.

1.05 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Test and rate louver performance in accordance with AMCA 500-L.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Krueger: www.krueger-hvac.com.

B. Price Industries: www.price-hvac.com.

C. Titus: www.titus-hvac.com.

D. Tuttle and Bailey; _____: www.tuttleandbailey.com/#sle.

E. Nailor

F. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ROUND CEILING DIFFUSERS

A. Type: Round, three-cone , stamped or spun, multi-core diffuser to discharge air in 360 degree pattern, with sectorizing baffles where indicated. Diffuser collar shall project not more than 1 inch above ceiling. In plaster ceilings, provide plaster ring and ceiling plaque.

B. Fabrication: Aluminum or steel as indicated with baked enamel finish.

C. Color: As indicated.

2.03 RECTANGULAR CEILING DIFFUSERS

A. Type: Provide plaque diffuser to discharge air in 360 degree pattern.

B. Fabrication: Aluminum or steel as indicated with baked enamel finish.

C. Color: As indicated.

2.04 SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, two-way deflection.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Construction: Made of aluminum extrusions with factory enamel finish.

D. Color: As indicated.

2.05 EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, blades paralell to long dimension face.

B. Fabrication: Steel with 20 gage, 0.0359 inch minimum frames and 22 gage, 0.0299 inch minimum blades, steel and aluminum with 20 gage, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish as indicated.

C. Color: As indicated.

2.06 ROOF HOODS

A. Manufacturers:
   1. Greenheck.
   2. Cook.
   3. Twin City.
   4. CaptiveAire
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fabricate air inlet or exhaust hoods in accordance with SMACNA (DCS).

C. Fabricate of galvanized steel, minimum 16 gage, 0.0598 inch base and 20 gage, 0.0359 inch hood, or aluminum, minimum 16 gage, 0.0598 inch base and 18 gage, 0.0598 inch hood; suitably reinforced; with removable hood; birdscreen with 1/2 inch square mesh for exhaust and 3/4 inch for intake, and factory prime coat finish. Paint to match existing rooftop equipment.

D. Mount unit on minimum 12 inch high curb base with insulation between duct and curb.

E. Make hood outlet area minimum of twice throat area.

PART 3 EXECUTION

3.01 INSTALLATION

A. The contractor shall inspect all equipment for damage upon delivery and shall immediately report damage to the owner and replace or repair such damage to the satisfaction of the owner. Install in accordance with manufacturer's instructions.

B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.

C. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

D. All diffusers and grilles shall be installed tight on their respective mounting surfaces, installed plumb and true with room dimensions, and accurately centered on projections, recesses, windows, ceiling grids, light fixtures, or doors. Provide appropriate frame wherever necessary to adapt to mounting surface.

E. Install items in accordance with manufacturer's instructions.

F. Install diffusers to ductwork with air tight connection.

G. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

H. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 91 23.

3.02 ADJUSTING AND CLEANING

A. All installed materials shall have debris removed and shall be vacuumed clean of dust. Remove any strippable protective coating using manufacturer's recommended method.

END OF SECTION

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SECTION 23 63 13
AIR COOLED REFRIGERANT CONDENSERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured units.

B. Casing.

C. Condenser coils.

D. Fans and motors.

E. Controls.

1.02 RELATED REQUIREMENTS

A. Section 23 23 00 - Refrigerant Piping.

B. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.

B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2022, with Addendum (2024).

C. ASHRAE Std 20 - Methods of Laboratory Testing Remote Mechanical-Draft Air-Cooled Refrigerant Condensers; 2019.

D. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

F. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, weights, accessories, electrical requirements, and wiring diagrams.

C. Factory Controls: Provide complete points list to TCC.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
   1. 1 year whole unit parts.
   2. 5 year compressor parts.

1.05 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's installation instruction for rigging, unloading and transporting units.

B. Protect units on site from physical damage. Protect coils.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Daikin

B. York International Corporation/Johnson Controls, Inc; _____: www.york.com/#sle.

C. Aaon

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Refer to plans for performance requirements.

2.03 MANUFACTURED UNITS

A. Provide packaged, factory assembled, pre-wired unit, suitable for outdoor use consisting of casing, condensing coil and fans, integral sub-cooling coil liquid accumulator and controls.

B. Construction and Ratings: In accordance with AHRI 210/240 and UL 207. Testing shall be in accordance with ASHRAE Std 20.

C. Performance Ratings: Energy Efficient Rating (EER)/Coefficient of Performance (COP) not less than prescribed by ASHRAE Std 90.1 I-P, in combination with compressor units.

2.04 CASING

A. House components in welded steel frame with steel panels with weather resistant, baked enamel finish.

B. Mount starters, disconnects, and controls in weatherproof panel provided with full opening access doors. Provide mechanical interlock to disconnect power when door is opened.

C. Provide removable access doors or panels with quick fasteners.

2.05 CONDENSER COILS

A. Coils: Aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling circuits. Air test under water to 425 psig, and vacuum dehydrate. Seal with holding charge of nitrogen.

2.06 FANS AND MOTORS

A. Vertical discharge direct driven propeller type condenser fans with fan guard on discharge, equipped with roller or ball bearings with grease fittings extended to outside of casing.

B. Weatherproof motors suitable for outdoor use, single phase permanent split capacitor or 3 phase, with permanent lubricated ball bearings and built-in current and thermal overload protection; refer to Section 23 05 13.

2.07 CONTROLS

A. Provide factory wired and mounted control panel, NEMA 250, containing fan motor starters, fan cycling thermostats, compressor interlock, and control transformer.

B. Provide controls to permit operation down to 45 degrees F ambient temperature.

C. Provide thermostat to cycle fan motors in response to outdoor ambient temperature.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide for connection to electrical service. Refer to Section 26 05 83.

C. Provide connection to refrigeration piping system. Refer to Section 23 23 00. Comply with ASHRAE Std 15.

D. Provide cooling season start-up, winter season shut-down service, for first year of operation.

E. Shut-down system if initial start-up and testing takes place in winter and machines are to remain inoperative. Repeat start-up and testing operation at beginning of first cooling season.

END OF SECTION

SECTION 23 73 16
MODULAR INDOOR AIR-HANDLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Modular Air Handling Unit to include fans, coils, dampers, controls assembled in a common case.
   1. Casing construction.
   2. Fan section.
   3. Coil section.
   4. Filter.
   5. Damper .
   6. Ultraviolet lights.
   7. Controls.

1.02 REFERENCE STANDARDS

A. ACGIH - Ultraviolet Radiation, TLV Physical Agents; 2010, 7th edition.

B. AHRI 260 - Sound Rating of Ducted Air Moving and Conditioning Equipment; 2011.

C. AHRI 1060 I-P - Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment; 2014.

D. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2012, with 2015 amendments.

E. ASTM E477 - Standard Test Method for Laboratory Measurements of Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers; 2013, with Editorial Revision (2015) .

F. UL 153 - Portable Electric Luminaries; Current Edition, Including All Revisions.

G. UL 508 - Industrial Control Equipment; Current Edition, Including All Revisions.

H. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

I. UL 1598 - Luminaires; Current Edition, Including All Revisions.

J. UL 1812 - Ducted Heat Recovery Ventilators; Current Edition, Including All Revisions.

K. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of Air Handling Units with size, location and installation of service utilities.

B. Coordinate the work with other trades for installation of roof mounted air handling units on roof curbs.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data:
   1. Published Literature: Indicate dimensions, weights, capacities, ratings, gauges and finishes of materials, and electrical characteristics and connection requirements.

C. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

D. Manufacturer's Instructions: Include installation instructions.

E. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Fan Belts: One set for each unit.
   3. Extra Filters: One set for each unit.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

C. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Daikin Basis of Design.

B. YORK/Johnson Controls

C. Aaon

2.02 DESCRIPTION

A. Air Handling Unit completely factory assembled and tested to comply with the performance and configuration shown on the documents.

2.03 CASING CONSTRUCTION

A. Walls and roofs shall be constructed of minimum 24 gauge painted galvanized steel. The inner liner shall be 24 gauge solid galvanized steel. Provide casing with minimum thermal resistance (R-value) of 13 hr-ft2-°F/BTU. Insulation shall be injected polyurethane foam. Casing panels shall be 2” double-wall construction with thermal break. Thermal break shall be between interior and exterior liner of the panel assembly, and between the panel and casing framework. All panel seams shall be sealed during assembly to produce an airtight unit.

B. Units base shall be constructed from sheet metal around the perimeter of the unit with intermediate channel and angle iron supports. Units shall have a minimum 6" channel height.

C. Steel plate floor shall be installed on the base. The floor shall be flat, reinforced from below. The base shall be provided with lifting lugs, a minimum of four [4] per unit section.

D. All drain connections shall terminate at the side of the unit. Each floor section shall have a capped floor cleanout drain.

E. Access doors MUST be the same thickness and construction as the unit casing to maximize thermal and acoustical resistance. A double glazed laminated glass window shall be provided in each door. Hinges shall be continuous piano type stainless steel

F. Two high pressure latches operable from either side of the door shall be provided. The door opening shall be fully gasketed with continuous ½” closed cell hollow round black gasketing and a metal encapsulated reinforcing backing that mechanically fastens to the door frame. The minimum door opening size shall be 18” x 70” [where height permits]. Fan compartments must have a door of minimum width to remove the motors.

2.04 FAN SECTION

A. Fans shall be centrifugal, electrically comutated motor type in an array to meet the scheduled flow and pressure requirements. Fans shall be factory provided with wiring harness, bulkhead assembly, bulkhead, mounting hardware, single point power, and BACnet compatible controls. Fans shall incorporate a wheel, heavy gauge reinforced steel inlet plate with removable spun inlet cone, structural steel frame, and shaft and bearings in AMCA Arrangement 4 configuration as an entire assembly.

B. All fans shall bear the AMCA label for sound and air performance.

C. The blades shall be polymer Airfoil type, designed for maximum efficiency and quiet operation.

D. Provide piezometer rings on each fan inlet for reading airflow by the ATC contractor.

E. Fan motors shall be high efficiency open drip-proof.

2.05 COILS

A. Fins shall have collars drawn, belled and firmly bonded to the tubes by means of mechanical expansion of the tubes. No soldering or tinning shall be used in the bonding process. Coils shall be mounted in the unit casing to be accessible for service. Capacities, pressure drops and selection procedure shall be certified in accordance with ARI Standard 410.

B. Coils shall be fully enclosed within the casing and cooling coils shall be on mounted 304 stainless steel angle racks manufactured to allow coils to slide out individually. Heating coils shall be mounted on galvanized angle racks manufactured to allow coils to slide out individually.

C. Coils shall be individually removable towards the access side. Coils must be individually racked, removable through the side access panels.

D. The manufacturer shall provide drain pans for all cooling coils. Drain pans shall be continuously welded 304 stainless steel. If the coil section must have intermediate drain pans and shall be interconnected with 1” stainless steel drain lines. Drain pans shall be IAQ sloped and fully drainable.

E. Coils shall be designed for chilled water and hot water service. Cooling coil face velocity shall not exceed 500 fpm. Coils shall be round seamless 5/8” diameter, .020” O.D. copper tube. All joints shall be brazed.

2.06 FILTER AND AIR CLEANER SECTION

A. Filter holding frames shall be of heavy duty construction designed for industrial applications. Holding frames applied in low efficiency filter applications will be either upstream or downstream accessible. Holding frames applied in high efficiency filter applications will be upstream accessible. Holding frames shall be constructed from no less than 18 gauge galvanized steel. They shall be equipped with foam gaskets and fasteners. Filter fasteners shall be capable of being installed without the requirement of tools, nuts or bolts. The holding frame shall be designed to accommodate standard size filters with the application of the appropriate type fastener.

B. Filter Media:
   1. Prefilter: Minimum Efficiency Reporting Value: Installed 8 MERV when tested in accordance with ASHRAE Std 52.2.
   2. Secondary Filter: Minimum Efficiency Reporting Value: Installed 13 MERV when tested in accordance with ASHRAE Std 52.2.

C. Differential Pressure Gauge:
   1. Provide factory installed dial type differential pressure gauge, flush mounted with casing outer wall, and fully piped to both sides of each filter to indicate status.
   2. Maintain plus/minus 5 percent accuracy within operating limits of 20 degrees F to 120 degrees F.

2.07 DAMPERS

A. Aluminum airfoil blade control dampers. Insulated dampers MUST be used on exhaust air and outdoor air dampers. Outdoor and exhaust air dampers shall be Class 1A low leakage.

B. Electric/Electronic Actuators: Actuators provided and mounted by temperature controls contractor.

2.08 ULTRAVIOLET LIGHTS

A. Tested and recognized by UL 153, UL 1598 and UL 1995 for luminaries, heating, and cooling equipment.

B. UV-C (Short Wave) Light Array Performance: Provide not less than 10 watts per sq ft.

C. Construction:
   1. Acceptable manufacturers for UV lights are UV Resources and Steril-Aire. Coordinate support frame size with AHU and field install.
   2. Materials:
      a. Provide UV-C resistant polymeric materials or shield from direct or indirect UV-C light with UV-C tolerant material.
      b. UV-C Fixtures: Stainless steel to resist corrosion.

3. Lamp Life: 9000 hrs minimum with no more than 20 percent loss of output after two years of continuous use.
4. Mount UV-C fixtures on slide-out rack to enable servicing from unit exterior via access door.
5. View Port: Provide with cover to allow viewing of the UV-C light array.

D. Safety Features:
1. Treat view windows to assure the UV-C energy emitted is below the threshold limit specified by American Conference of Governmental Industrial Hygienists (ACGIH).
2. Provide a mechanical interlock switch to disconnect power to the UV-C fixtures when the opening of an access door may pose an exposure risk to UV-C light.
3. Provide externally mounted reset switch to re-energize the UV lights after occupant has left the section and desires the lights to be activated.

E. Control: Provide unit mounted switch to power UV-C lights within the unit. UV-C lights shall be wired to a separate 120 volt circuit.

2.09 CONTROLS

A. Provided by TCC.

2.10 ELECTRICAL

A. Provide fan array with factory provided controls, UL listed for the application. Mount and wire as part of the unit single point power connection.

B. Mount a permanent nameplate on the unit to display the manufacturer, serial number, model number, date of manufacture, and current and voltage readings and ETL or UL Listing.

C. Provide permanent schematic and connection wiring diagrams indicating exactly how the starter was manufactured and wired including the wire terminal numbers

D. Vapor Proof Service Lights: Each section shall be equipped with a vapor- proof service light. All lights, switches and outlets shall be wired to a disconnect for a separate 120 volt external source. Each light shall have its own switch and be field wired. Coordinated wiring with electrical contractor.

2.11 UNIT CASING PERFORMANCE

A. Unit shall conform to ASHRAE Standard 111 Class 6 for casing leakage no more than 1% of design airflow at 1.25 times design static pressure up to a maximum of +8 inches w.g. in positive pressure sections and -8 inches w.g. in negative pressure sections down to a minimum of 50 CFM measurable leakage or 5,000 design CFM.

B. Provide wall panels and access doors that deflect no more than L/240 when subjected to 1.5 times design static pressure up to a maximum of +8 inches w.g. in positive pressure sections and -8 inches w.g. in negative pressure sections. ‘L’ is the panel-span length and ‘L/240’ is the deflection at panel midpoint.

C. Provide floors and roofs that deflect no more than L/240 when subjected to a 300 lb static load at mid-span. ‘L’ is the panel-span length and ‘L/240’ is the deflection at panel midpoint.

2.12 PART 3 EXECUTION

A. INSTALLATION
1. Install in accordance with manufacturer's instructions.
2. Bolt sections together with gaskets.
3. Install flexible duct connections between fan inlet and discharge ductwork and air handling unit sections. Ensure that metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
4. Make connections to coils with unions or flanges.
5. Hydronic Coils:
   a. Hydronic Coils: Connect water supply to leaving air side of coil (counterflow arrangement).
   b. Provide shut-off valve on supply line and lockshield balancing valve with memory stop on return line.
   c. Locate water supply at bottom of supply header and return water connection at top.
   d. Provide manual air vents at high points complete with stop valve.
   e. Ensure water coils are drainable and provide drain connection at low points.

6. Refrigerant Coils: Provide sight glass in liquid line within 12 inches of coil.
7. Insulate Coil Headers Located Outside Air Flow as Specified for Piping: See Section 23 07 19.
8. Cooling Coils:
    a. Pipe drain and overflow to nearest floor drain.
9. Field-wire each factory provided control for field installation.

B. FIELD QUALITY CONTROL
1. See Section 01 40 00 - Quality Requirements, for additional requirements.
2. Final Acceptance Requirements:
    a. Use dial indicator gauges to demonstrate fan and motor are aligned.
    b. Verify compliance with specifications using vibration analysis.
    c. Maximum Vibration Levels:
        1) 0.075 inch per second at 1 times run speed and at fan/blade frequency.
        2) 0.04 inch per second at other multiples of run speed.
3. Coordination of Other Tests and Inspections:
    a. Owner will employ independent Testing, Adjusting, and Balancing agency to test and/or inspect modular central-station air handling-unit.
    b. See Section 23 05 93.

C. SYSTEM STARTUP
1. Provide manufacturer's field representative to perform systems startup.
2. Prepare and start equipment and systems in accordance with manufacturers' instructions and recommendations.
3. Adjust for proper operation within manufacturer's published tolerances.

D. CLOSEOUT ACTIVITIES
1. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
2. See Section 01 79 00 - Demonstration and Training, for additional requirements.
3. Demonstrate proper operation of equipment to Owner's designated representative.
4. Demonstration: Demonstrate operation of system to Owner's personnel.
    a. Use operation and maintenance data as reference during demonstration.
    b. Briefly describe function, operation, and maintenance of each component.
5. Training: Train Owner's personnel on operation and maintenance of system.
    a. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
    b. Provide minimum training as requested by owner.
    c. Instructor: Manufacturer's training personnel.
    d. Location: At project site.

END OF SECTION

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SECTION 23 74 33
PACKAGED OUTDOOR MAKE-UP AIR UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Direct fired make-up air heater.

B. Controls.

1.02 RELATED REQUIREMENTS

A. Section 23 11 23 - Facility Natural-Gas Piping: Natural gas connections.

B. Section 23 33 00 - Air Duct Accessories: Flexible duct connections.

C. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.

B. AHRI 270 - Sound Performance Rating of Outdoor Unitary Equipment; 2015, with Addendum (2016).

C. ASHRAE Std 23.1 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Pressures of the Refrigerant; 2019.

D. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. ASHRAE Std 90.2 - Energy-Efficient Design of Low-Rise Residential Buildings; 2018, with Addendum (2024).

F. NEMA MG 1 - Motors and Generators; 2021.

G. NFPA 54 - National Fuel Gas Code; 2024.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data with dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.

C. Shop Drawings: Indicate dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.

D. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

E. Factory Controls: Provide complete points list to TCC.

1.05 REGULATORY REQUIREMENTS

A. Conform to NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. I.C.E. (Industrial Commercial Equipment Manufacturing Ltd.): www.ice-ww.com.

B. Applied Air/Mestek Technology, Inc: www.appliedair.com.

C. CaptiveAire.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MANUFACTURED UNITS

A. Unit: Outdoor unit.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207. Testing: ASHRAE Std 23.1.
   2. Performance Ratings: Energy Efficiency Rating (EER)/Coefficient of Performance (COP) not less than requirements of ASHRAE Std 90.1. Variable speed functionality in accordance with UFC 3-410-01.
   3. Heating Capacity: See plans.

2.03 FABRICATION

A. Casing and Components: Steel panels, 18 gage, 0.0478 reinforced with structural angles and channels to ensure rigidity; access panels to burner and blower motor assemblies from either side of unit.

B. Observation Port: On burner section for observing main and pilot flames.

C. Insulation: Double-wall with glass fiber insulation 1 inch thick on complete unit.

D. Finish: Heat resistant baked enamel. Paint grip finish. Paint to match other roof top equipment. Color selected by owner.

E. Outdoor Installation: Weatherproofed casing, with intake hood.

F. Outdoor air damper shall be Class 1A low-leakage.

2.04 FILTERS

A. Filter: Removable 2 inches thick MERV 8 glass fiber disposable filters in metal frames.

B. Units to have louvered weatherhood with 2" aluminum mesh filters.

C. Magnahelic pressure differential gauge mounted on casing for visual filter condition assessment. Gauge shall be constructed for installation in outdoor environment.

2.05 BURNERS

A. Assembly: For natural gas, capable of modulating turn down ratio of 25:1, including electric modulating main gas valve, motorized shut down valve, main and pilot gas regulators, pilot electric gas valve, manual shut-off valve and pilot adjustment valve.

B. Regulator: Required for initial gas pressure of 2 psi.

C. Pilot: Electrically ignited by spark rod through high voltage ignition transformer.

D. Damper: Motorized with end switch to prove position before burner will fire.

2.06 FAN

A. Fan: Statically and dynamically balanced centrifugal fan mounted on solid steel shaft with heavy duty self-aligning pre-lubricated ball bearings and V-belt drive with matching motor sheaves and belts.

B. Factory mounted VFD for kitchen demand control ventilation. Motor to have shaft grounding.

C. Electrical Characteristics: See plans.

2.07 CONTROLS

A. Controls: Pre-wire unit for connection of power supply. Field wiring from unit to remote control panel makes unit operative. Unit shall be controlled by factory provided, integral controls. Provide BACnet connectivity for BAS integration and system monitoring. Provide controls and equipment required for kitchen demand control ventilation control and low speed "Prep Mode". BAS shall be able to enable/disable "Prep Mode".

B. Interlocks: Unit to start when exhaust fan is running. Burner to operate when flow switch located in exhaust duct proves flow. Exhaust fan speed control and unit VFD shall modulate to provide kitchen demand control ventilation. .

C. Fan Discharge Thermostat: Controls modulating gas valve to maintain supply air temperature.
   1. Provide remote discharge thermostat adjustment within 20 feet of unit.

D. Safety Controls: Sense correct air flow before energizing pilot and sense pilot ignition before activating main gas valve.

E. Manual Reset Low and High Limit Controls: Maintain supply air temperature between set points and shut fan down if temperatures are exceeded.

2.08 ACCESSORIES

A. 115V GFCI Outlet

B. New roof curb. Confirm mounting requirements prior to ordering.

C. Factory mounted disconnect switch

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install to NFPA 54. Provide connection to natural gas system; refer to Section 23 11 23.

C. Provide flexible duct connections on outlet from unit; refer to Section 23 33 00.

3.02 SCHEDULES: SEE PLANS

END OF SECTION

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SECTION 26 00 10
BASIC ELECTRICAL REQUIREMENTS

PART 1GENERAL

1.01 SECTION INCLUDES:

A. Basic Electrical Requirements specifically applicable to Division 26 Sections, in addition to Division 01 - General Requirements.

1.02 SCOPE OF WORK:

A. The Electrical Contract Installation shall include a complete Electrical Installation for the project. All conduit, fixtures and equipment herein specified, mentioned or shown on Drawings, shall be furnished and installed in place, connected up and ready for normal operation except for such items as are specifically mentioned to be furnished by others.

1.03 WORK INCLUDED:

A. The Electrical Contract shall include all work under the listed Sections of the Specifications Index and all related Electrical work as shown on the Drawings for the project.

B. A Complete table of Electrical Reference Symbols is shown on the plans.

C. Under this Contract the Electrical Contractor shall furnish the Owner with two 3-ring binders of all pertinent systems related documents. Submit manuals to the Engineer for his review. The Engineer will then turn books over to the Owner. The books shall contain the following items:
   1. Shop drawings on all major equipment.
   2. Operating Instructions for all major equipment.
   3. Maintenance Instructions for all major equipment.
   4. Wiring diagrams for all equipment.
   5. Control drawings for any systems not furnished under other contracts.

D. The Electrical contractor is responsible for own equipment, such as cranes, lifts, etc. in order to provide a complete installation of Electrical systems.

E. The Electrical Contractor is responsible for contacting the utility company and coordinating the power connection for the building service. Include all costs in bid.

F. Coordinate utility service outages and reconnections with Utility Company and Owner.

G. Branch feeders, branch wiring, receptacles, special outlets, switches, light fixtures, dimmers, contactors, starters, timers, etc., as shown on the plans or required for operation of the electrical system.

H. A fire alarm system, including all conduit and wiring, manual pull stations, audio/visual warning alarms, smoke detectors, and fire alarm panel with annunciator.

I. Smoke detectors with integral alarms and auxiliary contact in each of the rooms as shown on the plans, with additional devices in handicap and hearing impaired rooms.

J. Repair of all damage done to the premises as a result of the installation and removal of all debris or surplus material left by those engaged in the work.

1.04 SPECIFICATIONS COMPLIANCE

A. The requirements of these specifications shall be complied with in every respect. Therefore, it shall be absolutely mandatory that the job foreman, all lead electricians, subcontractors and their foreman have completely studied these specifications, be completely knowledgeable as to their entire contents, and maintain a copy at the job-site. Failure to comply with this requirement will be reason to presume the electrician or subcontractor is not in responsible charge of his work due to ignorance of job requirements, and will be reason for the owner to require dismissal and replacement with approved personnel. Every foreman and lead mechanic shall be provided with a complete copy of this specification.

1.05 INCONSISTENCIES

A. If there is an inconsistency in the quality and/or quantity of Work required by the Contract Documents, either the greater quality and/or quantity of Work indicated shall be provided in accordance with the Engineer/Architect's interpretation without change in the contract sum.

1.06 CODES, FEES AND LATERAL COSTS:

A. The Electrical Installation shall meet all applicable local, state and federal codes and standards. All permits necessary for a complete electrical installation shall be paid for by this Contractor.

B. Except in those municipalities which provide state-approved electrical inspection, all installation of electrical equipment wiring shall be inspected by the State Board of Electricity. Allowance shall be made in the bid and contract for the cost of such inspection.

C. Fees for such inspection will be charged in accordance with the rules and regulations of the State Board of Electricity. Evidence of payment of fees shall be provided by the Contractor with his Request for Payment.

1.07 REGULATORY REQUIREMENTS:

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed by Underwriters Laboratories, Inc. or other testing firm acceptable to authority having jurisdiction.

1.08 SUBMITTALS:

A. Submit under provisions of Division 01.

B. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal.

C. The contractor shall submit four (4) copies of shop drawings on all equipment and materials to the engineer for approval. The contractor shall not use any equipment or materials that does not have the engineer's stamped approval.

D. Mark dimensions and values in units to match those specified.

1.09 PROJECT/SITE CONDITIONS:

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

1.10 SEQUENCING AND SCHEDULING:

A. Construct Work in sequence under provisions of Division 1.

1.11 PRE-CONSTRUCTION COORDINATION AND VERIFICATION:

A. This Contractor shall coordinate his work with other Contractors on this job. Any conflict which cannot be resolved shall be settled by the Architect/Engineer.

B. Field verification of scale dimensions on plans is directed since actual locations, distances and levels will be governed by actual field conditions.

C. The Contractors shall check architectural, structural, plumbing, heating, ventilating and electrical plans to avert possible installation conflicts. Should drastic changes from original plans be necessary to resolve such conflicts this Contractor shall notify the Architect/Engineer and secure written approval and agreement on necessary adjustments before the installation is started.

D. Discrepancies shown on different plans or between plans and actual field conditions or between plans and specifications shall promptly be brought to the attention of the Architect/Engineer for a decision.

E. The Contractor shall consider and review the complete set of documents, etc., Architectural, Structural, Mechanical, Electrical, etc., (Drawings and Specifications) as his complete set. He will be responsible for any and all electrical work shown or stated (to be by him), to include this work in his bid and install such items even though they are not specifically shown or stated on the Electrical section of the plans and specifications.

F. The drawings are indicative of the work to be installed, but do not show all bends, fittings, boxes and specialties required to complete the installation.

G. All conduits, wires, outlets, boxes, switches, receptacles, devices and fixtures shall be included in the work.

H. Where it is stated that the contractor shall “provide” a device or piece of equipment, it shall mean that such a device or equipments are finished and installed.

1.12 CUTTING, PATCHING, AND FIRESTOPPING:

A. The Electrical Contractor shall set all sleeves in construction for their Work.

B. Where cutting is required, it shall be done by the Electrical Contractor.

C. All patching shall be done by Electrical Contractor.

D. All conduit and outlet installations and cutting of any kind must be done with great care so as not to leave unsightly surfaces which may not be entirely concealed by plates, escutcheons, or their normal concealing construction, if such unsightly conditions occur, Electrical Contractor will be required, at their own expense, to replace the damaged construction.

E. This Electrical Contractor shall provide and install firestopping materials per Section 07 8400 - Firestopping.

1.13 SCAFFOLDING:

A. Furnish and erect all scaffolding, ladders, etc., required in the installation of wiring, equipment and fixtures.

1.14 ADDITIONAL ELECTRICAL COSTS:

A. If the Mechanical Contractor substitutes equipment for specified units, the mechanical contractor shall be responsible for any additional electrical installation costs for this substitution whether the other equipment was listed as equal in the specification or was approved equal after the project was in the bidding process.

1.15 GUARANTEE:

A. This Contractor shall be responsible for the proper installation and working of everything in this contract and shall guarantee to remedy free of charge any defects in workmanship and materials that may appear to give or gives rise to trouble of any kind for a period of one year from the time of final acceptance of his work by the Owner.

B. This Contractor shall be responsible for the proper installation and working of everything in this contract and shall guarantee to remedy free of charge any defects in workmanship and materials that may appear to give or gives rise to trouble of any kind for a period of one year from date of final substantial completion.

PART 2NOT USED

PART 3EXECUTION

3.01 EQUIPMENT CONNECTIONS:

A. Provide necessary power wiring for equipment furnished by others. Verify requirements with the Contractors responsible to supply each piece of equipment. Provide heavy duty disconnect switches as indicated.

3.02 AS-BUILT DRAWINGS:

A. Contractor shall keep an accurate record of all deviations from contract drawings and specifications. He shall neatly and correctly enter in colored crayon any deviations on drawings affected, and shall keep drawings available for inspection. Extra set of drawings will be furnished for this purpose.

B. At the completion of the job, and before final acceptance, the Contractor shall provide a complete set of as-built drawings. The Contractor shall show locations for all major electrical devices, including panelboards and all major runs of conduit, the circuiting of each fixture, outlet, etc., shall be shown. Certify to the accuracy of each print, by signature thereon, and deliver same to Architect.

END OF SECTION

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SECTION 26 05 05
SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field measurements and circuiting arrangements are as indicated.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents.

D. Report discrepancies to Architect before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

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.

D. Existing Electrical Service: Maintain existing system in service.

E. Existing Fire Alarm System: Maintain existing system in service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Notify Owner before partially or completely disabling system.
   2. Notify local fire service.
   3. Make notifications at least 24 hours in advance.
   4. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. All abandoned or unused electrical pathways, devices, components, etc. shall be removed in their entirety prior to final painting.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces. Use materials to match fire rating of wall.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

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.

I. Repair adjacent construction and finishes damaged during demolition and extension work.

J. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

A. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

B. Clean and repair existing materials and equipment that remain or that are to be reused.

C. 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.

END OF SECTION

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Wiring connectors.

C. Electrical tape.

D. Heat shrink tubing.

E. Wire pulling lubricant.

F. Cable ties.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).

E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.

F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2020.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

H. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

I. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

L. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

M. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

N. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

O. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

P. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.

F. Armored cable is not permitted.

G. Metal-clad cable is not permitted.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductor Material:
1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33.

H. Minimum Conductor Size:
1. Branch Circuits: 12 AWG.
   a. Exceptions:
      1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
      2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
2. Control Circuits: 14 AWG.

I. Conductor Color Coding:

1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
   a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
3. Color Code:
   a. 208Y/120 V, 3 Phase, 4 Wire System:
      1) Phase A: Black.
      2) Phase B: Red.
      3) Phase C: Blue.
      4) Neutral/Grounded: White.
   b. Equipment Ground, All Systems: Green.
   c. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Conductor Stranding:
   1. Feeders and Branch Circuits:
      a. Size 10 AWG and Smaller: Stranded.
      b. Size 8 AWG and Larger: Stranded.
   2. Control Circuits: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation:
   1. Copper Building Wire: Type THHN/THWN-2, except as indicated below.
      a. Size 4 AWG and Larger: Type XHHW-2.
      b. Installed Underground: Type XHHW-2.

2.04 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Wiring Connectors for Splices and Taps:
   1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
   2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors.

C. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
   2. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
   3. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
   4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors where connectors are required.

D. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

E. Mechanical Connectors: Provide bolted type.

2.05 ACCESSORIES

A. Electrical Tape:
   1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.

2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
3. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
4. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

D. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
1. Unless dimensioned, circuit routing indicated is diagrammatic.
2. When circuit destination is indicated without specific routing, determine exact routing required.
3. Arrange circuiting to minimize splices.
4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
6. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
   a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
   b. Increase size of conductors as required to account for ampacity derating.
   c. Size raceways, boxes, etc. to accommodate conductors.
7. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Installation in Raceway:
1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.

4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

G. Install conductors with a minimum of 12 inches of slack at each outlet.

H. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

I. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

J. Make wiring connections using specified wiring connectors.
1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
3. Do not remove conductor strands to facilitate insertion into connector.
4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

K. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
3. Wet Locations: Use heat shrink tubing.

L. Insulate ends of spare conductors using vinyl insulating electrical tape.

M. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

N. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

O. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. All secondary cables, cables from generators, and feeders from main distribution panels shall be tested to check integrity of cable insulation prior to Substantial Completion. Submit completed "High Potential Test Report" (Reference Section 01 78 00 - Project Closeout for "Project Closeout Submittal Checklist"). "Megger" Test reports are an acceptable substition.

C. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

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SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify exact locations of underground metal water service pipe entrances to building.
   2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Bonding and Equipment Grounding:
   1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
   2. Raceways may be used as sole equipment grounding conductor where permitted by NFPA 70. Provide insulated equipment grounding conductor where indicated or required, including but not limited to:
      a. In each nonmetallic feeder and branch circuit raceway.
      b. In each flexible conduit.

c. In outdoor portions of each metallic feeder and branch circuit raceway utilizing non-threaded fittings (where permitted) supplying rooftop multimotor and combination-load air-conditioning and refrigerating equipment.

3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
   a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
   b. Metal gas piping.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:
   1. Use insulated copper conductors unless otherwise indicated.
      a. Exceptions:
         1) Use bare copper conductors where installed underground in direct contact with earth.
         2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
   2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
   3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

D. Identify grounding and bonding system components in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

END OF SECTION

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SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 26 05 33.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

B. Section 26 05 33.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.

3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
    b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
    c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Comply with MFMA-4.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.
10. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Comply with MFMA-4.
    b. Channel Material: Use galvanized steel.
    c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
11. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that mounting surfaces are ready to receive support and attachment components.

B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

H. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00.
   5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

I. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

J. Secure fasteners according to manufacturer's recommended torque settings.

K. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

E. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
   1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
   2. Obtain permission from Architect before drilling or cutting structural members.

F. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

G. Install surface-mounted cabinets and panelboards with minimum of four anchors.

H. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch off wall.

I. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION

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SECTION 26 05 33.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Intermediate metal conduit (IMC).

C. Flexible metal conduit (FMC).

D. Liquidtight flexible metal conduit (LFMC).

E. Electrical metallic tubing (EMT).

F. Rigid polyvinyl chloride (PVC) conduit.

G. Conduit fittings.

H. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.

C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A); 2020.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.

F. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit; 2004.

G. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.

H. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

I. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.

J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

N. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

O. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.

P. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.

Q. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

R. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

S. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
   4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, implies all applications are acceptable. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use galvanized steel rigid metal conduit or rigid PVC conduit.
   2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit or rigid PVC conduit.
   3. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
   4. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
   5. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.

D. Embedded Within Concrete:
   1. Within Slab on Grade: Not permitted.
   2. Within Slab Above Ground: Not permitted.
   3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).

4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from concrete.

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or aluminum rigid metal conduit.

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
   1. Locations subject to physical damage include, but are not limited to:
      a. Where exposed below 12 feet, except within electrical and communication rooms or closets.
      b. Where exposed below 20 feet in warehouse areas.

K. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.

L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or Schedule 40 PVC.

M. Corrosive Locations Above Ground: Use aluminum rigid metal conduit.

N. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
   1. Maximum Length: 6 feet.

O. Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit.
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
   3. Maximum Length: 6 feet unless otherwise indicated.

2.02 CONDUIT REQUIREMENTS

A. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 3/4 inch (21 mm) trade size.
   2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
   3. Control Circuits: 3/4 inch (21 mm) trade size.
   4. Flexible Connections to Luminaires: 1/2 inch (16 mm) trade size.
   5. Underground, Interior: 1 inch (27 mm) trade size.
   6. Underground, Exterior: 1 inch (27 mm) trade size.

D. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit: www.alliedeg.com/#sle.
   2. Republic Conduit: www.republic-conduit.com/#sle.
   3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com/#sle.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.

c. Thomas & Betts Corporation: www.tnb.com/#sle.

2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 ALUMINUM RIGID METAL CONDUIT (RMC)

A. Manufacturers:
1. Allied Tube & Conduit: www.alliedeg.com/#sle.
2. Republic Conduit: www.republic-conduit.com/#sle.
3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com/#sle.

B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.
2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use aluminum.
4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.05 INTERMEDIATE METAL CONDUIT (IMC)

2.06 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
2. Electri-Flex Company: www.electriflex.com/#sle.
3. International Metal Hose: www.metalhose.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.

2.07 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
2. Electri-Flex Company: www.electriflex.com/#sle.
3. International Metal Hose: www.metalhose.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.

2.08 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Allied Tube & Conduit: www.alliedeg.com/#sle.
   2. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com/#sle.

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use compression (gland) or set-screw type.
      a. Do not use indenter type connectors and couplings.

2.09 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

B. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.10 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

E. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.

F. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.

E. Install intermediate metal conduit (IMC) in accordance with NECA 101.

F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

G. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated without specific routing, determine exact routing required.

3. Conceal all conduits unless specifically indicated to be exposed.
4. Conduits in the following areas may be exposed, unless otherwise indicated:
    a. Electrical rooms.
    b. Mechanical equipment rooms.
    c. Within joists in areas with no ceiling.
5. Where conduits cannot be feasibly concealed, utilize surface raceway (e.g. Wiremold V2100).
6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
7. Arrange conduit to maintain adequate headroom, clearances, and access.
8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
9. Route conduits above water and drain piping where possible.
10. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
11. Maintian minimum clearance of 6 inches between conduits and roof deck.
12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.
    c. Flues.
14. Group parallel conduits in the same area together on a common rack.

H. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.
    a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
8. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved). Provide roof membrane slip sheets under all supports.
    a. Cooper B-Line Dura-Blok DB Serires
    b. Erico Caddy Pyramid 50
    c. OMG Strut Model Pipe Guard
9. Use of wire for support of conduits is not permitted.

I. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.

7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

J. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

K. Underground Installation:
1. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 24 inches.
   b. Under Slab on Grade: 12 inches to bottom of slab.
2. Provide underground warning tape in accordance with Section 26 05 53 along entire conduit length for service entrance where not concrete-encased.

L. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where conduits are subject to earth movement by settlement or frost.

M. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

N. Provide grounding and bonding in accordance with Section 26 05 26.

3.03 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

END OF SECTION

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SECTION 26 05 33.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 27 26 - Wiring Devices:
   1. Wall plates.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
   4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
   5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
   6. Coordinate the work with other trades to preserve insulation integrity.
   7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
   8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Products: Provide products listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   3. Use suitable concrete type boxes where flush-mounted in concrete.
   4. Use suitable masonry type boxes where flush-mounted in masonry walls.
   5. Use raised covers suitable for the type of wall construction and device configuration where required.
   6. Use shallow boxes where required by the type of wall construction.
   7. Do not use "through-wall" boxes designed for access from both sides of wall.
   8. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
   9. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
   10. Wall Plates: Comply with Section 26 27 26.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
   1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
   2. NEMA 250 Environment Type, Unless Otherwise Indicated:
   3. Junction and Pull Boxes Larger Than 100 cubic inches:
      a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
   4. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

E. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

F. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

G. Box Locations:
   1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 31 00 as required where approved by the Architect.
   2. Unless dimensioned, box locations indicated are approximate.
   3. Locate boxes so that wall plates do not span different building finishes.
   4. Locate boxes so that wall plates do not cross masonry joints.
   5. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
   6. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.

H. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
   3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.

I. Install boxes plumb and level.

J. Flush-Mounted Boxes:
   1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
   2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
   3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

K. Install boxes as required to preserve insulation integrity.

L. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

M. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

N. Close unused box openings.

O. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

P. Provide grounding and bonding in accordance with Section 26 05 26.

Q. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

END OF SECTION

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SECTION 26 05 33.23
SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface raceway systems.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.
   1. Includes metal channel (strut) used as raceway.

C. Section 26 05 33.13 - Conduit for Electrical Systems.

D. Section 26 05 33.16 - Boxes for Electrical Systems.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 5 - Surface Metal Raceways and Fittings; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of raceways with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate rough-in locations of outlet boxes provided under Section 26 05 33.16 and conduit provided under Section 26 05 33.13 as required for installation of raceways provided under this section.
   3. Verify minimum sizes of raceways with the actual conductors and components to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install raceways until final surface finishes and painting are complete.
   2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.
   1. Surface Raceway Systems: Include information on fill capacities for conductors and cables.

PART 2 PRODUCTS

2.01 RACEWAY REQUIREMENTS

A. Provide all components, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

2.02 SURFACE RACEWAY SYSTEMS

A. Surface Metal Raceways: Listed and labeled as complying with UL 5.
   1. Wiremold, a brand of Legrand North America, Inc; Series V2000 or equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes and conduit terminations are installed in proper locations and are properly sized in accordance with NFPA 70 to accommodate raceways.

C. Verify that mounting surfaces are ready to receive raceways and that final surface finishes are complete, including painting.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install raceways plumb and level.

D. Secure and support raceways in accordance with Section 26 05 29 at intervals complying with NFPA 70 and manufacturer's requirements.

E. Close unused raceway openings.

F. Provide grounding and bonding in accordance with Section 26 05 26.

3.03 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Underground warning tape.

E. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

B. Section 26 05 73 - Power System Studies: Arc flash hazard warning labels.

1.03 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2023.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submitals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Panelboards:
         1) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
         2) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
      b. Enclosed switches, circuit breakers, and motor controllers:
         1) Identify voltage power source and circuit number. Include location when not within sight of equipment.
         2) Identify load(s) served. Include location.
   2. Service Equipment:
      a. Use identification nameplate to identify each service disconnecting means.
   3. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.

4. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
5. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
6. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
    a. Service equipment.
    b. Industrial control panels.
    c. Motor control centers.
    d. Elevator control panels.
    e. Industrial machinery.
7. Arc Flash Hazard Warning Labels: Comply with Section 26 05 73.
8. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.

C. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

D. Identification for Devices:
1. Use identification label to identify fire alarm system devices.
2. Use identification label to identify serving branch panel and circuit for all devices.
3. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Materials:
    a. Indoor Clean, Dry Locations: Use plastic nameplates.
    b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
    a. Equipment designation or other approved description.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
    a. Equipment Designation: 1/2 inch.
5. Color:
    a. Normal Power System: White text on black background.

D. Format for Receptacle an device identification:
   1. Label all device wall plates with the respective panel and circuit number. Provide black lettering on 1/2" clear adhesive tape to front of wall plate.

2.03 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Minimum Text Height: 1/8 inch.

F. Color: Black text on white background unless otherwise indicated.

2.04 UNDERGROUND WARNING TAPE

A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

B. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.

C. Legend: Type of service, continuously repeated over full length of tape.

D. Color:
   1. Tape for Buried Power Lines: Black text on red background.

2.05 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
   1. Materials:
      a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
   2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
   3. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
   3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.
   2. Flush-Mounted Equipment: Inside of equipment door.
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Branch Devices: Adjacent to device.
   6. Interior Components: Legible from the point of access.
   7. Conductors and Cables: Legible from the point of access.
   8. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

END OF SECTION

SECTION 26 05 83
WIRING CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 26 05 33.13 - Conduit for Electrical Systems.

C. Section 26 05 33.16 - Boxes for Electrical Systems.

D. Section 26 27 26 - Wiring Devices.

1.03 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Comply with NEMA WD 1.
   2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
   3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Wiring Devices: As specified in Section 26 27 26.

C. Flexible Conduit: As specified in Section 26 05 33.13.

D. Wire and Cable: As specified in Section 26 05 19.

E. Boxes: As specified in Section 26 05 33.16.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

SECTION 26 08 00
COMMISSIONING OF LIGHTING SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. See Section 01 9113 - General Commissioning Requirements for overall objectives; comply with the requirements of Section 01 9113.

B. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

C. The Commissioning of this project is not a full blown 3rd party commissioing effort but rather commissioning "light" to review the primary equipment and system functions.

D. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use. The CA is ISG.

E. The entire LIGHTING system is to be commissioned, including commissioning activities for the following specific items:
   1. Lighting
   2. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

F. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 RELATED REQUIREMENTS

A. Section 01 7800 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

B. Section 01 7900 - Demonstration and Training: Scope and procedures for Owner personnel training.

C. Section 01 9113 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

1.03 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - The HVAC&R Technical Requirements for the Commissioning Process 2007, with Errata (2012).

1.04 SUBMITTALS PROVIDED BY THE PRIMARY CONTRACTOR

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. All information is to be submitted in PDF format and be indexed.

C. Startup Reports: Submit for approval of Commissioning Authority.

D. Lighting and Occupancy Control O&M Manual Requirements.

E. Project Record Documents: See Section 01 7800 for additional requirements.
   1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
   2. Show actual locations of all Occupancy Control Sensors.

F. Draft Training Plan: In addition to requirements specified in Section 01 7900, include:
   1. Control system manufacturer's recommended training.
   2. Demonstration and instruction on function, overrides and settings.

G. Training Manuals: See Section 01 7900 for additional requirements.
   1. Provide PDF file format of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments will NOT become the property of Owner.

PART 3 EXECUTION

3.01 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

3.02 INSPECTING AND TESTING - GENERAL

A. Submit startup plans and startup reports. Prefunctional Checklists for each item of equipment or other assembly to be commissioned are provided in this specification Index.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned are provided in this specification Index.

C. Provide two-way radios for use during the testing if required.

3.03 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.

D. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

E. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
   1. Setpoint changing features and functions.
   2. Sensor calibrations.

F. Demonstrate to the Commissioning Authority:
   1. That all specified functions and features are set up, debugged and fully operable.

G. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.04 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 7800 for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.05 DEMONSTRATION AND TRAINING

A. See Section 01 7900 for additional requirements.

B. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

D. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the following minimum durations of training:

E. HVAC Control System Training: Perform training in at least three phases:
   1. Phase 1 - Basic Control System: Provide minimum of 1 hour min of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
      a. This training will be held on-site.

F. Provide the services of manufacturer representatives to assist instructors where necessary.

END OF SECTION

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SECTION 26 09 23
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Occupancy sensors.

B. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 26 05 29 - Hangers and Supports for Electrical Systems

B. Section 26 05 33.16 - Boxes for Electrical Systems.

C. Section 26 27 26 - Wiring Devices: Devices for manual control of lighting, including wall switches and wall dimmers.
   1. Includes finish requirements for wall controls specified in this section.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

D. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2023.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
   3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
   4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install lighting control devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
   1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

C. Shop Drawings:
   1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.

D. Field Quality Control Reports.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.02 OCCUPANCY SENSORS

A. All Occupancy Sensors:
   1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
   2. Sensor Technology:
      a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
   3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
   4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
   5. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
   6. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
   7. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for connecting to building automation system.

B. Wall Switch Occupancy Sensors:
   1. All Wall Switch Occupancy Sensors:
      a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
      b. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
      c. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
      d. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
      e. Finish: Match finishes specified for wiring devices in Section 26 27 26, unless otherwise indicated.
   2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

C. Wall Dimmer Occupancy Sensors:
   1. General Requirements:
      a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability , and no leakage current to load in off mode.
      b. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.

D. Ceiling Mounted Occupancy Sensors:
   1. All Ceiling Mounted Occupancy Sensors:
      a. Description: Low profile occupancy sensors designed for ceiling installation.
      b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
   2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
      a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

E. Power Packs for Low Voltage Occupancy Sensors:
   1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
   2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
   3. Input Supply Voltage: Dual rated for 120/277 V ac.
   4. Load Rating: As required to control the load indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of lighting control devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switch Occupancy Sensors: 48 inches above finished floor.
   2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
   3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 27 26.

G. Provide required supports in accordance with Section 26 05 29.

H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

I. Occupancy Sensor Locations:
   1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required

for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.

2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

J. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.

K. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 COMMISSIONING

A. See Section 26 0800-Commissioning of Lighting System

3.08 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Wall plates.

1.02 RELATED REQUIREMENTS

A. Section 26 05 33.16 - Boxes for Electrical Systems.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

D. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

G. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

H. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

I. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

J. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
   3. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
   4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Project Record Documents: Record actual installed locations of wiring devices.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide GFCI protection for receptacles installed within 6 feet of sinks.

E. Provide GFCI protection for receptacles installed in kitchens.

F. Provide GFCI protection for receptacles serving electric drinking fountains.

G. Unless noted otherwise, do not use combination switch/receptacle devices.

2.02 WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.

B. Wiring Devices, Unless Otherwise Indicated: Gray with stainless steel wall plate with matte finish.

2.03 WALL SWITCHES

A. Manufacturers:
   1. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   2. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20and where applicable FS W-S-896; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Standard Wall Switches: Commercial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.04 WALL DIMMERS

A. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

B. Control: Slide control type with separate on/off switch.

C. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

2.05 RECEPTACLES

A. Manufacturers:
   1. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   2. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498and where applicable FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.

2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:
   1. Standard Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
   1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
      a. Provide test and reset buttons of same color as device.
   2. Standard GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
   3. Weather Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

2.06 WALL PLATES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell-wiring.com/#sle.
   2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   3. Lutron Electronics Company, Inc: www.lutron.com.
   4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
   2. Size: Standard.
   3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Stainless Steel Wall Plates: Matte finish, Type 302 stainless steel.

D. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

E. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that openings in access floor are in proper locations.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switches: 48 inches above finished floor to top of box.
      b. Wall Dimmers: 48 inches above finished floor to top of box.
      c. Receptacles: 20 inches above finished floor to top of box or 6 inches above counter.
   2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
   3. Where multiple receptacles or wall switches are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
   4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
   5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Unless otherwise indicated, GFCI receptacles may be connected to provide feed-through protection to downstream devices. Label such devices to indicate they are protected by upstream GFCI protection.

I. Install wiring devices plumb and level with mounting yoke held rigidly in place.

J. Install wall switches with OFF position down.

K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

L. Do not share neutral conductor on branch circuits utilizing wall dimmers.

M. Install vertically mounted receptacles with grounding pole on bottom and horizontally mounted receptacles with grounding pole on left.

N. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

O. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

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SECTION 26 28 13
FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fuses.

1.02 RELATED REQUIREMENTS

A. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

B. Section 26 28 16.16 - Enclosed Switches: Fusible switches.

1.03 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.

E. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
   2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Fuses: One set(s) of three for each type and size installed.
   3. Fuse Pullers: One set(s) compatible with each type and size installed.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com/#sle.

B. Littelfuse, Inc: www.littelfuse.com/#sle.

2.02 APPLICATIONS

A. Service Entrance:
   1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.

2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

B. Feeders:
1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

C. Individual Motor Branch Circuits: Class RK5 time-delay.

2.03 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

H. Class L Fuses: Comply with UL 248-10.

I. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION

SECTION 26 28 16.13
ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed circuit breakers.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain one copy of each document on site.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed circuit breaker internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation: www.eaton.com/#sle.

B. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

C. Siemens Industry, Inc: www.usa.siemens.com.

2.02 ENCLOSED CIRCUIT BREAKERS

A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between 23 degrees F and 104 degrees F.

D. Short Circuit Current Rating:
   1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location indicated on the drawings.

E. Conductor Terminations: Suitable for use with the conductors to be installed.

F. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

G. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

H. Provide externally operable handle with means for locking in the OFF position.

2.03 MOLDED CASE CIRCUIT BREAKERS

A. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

B. Interrupting Capacity:
   1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      a. 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
   2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

C. Conductor Terminations:
   1. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

D. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed circuit breakers are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed circuit breakers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 05 29.

E. Install enclosed circuit breakers plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 05 26.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with manufacturer's instructions and NETA ATS, except Section 4.

C. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

END OF SECTION

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SECTION 26 28 16.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 28 13 - Fuses.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

G. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

D. Project Record Documents: Record actual locations of enclosed switches.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having

jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB/GE: www.geindustrial.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Siemens Industry, Inc: www.usa.siemens.com.

E. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

G. Provide with switch blade contact position that is visible when the cover is open.

H. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
   1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

I. Conductor Terminations: Suitable for use with the conductors to be installed.

J. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

K. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
   2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

L. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

M. Heavy Duty Switches:
   1. Comply with NEMA KS 1.
   2. Conductor Terminations:
      a. Lug Material: Copper suitable for terminating copper conductors only.

3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 05 29.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 05 26.

H. Provide fuses complying with Section 26 28 13 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

3.03 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.04 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

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SECTION 26 51 00
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts and drivers.

E. Lamps.

1.02 RELATED REQUIREMENTS

A. Section 26 05 29 - Hangers and Supports for Electrical Systems.

B. Section 26 05 33.16 - Boxes for Electrical Systems.

1.03 REFERENCE STANDARDS

A. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts; 2023.

B. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.

C. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.

D. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

E. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems; 2006.

F. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

G. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2023.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

K. UL 1598 - Luminaires; Current Edition, Including All Revisions.

L. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate dimensions and components for each fixture that is not a standard product of the manufacturer.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
   2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings. Alternate light fixture data sheet shall be submitted to the Engineer for approval prior to bid. No exceptions.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
   3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

H. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:

1. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.04 EXIT SIGNS

A. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
1. Number of Faces: Single or double as indicated or as required for the installed location.
2. Directional Arrows: As indicated or as required for the installed location.

B. Self-Powered Exit Signs:
1. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
2. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
3. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.05 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

B. Dimmable LED Drivers:
1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.

2.06 LAMPS

A. Manufacturers:
1. GE Lighting: www.gelighting.com.
2. Philips Lighting Co of NA: www.lighting.philips.com.
3. Sylvania: www.sylvania.com
4. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.

B. Lamps - General Requirements:
1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

C. Lamp Types: As specified for each fixture.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

D. Provide required support and attachment in accordance with Section 26 05 29.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   4. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

G. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.

H. Suspended Luminaires:
   1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
   2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.

I. Install accessories furnished with each luminaire.

J. Bond products and metal accessories to branch circuit equipment grounding conductor.

K. Install lamps in each luminaire.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.04 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.05 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

A. Just prior to Substantial Completion, replace all lamps that have failed.

3.07 SCHEDULE - SEE DRAWINGS

END OF SECTION

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SECTION 28 46 00
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Replacement and removal of existing fire alarm system components, wiring, and conduit indicated.

1.02 RELATED REQUIREMENTS

A. Section 23 33 00 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

E. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings to Include:
   1. Written narrative providing intent and system description.
   2. Riser diagram.
   3. Floor plan layout showing location of all devices and control equipment.
   4. Sequence of operation in an input/output matrix.
   5. Product Data to include:
      a. Equipment technical data sheets including manufacturer's published instructions.
      b. Battery calculations.
      c. Voltage drop calculations for notification appliance circuits.

C. Evidence of designer qualifications.

D. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
   1. Copy (if any) of list of data required by authority having jurisdiction.
   2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
   4. System zone boundaries and interfaces to fire safety systems.
   5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
   6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
   7. List of all devices on each signaling line circuit, with spare capacity indicated.
   8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
   9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
   10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.

11. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
12. Certification by Contractor that the system design complies with Contract Documents.
13. Do not show existing components to be removed.

E. Evidence of installer qualifications.

F. Evidence of maintenance contractor qualifications, if different from installer.

G. Inspection and Test Reports:
1. Submit inspection and test plan prior to closeout demonstration.
2. Submit documentation of satisfactory inspections and tests.
3. Submit NFPA 72 "Inspection and Test Form," filled out.

H. Operating and Maintenance Data: See Section 01 78 00 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
1. Complete set of specified design documents, as approved by authority having jurisdiction.
2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
4. List of recommended spare parts, tools, and instruments for testing.
5. Replacement parts list with current prices, and source of supply.
6. Detailed troubleshooting guide and large scale input/output matrix.
7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

I. Project Record Documents: See Section 01 78 00 for additional requirements; have one set available during closeout demonstration:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications.
3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

J. Closeout Documents:
1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
3. Operation and maintenance instructions.
4. Record (as-built) drawings.
5. Copy of site-specific software.
6. Warranty information.

K. Testing Reports:
1. Completed record of completion.
2. Completed Record of Inspection and Testing.
3. Maintenance contract.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer , with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.

1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.

C. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Alarm System shall be 'Desigo' Series by Siemens Industry, Inc. (no substitutions) to allow for compatability with and extension of existing networked system, and reporting to Owner's 'Siemens Desigo CC' monitoring workstation located at Camp Dodge.

B. Fire Safety Management System - Model Siemens Desigo CC
1. Switch Model - Basis of Design: Siemens X204-2LD

C. Fire Alarm Control Panel (FACP: Siemens.
1. Model FV-2025 for up to 252 points, with mass notification.
2. Model FV-2050 for up to 504 points, with mass notification.
3. Model FN2012-A1 Network Card
4. Model VN2002-A1 for Multi-Mode Fiber
5. Model VN2003-A1 for Single Mode Fiber

D. Initiating Devices and Notification Appliances:
1. Provide initiating devices and notification appliances made by the same manufacturer, where possible.

2.02 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
1. Fire Alarm System shall meet UFC 4-021-01 Mass Notification System requirements.
2. Fire Alarm Panel shall be configured to be monitored by the Owner's monitoring contractor. Panel shall include a programmable DACT fully compatible with Owner's central monitoring workstation for point by point reporting. Installer shall demonstrate successful reporting to workstation.
3. Provide all components necessary, regardless of whether shown in Contract Documents or not.
4. Protected Premises: Entire building shown on drawings.
5. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
   a. ADA Standards.
   b. The requirements of the State Fire Marshal.
   c. The requirements of the local authority having jurisdiction.
   d. Applicable local codes.
   e. Contract Documents (drawings and specifications).
   f. NFPA 101.
   g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
6. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
7. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
8. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
9. Program notification zones and voice messages as directed by Owner.
10. Fire Command Center: Location indicated on drawings.

11. Fire Alarm Control Unit: New, located at fire command center.

B. Circuits:
   1. Initiating Device Circuits (IDC): Class B, Style A.
   2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
   3. Notification Appliance Circuits (NAC): Class B, Style W.

C. Spare Capacity:
   1. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

D. Power Sources:
   1. Primary: Dedicated branch circuits of the facility power distribution system.
   2. Secondary: Storage batteries.
   3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
   4. Each Computer System: Provide uninterruptible power supply (UPS).

2.03 EXISTING COMPONENTS

A. Existing Fire Alarm System: Remove existing system completely after new system is fully operational and tested.

B. On-Premises Supervising Station: Include as part of this work all modifications necessary to existing supervising station to accommodate new fire alarm work.

C. Clearly label components that are "Not In Service."

D. Remove unused existing components and materials from site and dispose of properly.

2.04 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
   1. Kitchen hood suppression activation; also disconnect fuel source from cooking equipment.
   2. Duct smoke detectors.

C. HVAC:
   1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

2.05 COMPONENTS

A. General:
   1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
   2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Master Control Unit: As specified above.

C. Initiating Devices:
   1. Addressable Systems:
      a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
      b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.
   2. Heat Detectors: Provide "Fixed Temperature" heat detectors in Kitchen..

D. Circuit Conductors: Copper or optical fiber; provide 200 feet extra; color code and label.

E. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
   1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
   2. Provide one for each control unit where operations are to be performed.
   3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
   4. Provide extra copy with operation and maintenance data submittal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C. Obtain Owner's approval of locations of devices, before installation.

D. Install instruction cards and labels.

E. Fire alarm panel installer shall coordinate termination of the CAT5E cables and programming of the fire alarm panel with the Owner's telecommunication representative prior to work being performed.

F. Contractor shall provide a qualified electrician to put the fire system into bypass mode for each zone impacted by construction. All other zones shall remain operationally active if occupied during construction. Bring deactivated zones back online at completion of construction.
   1. It shall be the Contractors responsilbility to first, at least 10 business days in advance of the need, request approval from the Owner, and second, to contact and coordinate with the facility's Fire Detection & Alarm service provider.
      Provider's contact information is as follows:
      a. Siemens - 515-963-1463 - ashley.frink@siemens.com

G. Contractor shall be responsible to protect all active and inactive equipment and devices from damage for the duration of the Work. Any equipment or devices damaged as a result of the Work shall be repaired or replaced by the Contractor for a full and operational system.

3.02 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

H. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
   1. Record all system operations and malfunctions.
   2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
   3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
   4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.03 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
   1. Be prepared to conduct any of the required tests.
   2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of control unit manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
   5. Repeat demonstration until successful.

3.04 MAINTENANCE

A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner, at no extra cost, a written maintenance contract for one year, to include the work described below.

C. Perform routine inspection, testing, and preventive maintenance required by NFPA 72 and authority having jurisdiction, including:
   1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
   2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
   3. Record keeping required by NFPA 72 and authorities having jurisdiction.

D. Provide trouble call-back service upon notification by Owner:
   1. Provide on-site response within 2 hours of notification.
   2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

E. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

F. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

G. Comply with Owner's requirements for access to facility and security.

END OF SECTION

SECTION 31 10 00
SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clearing and protection of vegetation.

B. Removing existing sidewalks.

C. Removing existing exterior stairs.

1.02 RELATED REQUIREMENTS

A. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

B. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of benchmarks, survey control points, and existing construction to remain; reinstallation of removed products.

C. Section 01 74 19 - Construction Waste Management And Disposal: Limitations on disposal of removed materials; requirements for recycling.

D. Section 31 23 16 - Excavation and Earthwork: Topsoil removal and stockpile.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SITE CLEARING

A. Comply with other requirements specified in Section 01 70 00.

B. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

3.02 EXISTING UTILITITIES AND BUILT ELEMENTS

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Protect existing structures and other elements that are not to be removed.

3.03 VEGETATION

A. Do not remove or damage vegetation beyond the following limits:
   1. 40 feet outside the building perimeter.
   2. 10 feet each side of surface walkways, patios, surface parking, and utility lines less than 12 inches in diameter.
   3. 15 feet each side of roadway curbs and main utility trenches.

B. Install substantial, highly visible fences at least 3 feet high to prevent inadvertent damage to vegetation to remain:
   1. Around trees to remain within vegetation removal limits; locate no closer to tree than at the drip line.

C. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum disturbance of the subsoil.

D. Vegetation Removed: Do not burn, bury, landfill, or leave on site, except as indicated.
   1. Chip, grind, crush, or shred vegetation for mulching, composting, or other purposes; preference should be given to on-site uses.

E. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

3.04 SIDEWALKS AND PAVING

A. Remove paving and sidewalks back to an existing control or expansion joint, and provide sawcut joint to make neat clean termination.

B. Remove concrete and granular cushion to grade.

C. Recycle removed concrete in accordance with Section 01 74 19 - Construction Waste Management And Disposal.

3.05 DEBRIS

A. Remove debris, junk, and trash from site.
   1. Concrete and excess soils may be hauled to Camp Dodge spoils site. Coordinate with Owner.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 31 22 00
FINISH GRADING AND TOPSOIL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section of Specifications and related Drawings describe requirements pertaining to topsoil finish grading.

1.02 RELATED SECTIONS

A. Section 31 23 16 - Excavation and Earthwork

B. Section 32 92 19 - Seeding

1.03 REFERENCES

A. Make required analyses and material tests for topsoil and other materials of similar character per current methods of Association of Official Agricultural Chemists.

1.04 INSPECTION AND APPROVAL

A. All materials described and specified herein shall be subject to inspection and approval by the Architect.

B. Materials may be inspected by the Architect at source of supply.

C. This inspection does not waive the right to reject any material after it has been delivered to the site and/or installed.

PART 2 PRODUCTS

2.01 GENERAL

A. If acceptable topsoil material has been saved for use in finish grading, after sifting out all plant growth, rubbish and stones, use for areas designated to be finish graded. If stockpiled topsoil is not of sufficient quantity to complete work, furnish acceptable topsoil from another approved source.

B. Acceptable topsoil material shall be defined as natural fertile agricultural soil, capable of sustaining vigorous plant growth, uniform composition throughout without admixture of subsoil, and free of stones, lumps, plants and their roots, sticks, and other extraneous matter. Do not deliver while in frozen or muddy condition.

2.02 TOPSOIL

A. Natural, fertile, friable soil, possessing characteristics of representative productive topsoils in the vicinity.

B. Composition of the topsoil shall fall within the following limitations: Clay: minimum 10 percent, maximum 40 percent. Silt: minimum 14 percent, maximum 64 percent. Sand: minimum 12 percent, maximum 40 percent.

C. Obtain from naturally well-drained areas.

D. Not excessively acid or alkaline nor contain toxic substances which may be harmful to plant growth.

E. Without admixtures of subsoil, clean, reasonably free from clay lumps, stumps, roots, or similar substances one and one-half inches (1-1/2") or more in diameter, stones or gravel three-fourths inch (3/4") or more in diameter, debris, or other objects which might be a hindrance to planting operations.

PART 3 EXECUTION

3.01 SUBGRADE

A. Top of subgrade to be established and prepared five inches (5") below and parallel to final design grade.

3.02 PLACEMENT AND FINISH GRADING

A. Execute topsoil and finish grading work to levels, grades, and contours as indicated. Do not start work until after construction work on structures, walks, curbs, walls, and paved areas has been substantially completed, inspected and approved. Spread, rake, compact, and otherwise work topsoil to ensure smooth drainage grades. Minimum compacted thickness of topsoil for

lawn areas shall be 5 inches.

B. Prior to placing topsoil loosen with culti-packer, top three or four inches (3-4") of prepared and compacted subgrade to insure bond with imported topsoil.

C. Over the prepared subsoil, spread 5" of topsoil to stabilize the surface and to bring grade to finish level.

D. In all lawn areas, use a culti-packer, pulverizer, or similar tool to pulverize the soil and eliminate all lumps until the soil is completely fined and worked into a fine and mellow condition to finish grade; to a minimum 5" depth.

E. Finish all lawn areas free of clods, ruts, stones, debris, sticks, and other foreign material, etc., ready for sodding with only a light raking or scarifying required by the sodding subcontractor.

F. Finish grade to a tolerance of 0.1 feet at spot elevations showing ground as illustrated on the Drawings.

G. Finished surface shall be rounded at any abrupt changes in slope. Should figures for finished grades conflict with finished grade contours shown, the figures shall govern.

H. Finished grades, not otherwise indicated, shall be uniform levels or slopes between points where levels are given or between such points and existing finishing grades, without water pockets.

I. All lawn areas shall properly drain away from structures without ponding.

J. After placement, maintain surfaces to indicated finished grades.

END OF SECTION

SECTION 31 23 16
EXCAVATION AND EARTHWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section of specifications and related drawings describe requirements pertaining to excavation and earthwork including the following:
   1. Subgrade removal, replacement and preparation for slab-on-grade.
   2. Inspection Services
   3. Temporary Protection
   4. Excavation, Backfilling & Compaction
   5. Subbase Materials
   6. Fill and compaction for paving.

B. NPDS Grading Permit:
   1. NPDS permit has been taken out for previous development on this site. The Contractor shall extend, modify, and/or obtain the NPDS grading permit for work under this contract.

C. All work under this section is to be accomplished consistent with the requirements of the State of Iowa, local codes and any grading permits required.

1.02 RELATED SECTIONS

A. Section 01 40 00 - Quality Requirements

B. Section 31 10 00 - Site Clearing

C. Section 31 22 00 - Finish Grading and Topsoil

1.03 OPERATIONS PROCEDURES

A. Obtain Architect's concurrence for proposed methods of operations and procedure prior to starting work. Execute work in manner to prevent damage from any cause to adjacent streets, buildings, utilities, and similar properties. Full responsibility for repairs and replacement rests with Contractor.

1.04 SITE UTILITIES

A. The existing utilities shown on drawings are taken from public records. Prior to the start of any excavation, Contractors shall be responsible to verify with utility companies and Owner for private utilities the locations of existing utilities and whether additional utilities exist.

B. When underground utility lines are encountered, immediately notify utility company of discovery of such lines. Protect and allow time for utility company to remove them; or in event they waive removal, cut and cap such lines at property line in neat, safe manner.

C. Protect existing utilities indicated to remain.

D. Do not interrupt existing utilities service without advance notice to and written approval from the owner.

1.05 QUALITY CONTROL

A. Geotechnical Engineer shall be retained by the Owner to insure that all slabs and engineered fills are placed in a manner consistent with the provisions of this specification section.

B. Geotechnical Engineer shall be present on-site at the critical times of excavation and controlled filling including:
   1. Observe proof-rolling of building slab-on-grade area and observe and test existing soils materials prior to filling operations.
   2. Observe and report condition of all substrates below slab-on-grade and paving areas, probe as necessary.
   3. Review and approve all backfilling materials for suitability.
   4. Observe and test as required all fill materials and operations necessary to insure proper installation of engineered fills.

C. Geotechnical Engineer shall provide reports as inspections are completed. Copies shall be provided to the Owner, Contractor, Structural Engineer and Architect.

D. Field Testing:

1. Perform field density testing in accordance with ASTM D 1556 or ASTM D2167 as applicable.
2. Building Slab Subgrades: Perform at least one density test per 2,000 sf of slab area but in no case less than three tests.
3. Compacted fill layer: Perform at least one density test per 2,000 sf of slab area but in no case less than three tests.
4. Test for expansive soils.
5. Test soil support characteristics at existing electrical/communications utilities at east end of building slab.

1.06 ADDITIONAL EXCAVATION & FILLING

A. All additional work required due to unexpected conditions encountered during excavation as required by the Geotechnical Engineer will be negotiated with the Owner prior to proceeding with the work.

PART 2 MATERIALS

2.01 MATERIALS

A. Interior Slab Cushion: Granular fill to be clean/washed, free draining, approved crushed gravel or crushed stone, with 100% passing a 1-1/2" sieve and not more than 5% passing a #4 sieve

PART 3 EXECUTION

3.01 PREPARATION

A. Protection: Provide markers indicating limits of work and clear identification of items and areas requiring protection.

B. Provide protective snow fence enclosure around existing telecommunications lines prior to proceeding with any work.

C. Provide barricades, warning signs, and warning lights around open excavations or drives where applicable to prevent injury to persons and damage to properties.

D. The Contractor is solely responsible for determining the potential for injury to persons and damage to property.
   1. Where such potential is present, take appropriate protective measures.
   2. Protect persons from injury and protect existing and new improvements from damage caused directly or indirectly by construction operations.

E. Contractor shall arrange Utility Locates with Iowa One Call and with Iowa Army National Guard for private utilities prior to starting any work.

F. The contractor shall supply all construction layout staking for this project, including for exterior improvements and utilities.

3.02 EXISTING EXTERIOR STAIRS

A. Demo footings at existing stairs:
   1. Pier and footings within bearing of new footings; remove completely.
   2. Pier and footings outside bearing of new footing and under building pad; remove to min 2'-0" below slab.
   3. Refer to structural drawings for existing footings to be removed completely.

3.03 EXISTING UTILITIES TO BE REMOVED

A. Existing utilities under North Addition Slab-on-grade; remove trenched backfill and bedding materials of existing utilities to be demolished.

B. Remove to 5'-0" outside exterior footing line.

3.04 EXISTING AND EXCAVATED MATERIALS

A. Remove from the site all existing materials of every nature and description which are encountered in executing excavating, cutting or stripping to required lines and grades except existing materials specifically approved by the Geotechnical Engineer and required for filling and backfilling work and all soils that are clean and organic that will be allowed for use as additional fill and berming on site as approved by architect. It is the intent to avoid removal of clean fill from the site.

B. All materials to be excavated are to be assumed to be unclassified until approved by Geotechnical Engineer.

C. No additional payment will be made for removal of existing items such as slabs on earth, walls, sidewalks, curbs, paving and similar items remaining from previous construction and improvements within confines of new construction lines and limitations.

D. Remove from the site all approved existing excavated materials not used in fill or backfill work.

3.05 DEWATERING

A. Do not allow surface or ground water to flow into or accumulate in excavations or within the building or pavement areas.

B. Provide and operate pumps of sufficient size and in adequate number to maintain excavations and structures free of water during working and non-working hours until after backfilling is finished and permanent drains have been completed and connected to accomplish this requirement.

3.06 COMPACTION

A. Provide compacted fill per the stated requirements. Correct and re-compact all areas failing to comply with the stated criteria.

B. Provide all compaction of cohesive material consistent with the requirements of ASTM D-698 for each layer of fill material. Provide compaction of cohesionless materials consistent with ASTM D-2049.

C. Wet or dry scarified substrates and fill materials as necessary to obtain moisture contents within the optimum range for compaction operations.

D. Compaction Requirements:

Compaction Requirements	(Standard Proctor Density)	
	Cohesive Soil	Non-cohesive Soil
Within Building Footprint	95%	98%
Under Pavement Areas	95%	98%
Backfill Against Ext. Structure	90%	93%
Other Site Areas	85%	88%

3.07 SURFACE PREPARATION

A. Stripping: (Removal of top +/-12")
   1. Within designated paving areas and general site areas to receive cut/fill operations, remove earth, grass, weeds, and similar top coverings, and remove from site.
   2. Strip remaining existing topsoil exhibiting suitable properties and stockpile at suitable location on-site.
   3. Remove any additional material exhibiting organic characteristics and fill material at areas where existing utility trenches are encountered.

3.08 BUILDING AND PAVEMENT EXCAVATION

A. Excavation - General:
   1. Execute excavating carefully to required lines and grades, making allowances for execution of other construction operations. Execute work by means of hand and power shovels, except for final 6 inches for spread footing bottoms which shall be executed by hand.
   2. Wherever it is possible to slope faces of excavations to achieve stabilization, do so in compliance with requirements of governing authorities. Otherwise provide shoring and bracing.
   3. Maintain all excavations free of earth, rock, sand, debris, and all water until concrete work and backfill is completed.
   4. Over-excavation: Take proper care not to excavate beyond depths required except as directed by the Geotechnical Engineer. No uncontrolled backfilling will be permitted. In the event excavations are carried below required depths without authorization make the following corrections at no additional expense to Owner:
      a. Fill such excess excavations with concrete or

1) Place compacted and approved fill material complying with the requirements of this section pertaining to such material.

3.09 FILL

A. General (paving, structure, and site):
   1. Fill to required levels, grades, and contours with specified materials that will provide required compaction. Place in layers which, when compacted, will not exceed 9 inches.
   2. Wet or dry fill to obtain optimum moisture content, then roll and mechanically tamp each layer to minimum standard proctor density (ASTM D-698) as indicated for area.
   3. Provide compaction testing for each lift of material as recommended by the Geotechnical Engineer. Provide reports as specified in this section of the compaction tests performed.
   4. Redress and re-compact any areas that settle below required grades from traffic, precipitation, and storage loadings before execution of other work required thereover.

B. Site fill outside the confines of structure and paving:
   1. The subgrade for lawn and planting areas is specified in Section 31 22 00 - Finish Grading and Topsoil.
   2. Methods:
      a. Rough grading, including excavated, filled and transition areas shall be reasonably smooth, compacted, and free from irregular surface changes
      b. Degree of finish shall be that ordinarily obtainable from either blade-grader or scraper operations, except as otherwise specified
      c. Tolerance for areas within 10 feet if buildings and all areas to be paved shall not exceed 0.15 foot above or below established subgrade
      d. All ditches, swales, and gutters shall be finished to drain readily.
      e. Unless otherwise indicated on drawings, subgrade shall be evenly sloped to provide drainage away from building walls in all directions at a grade not less than 1/2 inch per foot in the first 10' measured from the building wall line.
      f. Provide roundings at top and bottom of banks and at other breaks in grade.

3.10 UTILITY TRENCHES

A. Refer to SUDAS Design Manual for additional backfill material, bedding material, piping support, and tracer tape requirements.

B. Refer to Mechanical and Electrical sections for Tracer Tape to be installed at all utility locations.

C. All backfilling of utility trenches is to meet the same compaction densities as that specified for other areas of the fill work in this section.

D. Provide cohesive "Plug" within trench at intersection with building footprint if granular fill materials are being utilized at other areas of the trench.

3.11 SURPLUS MATERIAL DISPOSAL

A. After completion of work, remove from premises any imported and excavated surplus materials not suitable for use as fill material.

B. Surplus material may be hauled to common stockpile on Camp Dodge. Coordinate location and haul route with Owner.

END OF SECTION

SECTION 32 92 19
SEEDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparation of subsoil.

B. Placing topsoil.

C. Seeding, mulching and fertilizer.

D. Maintenance to acceptance.

E. Seed all portions of site disturbed by construction operations.

1.02 RELATED REQUIREMENTS

A. Section 31 22 00 - Finish Grading and Topsoil

1.03 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer .

1.05 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of seed mixture.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable. Deliver seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

PART 2 PRODUCTS

2.01 SEED MIXTURE

A. Seed Mixture: Rate Lbs/1000 sf

Glade Kentucky Bluegrass (80%)	2.0
Liberty Kentucky Bluegrass (80%)	2.0
Merit Kentucky Bluegrass (80%)	2.0
APM Perennial Ryegrass (80%)	2.0
SR 4200 Perennial Ryegrass (80%)	2.0
TOTAL MIX	**10.0 lbs/1000 sf**

B. Contractor to review seed mix with timing of application and site conditions.

C. Mix rate of 10.0 lbs/1000 sf is to be considered a minimum. Contractor is responsible for providing established turf as indicated in Paragraph 3.9 Establishment, Final Inspection and Acceptance, and may use heavier seed rate as desired.

2.02 SOIL MATERIALS

A. Topsoil: Type as specified in Section 31 22 00.

2.03 ACCESSORIES

A. Mulching Material: Provide clean weed free threshed straw of wheat, rye, or oats. Straw harvested after killing frost or during dormant periods as well as discolored, weathered, rotted,

brittle, moldy, or caked material is unacceptable.
1. Fifty percent (50%) of fiber of each straw bail shall be ten inches or longer.

B. Fertilizer: Standard brand of commercial, non-agricultural type, conforming to applicable State Laws, and bearing name of producer; of a dry or liquid form, which can be uniformly distributed by the application equipment. Fertilizer shall be delivered with proper scale weight records and guaranteed analysis by supplier, with a permitted tolerance of 1% of each nutrient. Formulation: 8-32-16 or plant food ratio of 1-4-2.
1. Two applications are required. Installer to verify fertilizer mixture.

C. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.

D. Erosion Fabric: Jute matting, open weave.

E. Stakes: Softwood lumber, chisel pointed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared soil base is ready to receive the work of this Section.

B. Verify if grass herbicides have been applied to the Project Site within 1 year. Notify owner of necessity to delay permanent seeding & sodding operations and develop proposal for application of temporary run-off control seeding. Contract will be adjusted as necessary to allow for delay or abandonment of permanent seeding & sodding operations.

3.02 PREPARATION

A. Prepare subgrade in accordance with Section 31 22 00.

B. Place topsoil in accordance with Section 31 22 00.

C. Where weed growth has developed, remove all weeds and weed debris and disc-in weed stubble; substantial weed growth may require the application of a herbicide, applied as per manufacturer's instructions. Weed growth removal process to be approved by Architect, at no extra cost to owner.

D. Lightly disc soil surface to loosen.

E. Finish grade should be prepared so that top of topsoil will be as follows:
1. Seeding: a minimum of two inches (2") below sidewalk elevation on low side of paving and one inch (1") below sidewalk elevation on high side of paving.

F. Remove debris and rocks from bed as indicated under Section 31 22 00 - Finish Grading and Topsoil.

G. Apply fertilizer prior to seeding or sodding. Drag or till into the top 1" of the soil surface. Apply fertilizer at the rate of 1# of actual phosphorus per 1000 square feet.

H. Disc and harrow all areas to be seeded and firm up loosened seed-bed with a light roller to provide a smooth, uniform surface texture.

I. Architect to be notified forty-eight (48) hours in advance by Contractor when this operation is to take place. Architect to approve bed preparation and debris removal before proceeding.

3.03 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.

B. Apply after smooth raking of topsoil .

C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.

D. Mix thoroughly into upper 2 inches of topsoil.

E. Lightly water to aid the dissipation of fertilizer.

3.04 SEEDING

A. Sow seed uniformly using a drill type seeder. Each application of seed shall overlap the previous application by 1/2 the application width to ensure double coverage

B. Sow seed at the rate of 10 lbs./1000 sf. Rate of 10.0 lbs/1000 sf is to be considered a minimum. Contractor is responsible for providing established turf as indicated in Paragraph 3.09 Establishment, Final Inspection and Acceptance, and may use heavier seed rate as desired.

C. Do not seed areas in excess of that which can be mulched on same day.

D. Do not sow immediately following rain, when ground is too dry, or during windy periods.

E. Roll soil to "set" seed with soil and remove any lumps.

F. Spread mulch uniformly to form a continuous blanket and apply at a rate of two tons per acre. Anchor mulch by crimping into soil a minimum depth of 2".

G. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

H. Immediately begin watering and maintain soil dampness. Refer to maintenance section of this specification

I. Following germination, immediately re-seed areas without germinated seeds that are larger than 4 by 4 inches.

3.05 HYDROSEEDING (CONTRACTOR'S OPTION)

A. Apply seeded slurry with a hydraulic seeder at a rate of 10 lbs per 1000 sq ft evenly in two intersecting directions.

B. Do not hydroseed area in excess of that which can be mulched on same day.

C. Immediately following seeding, apply mulch to a thickness of 1/8 inches. Maintain clear of shrubs and trees.

D. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

E. Following germination, immediately re-seed areas without germinated seeds that are larger than 4 by 4 inches.

3.06 PROTECTION

A. Cover seeded slopes where grade is 4 inches per foot or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.

B. Lay fabric smoothly on surface, bury top end of each section in 6 inch deep excavated topsoil trench. Provide 12 inch overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.

C. Secure outside edges and overlaps at 36 inch intervals with stakes.

D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

3.07 MAINTENANCE

A. Provide maintenance at no extra cost to Owner; Owner will pay for water.

B. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

C. Begin immediately following installation.

D. Installer shall be responsible for maintenance of all seeded lawn areas until turf is established and accepted by the owner as indicated in Establishment, Final Inspection, and Acceptance.

E. Maintenance is defined as reasonable care and up-keep required to establish turf, including but not limited to watering, mowing, and weed control.

1. Watering
    a. Installer shall water all lawn areas as necessary until establishment and acceptance is received. Installer shall furnish their own hoses and sprinklers or trucks as required for watering operations.
    b. Water shall be available from building and site water systems. Cost of water shall be borne by contractor, owner will assume responsibility for water cost upon substantial completion and acceptance of building.
2. Mowing
    a. If turf is established prior to substantial completion, Contractor is responsible for mowing as required.

b. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at any one mowing.
c. Immediately remove clippings after mowing and trimming.
d. Owner will assume responsibility for mowing upon substantial completion and final acceptance of project.

F. Owner maintenance
1. Where any portion of maintenance is taken over by owner prior to establishment and final acceptance, Sub-contractor shall instruct owner's personnel on proper maintenance procedures. Sub-contractor shall periodically review maintenance operation of owner, and shall promptly report to owner any method, practices, or operations which he considers unsatisfactory, not in accord with his interest, or not good horticultural practice.
2. Failure of Subcontractor to inspect and report shall be construed as an acceptance by him of owner's operations. He shall not claim thereafter that any defects developing later as a result of such methods, practice, or operations.

G. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at any one mowing.

H. Neatly trim edges and hand clip where necessary.

I. Immediately remove clippings after mowing and trimming.

J. Water to prevent grass and soil from drying out.

K. Roll surface to remove minor depressions or irregularities.

L. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.

M. Immediately reseed areas that show bare spots.

N. Protect seeded areas with warning signs during maintenance period.

3.08 ESTABLISHMENT, FINAL INSPECTION, AND ACCEPTANCE

A. Acceptance and establishment shall be based upon following criteria:
1. Seed
a. Seed has germinated and is flourishing so that scattered bare spots in lawn areas shall not exceed one-fourth (1/4) square foot in area.
b. Scattered bare spots shall not exceed 25 square feet per 8,000 square feet total area.

B. When turf is established, contractor shall notify Architect in writing that work is ready for final inspection.

C. Give such notice at least five (5) days prior to the date stated for final inspection.

D. Architect will make an inspection to verify establishment of seeding/sodding and shall notify contractor in writing of any incomplete or deficient work.

E. Contractor shall re-seed and maintain all lawn areas, which do not meet the requirements of this Section at the time of inspection.

F. Replacement work (reseeding, maintenance, etc.) shall be as specified in this Section for original work.

G. Replacement work shall be re-inspected before final acceptance.

H. In the event seeding is interrupted by a seasonal change, delay of prepared area or other unforeseen or uncontrollable conditions, the Contractor may request inspection and acceptance of a part of the work area.

3.09 MEANS AND METHODS

A. Installer is responsible for means, materials, and methods to provide an established turf. Notify architect of any procedures detrimental to establishment of final turf and verify alternate means and methods prior to proceeding.

END OF SECTION