



Oregon State University

INVITATION TO BID (ITB) #2021-003793

RESEARCH WAY BUILDING LIBRARY ARCHIVE

ISSUE DATE: July 21, 2020

MANDATORY VIRTUAL PRE-BID CONFERENCE: July 27,
2020 at 3:00 PM via Zoom

BID DUE DATE/TIME: August 11, 2020 at 2:00 PM PT
via electronic bid submission to bids@oregonstate.edu

Question Deadline August 4, 2020 5:00 PM PT

PROJECT NUMBER: 2225-20

CONTRACT ADMINISTRATOR:

Matt Hausman, Construction Contracts Officer
Construction Contracts Administration
Oregon State University
644 SW 13th St.
Corvallis, OR 97333

Email: ConstructionContracts@oregonstate.edu

AWARD DECISION APPEALS:

Hanna Emerson, Construction Contracts Manager
Construction Contracts Administration
Oregon State University
644 SW 13th St.
Corvallis, OR 97333

Email: hanna.emerson@oregonstate.edu

This ITB is only open to contractors with a current OSU Reserve Contract for Construction Related Services.

It is the Bidder's responsibility to continue to monitor the [OSU Business and Bid Opportunities](#) website for Addenda. Failure to acknowledge any Addenda on the Bid Form may cause your Bid to be considered non-responsive.

OSU standards and policies govern this solicitation ([Procurement Thresholds and Methods, Procurement Solicitations and Contracts](#)) unless otherwise referenced or stated.

1.0 INTRODUCTION

1.1 Oregon State University (“OSU” and/or “Owner”) is conducting a competitive Comprehensive Reserve Invitation to Bid (ITB) process to retain ONE (1) General Contractor for the Research Way Building Library Archive project (the “Project”).

OSU is seeking bids only from firms accepted into OSU’s 2019-2023 Construction Related Services Reserve Contracting Program.

Firms not currently in the Construction Related Services Reserve Program can apply for entry into the program by responding to the RFQ contained at the following link: <https://bid.oregonstate.edu/>

PLEASE NOTE THE FOLLOWING:

VIRTUAL MANDATORY PRE-BID CONFERENCE – The Virtual Mandatory Pre-Bid Conference is scheduled for 3:00 PM PT on July 27, 2020. Firms wishing to attend shall e-mail constructioncontracts@oregonstate.edu no later than 30 minutes in advance to receive the Zoom link.

MANDATORY SITE-VISITS – Mandatory Site-Visits shall take place between 9:00 AM and 3:00 PM PT on July 29, 2020 at the Research Way Building (4700 SW Research Way – Corvallis, OR 97331). Firms are to e-mail constructioncontracts@oregonstate.edu by 12:00 PM on July 28, 2020 in order to reserve a 30-minute time slot during the time frame listed above. Effective July 15, 2020, through the Oregon Health Authority (OHA), Governor Kate Brown has mandated that gatherings be limited to Ten (10) people. Therefore, Site-Visits will be limited to no more than 3 attendees from each firm. In addition, physical distancing of 6 feet and face coverings are required. Individual attendees are responsible for their own face coverings and will not be allowed to visit the site without one

OSU WILL ONLY BE ACCEPTING SEALED BIDS ELECTRONICALLY - Bids are to be submitted to bids@oregonstate.edu by the Due Date/Time. A virtual Bid Opening will take place at 2:15 PM on August 11, 2020 via Zoom. Those interested in attending must e-mail constructioncontracts@oregonstate.edu by 1:30 PM on August 11, 2020 in order to receive the link.

All questions will need to be submitted via e-mail to constructioncontracts@oregonstate.edu by the Question Deadline in order to be addressed.

1.2 Background. Founded in 1868 as Oregon’s land grant institution, OSU serves the state, the nation and the world as a premier 21st-century research university. OSU is committed to exceptional research, discovery, innovation and engagement — and to integrating its research and engagement mission with the delivery of a high-quality, globally relevant and affordable education for the people of Oregon and beyond. OSU is one of only two land, sea, space and sun grant universities in the U.S. and is the only university in Oregon to have earned both Carnegie Classifications for Very High Research Activity and Community Engagement.

The university’s 570-acre main campus is located in the city of Corvallis, a vibrant college town of nearly 58,000 in the heart of Western Oregon’s Willamette Valley. Corvallis consistently ranks among the safest, most highly educated and greenest small cities in the nation.

1.3 Location. OSU Research Way Building (4700 SW Research Way – Corvallis, OR 97331).

1.4 Summary of Work. The Work consists of partial renovation of the basement of the OSU Research Way

Building at 4700 Research Way, Corvallis, Oregon. The renovation includes but is not limited to the demolition of existing abandoned MEP distribution, installation of new HVAC equipment, spray-applied insulation, wire partitions, etc. to create a new storage area for the Valley Library archive.

2.0 SCHEDULE

Solicitation Issue Date	July 21, 2020
Mandatory Pre-Bid Meeting	July 27, 2020 at 3:00 PM PT
Mandatory Site Visit	July 29, 2020 between 9:00 AM and 3:00 PM PT
Question Deadline	August 4, 2020 by 5:00 PM PT
Solicitation Revision Request Deadline	August 4, 2020 by 5:00 PM PT
Final Addendum Deadline (if necessary)	by August 7, 2020
Bid Due Date/Time	August 11, 2020 2:00 PM PT

The following dates are tentative and subject to change without notice:

Notice of Intent to Award	by August 14, 2020
Estimated Contract Execution	by August 21, 2020
Estimated Notice to Proceed	by August 24, 2020
Substantial Completion	April 1, 2021
Final Completion	May 1, 2021

3.0 QUESTIONS, SOLICITATION REVISION REQUESTS, CHANGE OR MODIFICATION

3.1 Questions

3.1.1 If a Bidder is unclear about any information contained in this document or its exhibits (Project, scope, agreement terms, etc.), they may submit those questions for formal clarification to the **Contract Administrator** at any time prior to the Question Deadline listed in Section 2.0 of this ITB.

3.1.2 All questions and contacts with Owner regarding any information in this ITB must be addressed either in writing or email to the **Contract Administrator**, unless otherwise stated in this ITB document at the address or email listed in this document no later than the Question Deadline listed in Section 2.0 of this ITB.

3.1.3 Any clarification provided by the Owner for this ITB or the documents included as exhibits to this ITB shall be made by a duly issued Addendum. The Owner will not be responsible for any other explanation or interpretation of this ITB or the documents included as exhibits to this ITB nor for any other approval of a particular manufacturer's process or item.

3.2 Solicitation Revision Requests

3.2.1 Bidders may submit a written request for change of particular solicitation provisions and/or contract terms and conditions to Hanna Emerson, **Construction Contracts Manager** at the address or email listed in this document. Such requests for change shall be received no later than the Solicitation Revision Deadline listed above.

3.2.2 Such requests for change shall include the reasons for the request and any proposed changes to the

solicitation provisions, specifications and/or contract terms and conditions.

3.2.3 Requests for contract terms and conditions revisions may not be considered if request(s) are not received by the Solicitation Revision Deadline.

3.3 Change or Modification

3.3.1 Any change or modification to the specifications or particular solicitation provisions will be in the form of an addendum to the ITB and will be made available to all firms. It is the responsibility of each firm to visit the website and download any addenda to this ITB. No information received in any manner different than as described herein shall serve to change the ITB in any way, regardless of the source of the information.

4.0 PUBLIC RECORD

Owner will retain this ITB and one copy of each bid received, together with copies of all documents pertaining to the award of a contract. These documents will be made a part of a file or record, which shall be open to public inspection after Owner has announced its intent to award a contract. If a bid contains any information that is considered a trade secret under ORS 192.345(2), you must mark each trade secret with the following legend: **“This data constitutes a trade secret under ORS 192.345(2), and shall not be disclosed except in accordance with the Oregon Public Records Law, ORS Chapter 192.”**

The Oregon Public Records Law exempts from disclosure only bona fide trade secrets, and the exemption from disclosure applies only “unless the public interest requires disclosure in the particular instance.”

Therefore, non-disclosure of documents or any portion of a document submitted as part of a proposal may depend upon official or judicial determination made pursuant to the Public Records Law.

In order to facilitate public inspection of the non-confidential portion of the proposal, material designated as confidential shall accompany the proposal, but shall be readily separable from it. Prices, makes, model or catalog numbers of items offered, scheduled delivery dates, and terms of payment shall be publicly available regardless of any designation to the contrary. Any proposal marked as a trade secret in its entirety shall be considered non-responsive and shall be rejected.

5.0 FORM OF AGREEMENT

A sample copy of the Construction Services Reserve Supplement is included as an exhibit to this ITB. The sample contract may contain certain notes or alternative provisions. Those alternative provisions will be included at the sole discretion of the Owner.

6.0 BUREAU OF LABOR AND INDUSTRIES (BOLI) PREVAILING WAGES

In compliance with Oregon Prevailing Wage Law, the following is incorporated into this ITB:

The Contractor and all subcontractors shall comply with the provisions of ORS 279C.800 through 279C.870, relative to Prevailing Wage Rates (PWR) as outlined in Sections C.1 and C.2 of the General Conditions. The resulting Contract is subject to the following BOLI wage rate requirements, which are incorporated herein by reference:

6.1 July 1, 2020 PWR Apprenticeship Rates

- 6.2 July 1, 2020 Prevailing Wage Rates for Public Works Contracts in Oregon
- 6.3 July 1, 2018 Definitions of Covered Occupations for Public Works Contracts in Oregon

These BOLI wage rates are available here: https://www.oregon.gov/boli/WHD/PWR/Pages/pwr_state.aspx.

7.0 INSTRUCTIONS TO BIDDERS

- 7.1 **Summary of Work.** The Work contemplated in this document shall be for the Owner in connection with the Project described in the Summary of Work in Section 1.0 of this document.

- 7.2 **Pre Bid Conference and Examination of Site Conditions**

- 7.2.1 Before submitting a Bid, if required by this ITB, the Bidder shall attend a mandatory Pre-Bid Conference, which may include a site examination. Attendance will be documented utilizing a combination of checking in and an email to the **Contract Administrator**. Prime bidders will be required to check in on-site and follow up with an email to the **Contract Administrator** no later than 5 PM on the day of the Pre-Bid Conference. Prime bidders who arrive more than ten (10) minutes after start time of the meeting (as stated in the ITB and by the Owner's clock) or after the discussion portion of the meeting, (whichever comes first) shall not be permitted to sign in and will not be permitted to submit a Bid.

- 7.2.2 In any event, the Bidder shall examine the Work site to ascertain its physical condition. Failure to comply with this section will not release Contractor from entering into the Contract nor excuse Contractor from performing the Work in strict accordance with the terms and conditions of the Contract Documents.

- 7.2.3 The Bidder shall be responsible for being fully informed as to the quality, quantity and sources of supply of the materials listed within the documents included as exhibits to this ITB.

- 7.2.4 The Owner will not be responsible for any loss or unanticipated costs which may arise as a result of Contractor's failure to be fully informed in advance with regard to all conditions pertaining to the Work and the character of the Work required.

- 7.2.5 No statement made by any officer, agent, or employee of the Owner in relation to the physical conditions pertaining to the Work site or quality, quantity, and supply of materials will be binding on the Owner, unless included in writing in the documents included as exhibits to this ITB or an Addendum.

- 7.2.6 Physical distancing guidelines will be utilized during the Pre-Bid Conference. Physical distancing guidelines include but are not limited to maintaining a distance of approximately six feet from others, not shaking hands and wearing a face covering.

- 7.3 **Brand-Name Specification.** To establish a basis of quality, certain processes, types of machinery and equipment or kinds of materials may be specified in the documents included as exhibits to this ITB either by description of process or by designating a manufacturer by name and referring to a brand or product designation or by specifying a kind of material. Whenever a process is designated or a manufacturer name, brand or item designation is given, or whenever a process or material covered by patent is designated or described, it shall be understood that the words "or approved equal" follow such name, designation or description, whether they do so or not.

7.4 Substitution Approval Process

7.4.1 Prior to submitting a Bid that contains a Substitution, the Bidder must first seek approval of the Substitution from the Owner by submitting a written request to the **Contract Administrator** for approval prior to the deadline for questions as stated in this Solicitation.

7.4.2 Substitution requests shall be submitted in accordance with Division 01 requirements.

7.4.3 Only approved Substitution requests will be acknowledged via Addendum(a) to this ITB and shall become a part of the documents included as exhibits to this ITB. When approved, it is with the understanding that the substituted article or material is of equal or better value and utility than the one specified.

7.5 Execution of the Bid Form

7.5.1 The Bid Form is hereby defined as the OSU form furnished by Owner to be completed by Bidder.

7.5.2 The Bid Form relates to Bids on this ITB. Only the amounts and information asked for on the Bid Form will be considered as the Bid. Each Bidder shall Bid upon the Work exactly as set forth in the Bid Form. The Bidder shall include in the Bid a sum to cover the cost of all items contemplated by the documents included as exhibits to this ITB. Bids that fail to address alternates set forth on the Bid Form may be considered non-responsive.

7.5.3 Each Bid Form must: 1) Be completed in accordance with these instructions; 2) Include the appropriate signatures as noted on the Bid Form; and 3) Include numbers pertaining to the Base Bid(s) stated both in writing and in figures.

7.5.4 When Bidding on an alternate for which there is no charge, the Bidder shall write the words "No Charge" in the space provided on the Bid Form. If one or more alternates is shown on the Bid Form, the Bidder shall indicate whether each is "add" or "deduct."

7.5.5 When Bidding on unit prices, quantities stated on the Bid Form are estimates and are included for the purpose of award of a Contract. In the event of a discrepancy between unit prices and extensions, the unit price shall govern.

7.5.6 Incomplete Bids may be rejected.

7.5.7 Bids that contain conditions not provided for on the Bid Form may be rejected.

7.5.8 Bids that contain ambiguities may be rejected.

7.5.9 With the exception of filling in the required fields on the Bid Form, no other alterations to the Bid Form shall be made.

7.6 Submission of Bid. Each Bid shall be emailed to bids@oregonstate.edu. Bids must be received by the time and in the format specified in this ITB. The email subject line should contain the ITB No., ITB Title and Firm Name. Only those Bids received at this email address by the Bid Due Date/Time shall be considered

responsive. Bids submitted directly to the **Contract Administrator**, either in paper form or via email will NOT be considered responsive. It is highly recommended that the Bidder confirms receipt of the email with the **Contract Administrator**. The **Contract Administrator** or their designee, may open the email to confirm receipt but will NOT verify the integrity of the attachment(s), answer questions related to the content of the Bid, or address the overall responsiveness of the Bid.

7.7 Bid Closing and Opening of Bids

7.7.1 All Bids must be received by the Owner by the Due Date/Time. The Owner's official clock shall prevail in any time conflict. Any Bid received after the Due Date/Time will be rejected, and will be retained and part of the Owner's archive records in accordance with OSU Standards.

7.7.2 At the time of opening and reading of Bids, each Bid received, irrespective of any irregularities or informalities, may be publicly opened and read aloud. If the public reading of the Bids occurs, the format of such reading will be delivered virtually as described herein.

7.8 Acceptance or Rejection of Bids by Owner

7.8.1 The procedures for Contract awards shall be in compliance with the provisions of OSU standards and policies adopted by the Owner.

7.8.2 The Owner reserves the right to reject any or all Bids and to waive minor informalities.

7.8.3 Unless all Bids are rejected, the Owner will award the Contract(s) based on the lowest responsive Bid from a responsible Bidder. If that Bidder does not execute the Contract(s), the Contract(s) will be awarded to the next lowest responsive Bid from a responsible Bidder or Bidders in succession, provided this ITB is not cancelled under the provisions of OSU standards and policies adopted by the Owner.

7.8.4 The Owner reserves the right to hold the Bid of the three lowest Bidders for a period of Sixty (60) Days from the time of Bid opening pending Award of the Contract.

7.8.5 In determining the lowest Bidder, the Owner reserves the right to take into consideration any or all Base Bids as well as alternates or combinations indicated in the Bid Form.

7.8.5.1 When alternates are included on the Bid Form, they may be exercised at the sole discretion of the Owner within Sixty (60) Days of the Effective Date of the Contract, unless extended by written mutual agreement of the Parties.

7.8.5.2 The Owner has the right to accept alternates without regard to order or sequence; but, such acceptance must not deliberately impair the selection of a low, responsible and responsive Bidder to whom the Contract would be awarded under an equitable bid procedure.

7.8.6 If Owner has not accepted a Bid within sixty (60) Days after the opening of the Bids, each of the three lowest Bidders may withdraw the Bid submitted.

7.9 Withdrawal of Bid

7.9.1 At any time prior to the Closing Date and Time a Bidder may withdraw its Bid in accordance with OSU Standards. This will not preclude the submission of another Bid by such Bidder prior to the Closing Date and Time.

7.9.2 After the Closing Date and Time, Bidders are prohibited from withdrawing their Bid, except as provided by OSU Standards.

7.10 Execution of Contract, Agreement, Performance Bond and Payment Bond

7.10.1 The Bidder shall be required to execute the Contract as provided, and, if applicable, deliver a Performance Bond and a Payment Bond from a surety company licensed to do surety business in the State of Oregon within time period contained in the Award letter. The Contract Documents shall be delivered to the Owner in the manner stated in the Award letter.

7.11 Public Works Bond. At the time of submission of its Bid, each Bidder shall have on file with the Construction Contractors Board a public works bond required by ORS 279C.836, unless otherwise exempt under that statute. Failure to have on file a public works bond at the time of submission of the Bid may result in rejection of the Bid as non-responsive.

7.12 Equity Contracting. Owner will require the successful Contractor to comply with OSU Standards, policies, rules and procedures requiring good faith efforts in subcontracting with minority, women, emerging small business or service-disabled veteran owned business enterprises.

8.0 RESERVED

9.0 EXHIBITS

Exhibit A – Bid Form

Exhibit B – Sample OSU Construction Reserve Supplement

Exhibit C – OSU General Conditions for Reserve Contracts

Exhibit D – Performance Bond, Payment Bond

Exhibit E – MWESB Project Contract Report Instructions and Report

Exhibit F – Specifications

Exhibit G – Plans (available at the following: <https://oregonstate.box.com/s/dk7adj9z6ph81teq0mp4uuci28zcdlzh>)

Exhibit H – Mechanical Compliance Certificate and Structural Calculations

Exhibit I – Addenda (if and when applicable)

End of ITB



BID FORM

ITB NUMBER & NAME: 2021-003793 – Research Way Building Library Archive

BID DUE DATE AND TIME: _____
(fill in)

FROM: _____
(Name of Contractor)

TO: Oregon State University (“Owner”)
Construction Contracts Administration
644 SW 13th St.
Corvallis, Oregon 97333

1. The Undersigned hereby proposes to furnish all material and labor and perform all work hereinafter indicated for the above project in strict accordance with the Contract Documents for the Base Bids as follows:

BASE BID: _____ \$ _____

The Undersigned proposes to add to or deduct from the Base Bid indicated above the items of work relating to the following Alternate(s) as designated in the Specifications:

ALTERNATE 1: Demo additional overhead abandoned utilities north of Grid 5.5 as indicated per drawings (see E-101 and M-102, labeled Alternate #1). Demo additional steel bollards north of Grid 5.5 as indicated per drawings (see D-110, labeled in keynote D 010 as Alternate #1).

(circle one) ADD/DEDUCT: \$ _____

and the Undersigned agrees to be bound by the documents either contained in or incorporated by reference in the Invitation to Bid and ADDENDA numbered ____ through ____, inclusive. *(fill in blanks)*

2. The work shall be completed within the time stipulated and specified in Division 1, Section 01 11 00, of the Specifications.

3. The Undersigned certifies that: (1) This Bid has been arrived at independently and is being submitted without collusion with and without any agreement, understanding, or planned common course of action with any other vendor of materials, supplies, equipment or services described in the invitation to bid designed to limit independent bidding or competition; and (2) The contents of the Bid have not been communicated by the Undersigned or its employees or agents to any person not an employee or agent of the Undersigned or its surety on any Bid security furnished with the Bid and will not be communicated to such person prior to the official opening of the Bid.

4. The Undersigned agrees, if awarded a contract, to comply with the provisions of ORS 279C.800 through 279C.870 pertaining to the payment of the prevailing wages.

5. Contractor's CCB license number is _____. As a condition to submitting a Bid, Contractor must be licensed with the Oregon Construction Contractors Board in accordance with ORS 701.021 to 701.128, and disclose the license number. Failure to be licensed and disclose the number will render the Bid unresponsive and it will be rejected, unless contrary to federal law.

6. The Bidder hereby certifies that all subcontractors who perform construction work as described in ORS 701.005(5) are licensed with the Construction Contractors Board in accordance with ORS 701.021 to 701.128 at the time the Bid is submitted.

7. Contractor's Project Manager for this project is: _____,
Email: _____ Cell Phone: _____.

8. The Undersigned agrees, if awarded the Contract, to deliver to Owner, a satisfactory Performance Bond and Payment Bond, each in an amount equal to one hundred (100) percent of the Contract sum, using forms provided by the Owner. The surety requested to issue the Performance Bond and Payment Bond will be:

(name of surety company - not insurance agency)

The Undersigned hereby authorizes said surety company to disclose any information to the Owner concerning the Undersigned's ability to supply a Performance Bond and Payment Bond each in the amount of the Contract.

By signature below, Contractor agrees to be bound by this Bid.

NAME OF FIRM: _____

ADDRESS: _____

FEDERAL TAX ID: _____

TELEPHONE NO: _____

SIGNATURE: _____

Authorized Signature

Printed Name

******* END OF BID *******

EXHIBIT B

**OSU RESERVE CONTRACT SUPPLEMENT
OSU RESERVE CONTRACT FOR CONSTRUCTION
RELATED SERVICES
SUPPLEMENT NO.: OSU-xxx-C-18-xx
PROJECT NAME**

This OSU Reserve Contract Supplement dated XXXX (the "Supplement") is entered into between:

"Contractor":

and "Owner": Oregon State University
Construction Contract Administration
644 SW 13th Ave
Corvallis, OR 97333

(collectively the "Parties") pursuant to the OSU Reserve Contract for Construction Related Services between the Parties (the "Reserve Contract"). Capitalized terms have the meaning defined in the General Conditions unless otherwise defined in the Reserve Contract or herein.

1. DESCRIPTION OF THE PROJECT. The project to which this Supplement pertains is described as follows: (the "Project").

2. WORK TO BE PERFORMED. Contractor shall perform the following work on the Project: (the "Work"). Contractor will perform the Work according to the terms and conditions of this Supplement and the Contract Documents, which are incorporated herein by this reference.

3. SCHEDULE. Contractor shall perform the Work according to the following schedule: (the "Schedule").

4. COMPENSATION. Owner shall compensate Contractor for Work in the firm, fixed-price amount of \$XXX.XX in accordance with the requirements of the General Conditions.

The cost of the Work under this Supplement, even if this Supplement is later amended to include additional work, must not exceed the greater of \$2,000,000 or the maximum allowable under OSU standards and policies.

5. TERM. This Supplement is effective on the date it has been signed by every Party hereto (the "Supplement Effective Date"). No Work shall be performed or payment made prior to the Supplement Effective Date. Contractor shall perform its obligations in accordance with the Contract Documents, unless this Supplement is earlier terminated or suspended.

Contractor hereby agrees that the Work set forth in this Supplement may continue beyond the Term of the Reserve Contract and will be performed through final completion of Contractor's Work, including completion of all warranty work. The Parties expressly agree that they may execute a Supplement Amendment and extend the date which Contractor's Work may be completed, which may include a date beyond the Term of the Reserve Contract.

Termination or suspension does not extinguish or prejudice Owner's right to enforce the Supplement with respect to any breach by the Contractor that has not been cured.

6. PERFORMANCE AND PAYMENT BONDS. The performance and payment bond requirements for this Project are as follows (check one of the following):

As a condition precedent to the effectiveness of this Supplement and to Owner's obligation to make payment for the Work, Contractor shall provide the Owner with a performance bond and a separate payment bond in a sum equal to the Contract Price stated in Section 4 of this Supplement.

This Project has a Contract price of \$150,000 or less, and Owner has determined that performance and payment bonds will not be required for this Project.

7. PREVAILING WAGE RATES.

Prevailing Wage Rates requirements apply to this Project. Contractor and all subcontractors shall comply with the provisions of ORS 279C.800 through 279C.870, relative to Prevailing Wage Rates and the required public works bond, as outlined in Sections C.1, C.2 and G.2.3 of the General Conditions. The Bureau of Labor and Industries (BOLI) wage rates and requirements set forth in the following BOLI booklet (and any listed amendments to that booklet), which are incorporated herein by reference, apply to the Work authorized under this Supplement:

PREVAILING WAGE RATES for Public Works Contracts in Oregon, XXXX, as amended XXXX, which can be downloaded at the following web address:

[http://www.boli.state.or.us/BOLI/WHD/PWR/pwr_book.shtml]

The Work will take place in XXX County, Oregon.

8. INSURANCE REQUIREMENTS.

Contractor shall comply with and obtain the insurance coverage amounts stated in the General Conditions.

The Owner has determined that the Contractor shall obtain insurance in the amount described in the Supplemental General Conditions, attached hereto.

9. OTHER TERMS. Except as specifically modified by this Supplement, all terms of the Reserve Contract remain unchanged.

10. EXECUTION AND COUNTERPARTS. This Supplement may be executed in several counterparts, each of which shall be an original, all of which shall constitute but one and the same instrument.

Contractor hereby confirms and certifies that the representations, warranties, and certifications contained in the Reserve Contract remain true and correct as of this Supplement Effective Date.

IN WITNESS HEREOF, the Parties have duly executed this Supplement as of the dates indicated below.

, Contractor

Oregon State University, Owner

Print Name: _____

Print Name: Anita Nina Azarenko

Signature: _____

Signature: _____

Title: _____

Title: Associate Vice President for
University Facilities, Infrastructure and
Operations

Date: _____

Date: _____

SAMPLE

OREGON STATE UNIVERSITY GENERAL CONDITIONS FOR RESERVE CONTRACTS

January 31, 2019

INSTRUCTIONS: The attached **Oregon State University General Conditions for Reserve Contracts ("General Conditions")** apply to all designated Reserve Contracts. Changes to the General Conditions (including any additions, deletions or substitutions) should only be made by attaching Supplemental General Conditions. The text of these General Conditions should not otherwise be altered.

TABLE OF SECTIONS

SECTION A **GENERAL PROVISIONS**

- A.1 DEFINITION OF TERMS
- A.2 SCOPE OF WORK
- A.3 INTERPRETATION OF CONTRACT DOCUMENTS
- A.4 EXAMINATION OF PLANS, SPECIFICATIONS, AND SITE
- A.5 INDEPENDENT CONTRACTOR STATUS
- A.6 RETIREMENT SYSTEM STATUS AND TAXES
- A.7 GOVERNMENT EMPLOYMENT STATUS

SECTION B **ADMINISTRATION OF THE CONTRACT**

- B.1 OWNER'S ADMINISTRATION OF THE CONTRACT
- B.2 CONTRACTOR'S MEANS AND METHODS
- B.3 MATERIALS AND WORKMANSHIP
- B.4 PERMITS
- B.5 COMPLIANCE WITH GOVERNMENT REGULATIONS
- B.6 SUPERINTENDENCE
- B.7 INSPECTION
- B.8 SEVERABILITY
- B.9 ACCESS TO RECORDS
- B.10 WAIVER
- B.11 SUBCONTRACTS AND ASSIGNMENT
- B.12 SUCCESSORS IN INTEREST
- B.13 OWNER'S RIGHT TO DO WORK
- B.14 OTHER CONTRACTS
- B.15 GOVERNING LAW
- B.16 LITIGATION
- B.17 ALLOWANCES
- B.18 SUBMITTALS, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
- B.19 SUBSTITUTIONS
- B.20 USE OF PLANS AND SPECIFICATIONS
- B.21 FUNDS AVAILABLE AND AUTHORIZED
- B.22 NO THIRD PARTY BENEFICIARIES

SECTION C **WAGES AND LABOR**

- C.1 MINIMUM WAGES RATES ON PUBLIC WORKS
- C.2 PAYROLL CERTIFICATION AND FEE REQUIREMENTS
- C.3 PROMPT PAYMENT AND CONTRACT CONDITIONS
- C.4 PAYMENT FOR MEDICAL CARE
- C.5 HOURS OF LABOR

SECTION D **CHANGES IN THE WORK**

- D.1 CHANGES IN THE WORK
- D.2 DELAYS
- D.3 CLAIMS REVIEW PROCESS

SECTION E
PAYMENTS

- E.1 SCHEDULE OF VALUES
- E.2 APPLICATIONS FOR PAYMENT
- E.3 PAYROLL CERTIFICATION REQUIREMENT
- E.4 DUAL PAYMENT SOURCES
- E.5 RETAINAGE
- E.6 FINAL PAYMENT

SECTION F
JOB SITE CONDITIONS

- F.1 USE OF PREMISES
- F.2 PROTECTION OF WORKERS, PROPERTY, AND THE PUBLIC
- F.3 CUTTING AND PATCHING
- F.4 CLEANING UP
- F.5 ENVIRONMENTAL CONTAMINATION
- F.6 ENVIRONMENTAL CLEAN-UP
- F.7 FORCE MAJEURE

SECTION G
INDEMNITY, BONDING AND INSURANCE

- G.1 RESPONSIBILITY FOR DAMAGES/INDEMNITY
- G.2 PERFORMANCE AND PAYMENT SECURITY, PUBLIC WORKS BOND
- G.3 INSURANCE

SECTION H
SCHEDULE OF WORK

- H.1 CONTRACT PERIOD
- H.2 SCHEDULE
- H.3 PARTIAL OCCUPANCY OR USE

SECTION I
CORRECTION OF WORK

- I.1 CORRECTIONS OF WORK BEFORE FINAL PAYMENT
- I.2 WARRANTY WORK

SECTION J
SUSPENSION AND/OR TERMINATION OF THE WORK

- J.1 OWNER'S RIGHT TO SUSPEND THE WORK
- J.2 CONTRACTOR'S RESPONSIBILITIES
- J.3 COMPENSATION FOR SUSPENSION
- J.4 OWNER'S RIGHT TO TERMINATE CONTRACT
- J.5 TERMINATION FOR CONVENIENCE
- J.6 ACTION UPON TERMINATION

SECTION K
CONTRACT CLOSE-OUT

- K.1 RECORD DOCUMENTS
- K.2 OPERATION AND MAINTENANCE MANUALS
- K.3 COMPLETION NOTICES
- K.4 TRAINING
- K.5 EXTRA MATERIALS
- K.6 ENVIRONMENTAL CLEAN-UP
- K.7 CERTIFICATE OF OCCUPANCY
- K.8 OTHER CONTRACTOR RESPONSIBILITIES
- K.9 SURVIVAL

**OREGON STATE UNIVERSITY
GENERAL CONDITIONS FOR RESERVE CONTRACTS
("General Conditions")**

**SECTION A
GENERAL PROVISIONS**

A.1 DEFINITION OF TERMS

In the Contract Documents, the following terms shall be as defined below:

AMENDMENT, means a writing which, when fully executed by the Parties to this Contract, constitutes a change to a Contract Document. Amendments to Supplements (hereinafter a "Supplement Amendment") shall be issued in accordance with the changes provisions of Section D and, if applicable, establish a Contract Price or Contract Time adjustment.

APPLICABLE LAWS, means federal, state and local laws, codes, rules, regulations and ordinances applicable to the Work and to the Contract.

ARCHITECT/ENGINEER, means the Person appointed by the Owner to make drawings and specifications and, to provide contract administration of the Work contemplated by the Contract to the extent provided herein or by supplemental instruction of Owner (under which Owner may delegate responsibilities to the Architect/Engineer), in accordance with ORS Chapter 671 (Architects) or ORS Chapter 672 (Engineers) and administrative rules adopted thereunder.

CHANGE ORDER, means a written order issued by the Owner to be later included as an Amendment. A Change Order shall not be effective until codified as an Amendment.

CLAIM, means a demand by Contractor pursuant to Section D.3 for review of the denial of Contractor's initial request for an adjustment of Contract terms, payment of money, extension of Contract Time or other relief, submitted in accordance with the requirements and within the time limits established for review of Claims in these General Conditions.

CONSTRUCTION CHANGE DIRECTIVE, means a written order by the Owner to the Contractor requiring a change in the Work within the general scope of the Contract Documents, issued under the changes provisions of Section D.

CONSTRUCTION SCHEDULE, means the schedule prepared by the Contractor in CPM format and approved by the Owner, and all adjustments thereto approved by the Owner, that describes sequence and timing of the Work.

CONTRACT, means the written agreement between the Owner and the Contractor comprised of the Contract Documents which describe the Work to be done and the obligations between the parties.

CONTRACT DOCUMENTS, means the Reserve Contract, General Conditions, Supplemental General Conditions if any, Supplements, the accepted Offer, Plans, Specifications, Change Orders, Amendments, Construction Change Directives, Solicitation Document and addenda thereto, Instructions to Offerors, and Supplemental Instructions to Offerors, the Construction Schedule prepared and approved in accordance with the Construction Documents, and all other required Submittals.

CONTRACT PERIOD, as set forth in the Contract Documents, means the total period of time beginning with the full execution of a Supplement and, if applicable, the issuance of a Notice to Proceed and concluding upon Final Completion.

CONTRACT PRICE, means the total of the awarded Offer amount, as increased or decreased by the price of approved alternates, as indicated in the Contract Documents.

CONTRACT TIME, means any incremental period of time allowed under the Contract to complete any portion of the Work as reflected in the project schedule.

CONTRACTOR, means the Person awarded the Contract for the Work contemplated.

CPM, means a critical path method format to be used for the Construction Schedule.

DAYS, are calendar days, including weekdays, weekends and holidays, unless otherwise specified.

DIRECT COSTS, means, unless otherwise provided in the Contract Documents, the cost of materials, including sales tax, cost of delivery; cost of labor, including social security, Medicare and unemployment insurance, and fringe benefits required by agreement or custom; worker's compensation insurance; project specific insurance (including, without limitation, Builder's Risk Insurance and Builder's Risk Installation Floater); bond premiums, rental cost of equipment, and machinery required for execution of the Work; and the additional costs of field personnel directly attributable to the Work.

FINAL COMPLETION, means the final completion of all requirements under the Contract, including Contract Closeout as described in Section K but excluding Warranty Work as described in Section I.2, and the final payment and release of all retainage, if any, released.

FINAL PAYMENT, means the last payment to the Contractor, including retainage, in connection with the Work.

FORCE MAJEURE, means an act, event or occurrence caused by fire, riot, war, acts of God, nature, sovereign, or public enemy, strikes, freight embargoes or any other act, event or occurrence that is beyond the control of the party to this Contract who is asserting Force Majeure.

MWESB REPORT, means an accurate report by the Contractor to the Owner identifying all Minority, Women and Emerging Small Business (MWESB) enterprises, as those terms are defined in ORS 200.005, receiving contracts throughout the course of the Work. An initial MWESB report is required (see Section E.2.9) and MWESB Reports are required annually (see Section E.2.9) and as a condition of final payment (see Section K.1). The initial report shall include the total number of contracts and subcontracts awarded to MWESB enterprises and the dollar value of their respective contracts and subcontracts. The annual reports shall include the total number of contracts and subcontracts awarded to MWESB enterprises, the dollar value of each, and the expenditure toward each contract and subcontract during the previous twelve (12) months. The final report shall include the total number of contracts and subcontracts awarded to MWESB enterprises and the dollar value of their respective contracts and subcontracts including all Supplements and Amendments incorporated during the course of the project. The reports shall only include enterprises certified with the State of Oregon as MWESB enterprises and shall include individual identification of each enterprise as a Minority business enterprise, a Women business enterprise, and/or an Emerging Small Business Enterprise, as applicable.

NOTICE TO PROCEED, means the official written notice from the Owner stating that the Contractor is to proceed with the Work defined in the Contract Documents. Notwithstanding the Notice to Proceed, Contractor shall not be authorized to proceed with the Work until all initial Contract requirements, including the Contract, performance bond and payment bond, and certificates of insurance, have been fully executed and submitted to Owner in a suitable form.

OFFER, means a bid in connection with Instructions to Bidders or a proposal in connection with a Request for Proposals.

OFFEROR, means an entity who submits a response to a solicitation document.

OVERHEAD, means those items which may be included in the Contractor's markup (general and administrative expense and profit) and that shall not be charged as Direct Cost of the Work, including without limitation such Overhead expenses as wages or salary of personnel above the level of foreman (i.e., superintendents and project managers), expenses of Contractor's offices and supplies at the job site (e.g. job trailer) and at Contractor's principal place of business and including expenses of personnel staffing the job site office and Contractor's principal place of business, and Commercial General Liability Insurance and Automobile Liability Insurance.

OWNER, means Oregon State University (OSU). Owner may elect, by written notice to Contractor, to delegate certain duties to more than one party, including without limitation, to an Architect/Engineer. However, nothing in these General Conditions is intended to abrogate the separate design professional responsibilities of Architects under ORS Chapter 671 or of Engineers under ORS Chapter 672.

PERSON, means a natural person or entity doing business as a sole proprietorship, a partnership, a joint venture, a corporation, a limited liability company or partnership, or any other entity possessing the legal capacity to contract.

PLANS, means the drawings which show the location, type, dimensions, and details of the Work to be done under the Contract.

PROJECT, means the total design, development and construction of which the Work performed under the Construction Documents may be the whole or a part.

PUNCH LIST, means the list of Work yet to be completed or deficiencies which need to be corrected in order to achieve Final Completion of the Contract.

RECORD DOCUMENT, means the as-built Plans, Specifications, testing and inspection records, product data, samples, manufacturer and distributor/supplier warranties evidencing transfer of ownership to Owner, operational and maintenance manuals, shop drawings, Construction Change Directives, MWESB Reports, correspondence, certificate(s) of occupancy, and other documents listed in Subsection B.9.1 of these General Conditions, recording all Services performed.

SUPPLEMENTAL GENERAL CONDITIONS, means those conditions that remove from, add to, or modify these General Conditions. Supplemental General Conditions may be included in the Solicitation Document or may be a separate attachment to the Contract.

SOLICITATION DOCUMENT, means a document used in a formal procurement soliciting two or more qualified sources by public notice for the same specifications and requirements.

SPECIFICATION, means a description of the physical, functional, or performance characteristics, or of the nature of the goods, services or construction, including any requirement to be satisfied by a product, material or process indicating, if appropriate, the procedures to determine whether the requirements are satisfied. Specifications may be incorporated by reference and/or may be attached to the Contract.

SUBCONTRACT, means a contract between the Contractor and a subcontractor for the performance of a portion of the Work.

SUBCONTRACTOR, means a Person having a direct contract with the Contractor, or another Subcontractor, to perform one or more items of the Work.

SUBSTANTIAL COMPLETION, means the date when the Owner accepts in writing the construction, alteration or repair of the improvement to real property constituting the Work or any designated portion thereof as having reached that state of completion when it may be used or occupied for its intended purpose. Substantial Completion of facilities with operating systems occurs only after thirty (30) continuous Days of successful, trouble-free operation of the operating systems as provided in Section K.3.2.

SUBSTITUTIONS, means items that in function, performance, reliability, quality, and general configuration are the same or better than the product(s) specified. Approval of any substitute item shall be solely determined by the Owner. The decision of the Owner is final.

SUPPLEMENT, means a writing which, when fully executed by the Parties thereto, constitutes written agreement between the Owner and the Contractor comprised of the Contract Documents which describe the Work to be done and the obligations between the parties.

WORK, means the furnishing of all materials, equipment, labor, transportation, services and incidentals necessary to successfully complete any individual item or the entire Contract and the carrying out of duties and obligations imposed by the Contract Documents.

A.2 SCOPE OF WORK

The Work contemplated under this Contract includes all labor, materials, transportation, equipment and services for, and incidental to, the completion of all construction work in connection with the project described in the Contract Documents. The Contractor shall perform all Work necessary so that the project can be legally occupied and fully used for the intended use as set forth in the Contract Documents. Execution of the Contract by the Contractor is an express representation (1) that the Contractor understands the intent stated herein with respect to the Preconstruction Phase Services, and (2) the Contractor's execution of an Amendment, including the GMP Amendment, shall be an express and unqualified representation that the Contractor understands the intent stated herein and therein.

A.3 INTERPRETATION OF CONTRACT DOCUMENTS

A.3.1 Unless otherwise specifically defined in the Contract Documents, words which have well-known technical meanings or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings. Contract Documents are intended to be complementary. Whatever is called for in one is interpreted to be called for in all. However, in the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following descending order of precedence:

- (a) Contract Supplements, Amendments and Construction Change Directives, with those of later date having precedence over those of an earlier date;
- (b) The Supplemental General Conditions;
- (c) General Conditions;
- (d) The Reserve Contract Supplements;
- (e) Construction Change Directive;
- (f) Division One (General Requirements) of the Specifications;

- (g) Detailed Schedules of finishes, equipment and other items included in the Specifications;
- (h) Plans and Specifications (other than Division One and the Detailed Schedules to the Specifications);
- (i) Large-scale drawings on Plans;
- (j) Small-scale drawings on Plans;
- (k) Dimension numbers written on Plans which shall prevail and take precedence over dimensions scaled from Plans;
- (l) The Solicitation Document, and any addenda thereto;
- (m) The Reserve Contract.

A.3.2 In the case of an inconsistency between Plans and Specifications or within either document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Owner's interpretation in writing.

A.3.3 If the Contractor finds discrepancies in, or omissions from the Contract Documents, or if the Contractor is in doubt as to their meaning, the Contractor shall at once notify the Owner. Matters concerning and interpretation of requirements of the Contract Documents will be decided by the Owner, who may delegate that duty in some instances to the Architect/Engineer. Responses to Contractor's requests for interpretation of Contract Documents will be made in writing by Owner (or the Architect/Engineer) within any time limits agreed upon or otherwise with reasonable promptness. Interpretations and decisions of the Owner (or Architect/Engineer) will be consistent with the intent of and reasonably inferable from the Contract Documents. Contractor shall not proceed without direction in writing from the Owner (or Architect/Engineer).

A.3.4 References to standard specifications, manuals, codes of any technical society, organization or association, to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code, laws or regulations in effect in the jurisdiction where the project is occurring on the first published date of the Solicitation Document, except as may be otherwise specifically stated.

A.4 EXAMINATION OF PLANS, SPECIFICATIONS, AND SITE

A.4.1 It is understood that the Contractor, before submitting an Offer, has made a careful examination of the Contract Documents; has become fully informed as to the quality and quantity of materials and the character of the Work required; and has made a careful examination of the location and conditions of the Work and the sources of supply for materials. The Owner will in no case be responsible for any loss or for any unanticipated costs that may be suffered by the Contractor as a result of the Contractor's failure to acquire full information in advance in regard to all conditions pertaining to the Work. No oral agreement or conversation with any officer, agent, or personnel of the Owner, or with the Architect/Engineer either before or after the execution of this Contract, shall affect or modify any of the terms or obligations herein contained.

A.4.2 Should the Plans or Specifications fail to particularly describe the materials, kind of goods, or details of construction of any aspect of the Work, Contractor shall have the duty to make inquiry of the Owner and Architect/Engineer as to what is required prior to performance of the Work. Absent Specifications to the contrary, the materials or processes that would normally be used to produce first quality finished Work shall be considered a part of the Contract requirements.

A.4.3 Any design errors or omissions noted by the Contractor shall be reported promptly to the Owner, and confirmed in writing including without limitation, any nonconformity with Applicable Laws.

A.4.4 If the Contractor believes that adjustments to cost or Contract Time is involved because of clarifications or instructions issued by the Owner (or Architect/Engineer) in response to the Contractor's notices or requests for information, the Contractor must submit a written request to the Owner, setting forth the nature and specific extent of the request, including all time and cost impacts against the Contract as soon as possible, but no later than thirty (30) Days after receipt by Contractor of the clarifications or instructions issued. If the Owner denies Contractor's request for additional compensation, additional Contract Time, or other relief that Contractor believes results from the clarifications or instructions, the Contractor may proceed to file a Claim under Section D.3, Claims Review Process. If the Contractor fails to perform the obligations of Sections A.4.1 to A.4.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations.

A.5 INDEPENDENT CONTRACTOR STATUS

The service or services to be performed under this Contract are those of an independent contractor as defined in ORS 670.600. Contractor represents and warrants that it is not an officer, employee or agent of the Owner as those terms are used in ORS 30.265.

A.6 RETIREMENT SYSTEM STATUS AND TAXES

Contractor represents and warrants that it is not a contributing member of the Public Employees' Retirement System and will be responsible for any federal or state taxes applicable to payment received under this Contract. Contractor will not be eligible for any benefits from these Contract payments of federal Social Security, employment insurance, workers' compensation or the Public Employees' Retirement System, except as a self-employed individual. Unless the Contractor is subject to backup withholding, Owner will not withhold from such payments any amount(s) to cover Contractor's federal or state tax obligations.

A.7 GOVERNMENT EMPLOYMENT STATUS

A.7.1 If this payment is to be charged against federal funds, Contractor represents and warrants that it is not currently employed by the Federal Government. This does not preclude the Contractor from holding another contract with the Federal Government.

A.7.2 Contractor represents and warrants that Contractor is not an employee of the State of Oregon for purposes of performing Work under this Contract

**SECTION B
ADMINISTRATION OF THE CONTRACT**

B.1 OWNER'S ADMINISTRATION OF THE CONTRACT

B.1.1 The Owner shall administer the Contract as described in the Contract Documents (1) during construction (2) until Final Payment is due and (3) during the one-year period for correction of Work. The Owner will act as provided in the Contract Documents, unless modified in writing in accordance with other provisions of the Contract. In performing these tasks, the Owner may rely on the Architect/Engineer or other consultants to perform some or all of these tasks.

B.1.2 The Owner will visit the site at intervals appropriate to the stage of the Contractor's operations (1) to become generally familiar with and to keep the Owner informed about the progress and

quality of the portion of the Work completed, (2) to endeavor to guard the Owner against defects and deficiencies in the Work, and (3) to determine in general if Work is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. The Owner will not make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Owner will neither have control over or charge of, nor be responsible for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work. Inspection of the progress, quantity, or quality of the Work done by the Owner, any Owner representative, and public agency, the Architect/Engineer, or any inspector, shall not relieve the Contractor of any responsibility for the compliance of all Work with the Contract Documents.

- B.1.3 Except as otherwise provided in the Contract Documents or when direct communications have been specifically authorized, the Owner and Contractor shall communicate with each other about matters arising out of or relating to the Contract. Communications by and with the Architect/Engineer's consultants shall be through the Architect/Engineer. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.
- B.1.4 Based upon the Architect/Engineer's evaluations of the Contractor's Application for Payment, or unless otherwise stipulated by the Owner, the Architect/Engineer will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

B.2 CONTRACTOR'S MEANS AND METHODS; MITIGATION OF IMPACTS

- B.2.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures.
- B.2.2 The Contractor is responsible to protect and maintain the Work during the course of construction and to mitigate any adverse impacts to the project, including those caused by authorized changes, which may affect cost, schedule, or quality.
- B.2.3 The Contractor is responsible for the actions of all its personnel, laborers, suppliers, and Subcontractors on the project. The Contractor shall enforce strict discipline and good order among Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of persons who are unfit or unskilled for the tasks assigned to them.

B.3 MATERIALS AND WORKMANSHIP

- B.3.1 The intent of the Contract Documents is to provide for the construction and completion in every detail of the Work described. All Work shall be performed in a professional manner and unless the means or methods of performing a task are specified elsewhere in the Contract Documents, Contractor shall employ methods that are generally accepted and used by the industry, in accordance with industry standards.

B.3.2 The Contractor is responsible to perform the Work as required by the Contract Documents. Defective Work shall be corrected at the Contractor's expense.

B.3.3 Work done and materials furnished shall be subject to inspection and/or observation and testing by the Owner to determine if they conform to the Contract Documents. Inspection of the Work by the Owner does not relieve the Contractor of responsibility for the Work in accordance with the Contract Documents.

B.3.4 Contractor shall furnish adequate facilities, as required, for the Owner to have safe access to the Work including without limitation walkways, railings, ladders, tunnels, and platforms. Producers, suppliers, and fabricators shall also provide proper facilities and access to their facilities.

B.3.5 The Contractor shall furnish Samples of materials for testing by the Owner and include the cost of the Samples in the Contract Price.

B.4 PERMITS

Contractor shall obtain and pay for all necessary permits and licenses, except for those specifically excluded in the Supplemental General Conditions, for the construction of the Work, for temporary obstructions, enclosures, opening of streets for pipes, walls, utilities, environmental Work, etc., as required for the Project. Owner shall obtain and pay for the general building permit and pay for any specialty permits required for the Work. Contractor shall be responsible for all violations of the law, in connection with the construction or caused by obstructing streets, sidewalks or otherwise. Contractor shall give all requisite notices to public authorities. The Contractor shall pay all royalties and license fees. The Contractor shall defend all suits or claims for infringement of any patent or other proprietary rights and save harmless and blameless from loss, on account thereof, Oregon State University, and its departments, divisions, members and employees.

B.5 COMPLIANCE WITH GOVERNMENT REGULATIONS

B.5.1 Contractor shall comply with Applicable Laws pertaining to the Work and the Contract. Failure to comply with such requirements shall constitute a breach of Contract and shall be grounds for Contract termination. Without limiting the generality of the foregoing, Contractor expressly agrees to comply with the following, as applicable: (i) Title VI and VII of Civil Rights Act of 1964, as amended; (ii) Section 503 and 504 of the Rehabilitation Act of 1973, as amended; (iii) the Health Insurance Portability and Accountability Act of 1996; (iv) the Americans with Disabilities Act of 1990, as amended; (v) ORS Chapters 659 and 659A; as amended; (vi) all regulations and administrative rules established pursuant to the foregoing laws; and (vii) all other applicable requirements of federal and state civil rights and rehabilitation statutes, rules and regulations.

B.5.2 Contractor shall comply with all applicable requirements of federal and state civil rights and rehabilitation statutes, rules and regulations, and

- (a) Contractor shall not discriminate against Disadvantaged, Minority, Women or Emerging Small Business enterprises, as those terms are defined in ORS 200.005, or a business enterprise that is owned or controlled by or that employs a disabled veteran, as that term is defined in ORS 408.225, in the awarding of subcontracts.
- (b) Contractor shall maintain, in current and valid form, all licenses and certificates required by Applicable Laws or this Contract when performing the Work.

- B.5.3 Unless contrary to federal law, Contractor shall certify that it shall not accept a bid from Subcontractors to perform Work as described in ORS 701.005 under this Contract unless such Subcontractors are registered with the Construction Contractors Board in accordance with ORS 701.021 to 701.068 at the time they submit their bids to the Contractor.
- B.5.4 Unless contrary to federal law, Contractor shall certify that each landscape contractor, as defined in ORS 671.520(2), performing Work under this Contract holds a valid landscape contractor's license issued pursuant to ORS 671.560.
- B.5.5 The following notice is applicable to Contractors who perform excavation Work. ATTENTION: Oregon law requires you to follow rules adopted by the Oregon Utility Notification Center. Those rules are set forth in OAR 952-001-0010 through OAR 952-001-0100. You may obtain copies of the rules by calling the center at (503)232-1987.
- B.5.6 Failure to comply with any or all of the requirements of B.5.1 through B.5.5 shall be a breach of Contract and constitute grounds for Contract termination. Damages or costs resulting from such noncompliance shall be the responsibility of Contractor.

B.6 SUPERINTENDENCE

Contractor shall keep on the site, during the progress of the Work, a competent superintendent and any necessary assistants who shall be satisfactory to the Owner and who shall represent the Contractor on the site. Directions given to the superintendent by the Owner shall be confirmed in writing to the Contractor.

B.7 INSPECTION

- B.7.1 Owner shall have access to the Work at all times.
- B.7.2 Inspection of the Work will be made by the Owner at its discretion. The Owner will have authority to reject Work that does not conform to the Contract Documents. Any Work found to be not in conformance with the Contract Documents, in the discretion of the Owner, shall be removed and replaced at the Contractor's expense.
- B.7.3 Contractor shall make or obtain at the appropriate time all tests, inspections and approvals of portions of the Work required by the Contract Documents or by Applicable Laws or orders of public authorities having jurisdiction. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work. The Contractor shall give the Owner timely notice of when and where tests and inspections are to be made so that the Owner may be present for such procedures. Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Owner.
- B.7.4 As required by the Contract Documents, Work done or material used without required inspection or testing and/or without providing timely notice to the Owner may be ordered removed at the Contractor's expense.
- B.7.5 If directed to do so any time before the Work is accepted, the Contractor shall uncover portions of the completed Work for inspection. After inspection, the Contractor shall restore such portions of Work to the standard required by the Contract. If the Work uncovered is unacceptable or was done without required

testing or inspection or sufficient notice to the Owner, the uncovering and restoration shall be done at the Contractor's expense. If the Work uncovered is acceptable and was done with sufficient notice to the Owner, the uncovering and restoration will be paid for pursuant to a Supplement Amendment.

- B.7.6 If any testing or inspection reveals failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Owner's and Architect/Engineer's services and expenses, shall be at the Contractor's expense.
- B.7.7 When the United States government participates in the cost of the Work, or the Owner has an agreement with other public or private organizations, or if any portion of the Work is being performed for a third party or in close proximity to third party facilities, representatives of these organizations shall have the right to inspect the Work affecting their interests or property. Their right to inspect shall not make them a party to the Contract and shall not interfere with the rights of the parties of the Contract. Instructions or orders of such parties shall be transmitted to the Contractor, through the Owner.

B.8 SEVERABILITY

If any provision of this Contract is declared by a court to be illegal or in conflict with any law, the validity of the remaining terms and provisions shall not be affected and the rights and obligations of the parties shall be construed and enforced as if the Contract did not contain the particular provision held to be invalid.

B.9 ACCESS TO RECORDS

- B.9.1 Contractor shall keep, at all times on the Work site, one record copy of the complete Contract Documents, including the Plans, Specifications, Construction Change Directives and addenda, in good order and marked currently to record field changes and selections made during construction, and one record copy of Shop Drawings, Product Data, Samples and similar submittals, and shall at all times give the Owner access thereto.
- B.9.2 Contractor shall retain and the Owner and its duly authorized representatives shall have access, for a period not less than ten (10) years, to all Record Documents, financial and accounting records, and other books, documents, papers and records of Contractor which are pertinent to the Contract, including records pertaining to Overhead and indirect costs, for the purpose of making audit, examination, excerpts and transcripts. If for any reason, any part of the Work or this Contract shall be subject to litigation, Contractor shall retain all such records until all litigation is resolved and Contractor shall continue to provide Owner and/or its agents with full access to such records until such time as all litigation is complete and all periods for appeal have expired and full and final satisfaction of any judgment, order or decree is recorded and Owner receives a record copy of documentation from Contractor.

B.10 WAIVER

Failure of the Owner to enforce any provision of this Contract shall not constitute a waiver or relinquishment by the Owner of the right to such performance in the future nor of the right to enforce any other provision of this Contract.

B.11 SUBCONTRACTS AND ASSIGNMENT

- B.11.1 Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound by the terms and conditions of these General Conditions, and to assume toward the Contractor all of the obligations and

responsibilities which the Contractor assumes toward the Owner thereunder, unless (1) the same are clearly inapplicable to the subcontract at issue because of legal requirements or industry practices, or (2) specific exceptions are requested by Contractor and approved in writing by Owner. Where appropriate, Contractor shall require each Subcontractor to enter into similar agreements with sub-subcontractors at any level.

B.11.2 At Owner's request, Contractor shall submit to Owner prior to their execution either Contractor's form of subcontract, or the subcontract to be executed with any particular Subcontractor. If Owner disapproves such form, Contractor shall not execute the form until the matters disapproved are resolved to Owner's satisfaction. Owner's review, comment upon or approval of any such form shall not relieve Contractor of its obligations under this Agreement or be deemed a waiver of such obligations of Contractor.

B.11.3 Contractor shall not assign, sell, or transfer its rights, or delegate its responsibilities under this Contract, in whole or in part, without the prior written approval of the Owner. No such written approval shall relieve Contractor of any obligations of this Contract, and any transferee shall be considered the agent of the Contractor and bound to perform in accordance with the Contract Documents. Contractor shall remain liable as between the original parties to the Contract as if no assignment had occurred.

B.12 SUCCESSORS IN INTEREST

The provisions of this Contract shall be binding upon and shall accrue to the benefit of the parties to the Contract and their respective permitted successors and assigns.

B.13 OWNER'S RIGHT TO DO WORK

Owner reserves the right to perform other or additional work at or near the project site with other forces than those of the Contractor. If such work takes place within or next to the project site, Contractor shall coordinate work with the other contractors or forces, cooperate with all other contractors or forces, carry out the Work in a way that will minimize interference and delay for all forces involved, place and dispose of materials being used so as not to interfere with the operations of another, and join the Work with the work of the others in an acceptable manner and perform it in proper sequence to that of the others. The Owner will resolve any disagreements that may arise between or among Contractor and the other contractors over the method or order of doing all work (including the Work). In case of unavoidable interference, the Owner will establish work priority (including the Work) which generally will be in the sequence that the contracts were awarded.

B.14 OTHER CONTRACTS

In all cases and at any time, the Owner has the right to execute other contracts related to or unrelated to the Work of this Contract. The Contractor of this Contract shall fully cooperate with any and all other contractors without additional cost to the Owner in the manner described in section B.13.

B.15 GOVERNING LAW

This Contract shall be governed by and construed in accordance with the laws of the State of Oregon without regard to principles of conflict of laws.

B.16 LITIGATION

Any Claim between Owner and Contractor that arises from or relates to this Contract and that is not resolved through the Claims Review Process in Section D.3 shall be brought and conducted solely

and exclusively within the Circuit Court of Benton County for the State of Oregon; provided, however, if a Claim must be brought in a federal forum, then it shall be brought and conducted solely and exclusively within the United States District Court for the District of Oregon. In no event shall this section be construed as a waiver by the State of Oregon on any form of defense or immunity, whether sovereign immunity, governmental immunity, immunity based on the Eleventh Amendment to the Constitution of the United States or otherwise, from any claim or from the jurisdiction of any court. CONTRACTOR, BY EXECUTION OF THIS CONTRACT, HEREBY CONSENTS TO THE IN PERSONAM JURISDICTION OF THE COURTS REFERENCED IN THIS SECTION B.16.

B.17 ALLOWANCES

B.17.1 The Contractor shall include in the Contract Price all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct.

B.17.2 Unless otherwise provided in the Contract Documents:

- (a) When finally reconciled, allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- (b) Contractor's costs for unloading and handling at the site, labor, installation costs, Overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Price but not in the allowances;
- (c) Whenever costs are more than or less than allowances, the Contract Price shall be adjusted accordingly by Amendment. The amount of the Amendment shall reflect (i) the difference between actual costs and the allowances under Section B.17.2 (a) and (2) changes in Contractor's costs under Section B.17.2 (b).
- (d) Unless Owner requests otherwise, Contractor shall provide to Owner a proposed fixed price for any allowance work prior to its performance.

B.18 SUBMITTALS, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

B.18.1 The Contractor shall prepare and keep current, for the Architect's/Engineer's approval (or for the approval of Owner if approval authority has not been delegated to the Architect/Engineer), a schedule and list of Submittals which is coordinated with the Contractor's construction schedule and allows the Architect/Engineer reasonable time to review Submittals. Owner reserves the right to finally approve the schedule and list of Submittals. Submittals include, without limitation, Shop Drawings, product data, and samples which are described below:

- (a) Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor (including any sub-subcontractor), manufacturer, supplier or distributor to illustrate some portion of the Work.
- (b) Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.
- (c) Samples are physical examples which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

- B.18.2 Shop Drawings, Product Data, Samples and similar Submittals are not Contract Documents. The purpose of their Submittal is to demonstrate for those portions of the Work for which Submittals are required by the Contract Documents the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents. Review of Submittals by the Architect/Engineer is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, or for approval of safety precautions or, unless otherwise specifically stated by the Architect/Engineer, of any construction means, methods, techniques, sequences or procedures, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect/Engineer's review of the Contractor's Submittals shall not relieve the Contractor of its obligations under the Contract Documents. The Architect/Engineer's approval of a specific item shall not indicate approval of an assembly of which the item is a component. Informational Submittals upon which the Architect/Engineer is not expected to take responsive action may be so identified in the Contract Documents. Submittals which are not required by the Contract Documents may be returned by the Architect/Engineer without action.
- B.18.3 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect/Engineer Shop Drawings, Product Data, Samples and similar Submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors. Submittals which are not marked as reviewed for compliance with the Contract Documents and approved by the Contractor may be returned by the Architect/Engineer without action.
- B.18.4 Approving and submitting shop drawings, product data, samples and similar Submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and has checked and coordinated the information contained within such Submittals with the requirements of the Work and of the Contract Documents.
- B.18.5 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar Submittals until the respective Submittal has been approved by the Architect/Engineer.
- B.18.6 The Work shall be in accordance with approved Submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect/Engineer's review or approval of Shop Drawings, Product Data, Samples or similar Submittals unless the Contractor has specifically informed the Architect/Engineer in writing of such deviation at the time of submittal and (i) the Architect/Engineer has given written approval to the specific deviation as a minor change in the Work, or (ii) a Supplement Amendment or Construction Change Directive has been executed by Owner authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar Submittals by the Architect/Engineer's review or approval thereof.
- B.18.7 In the event that Owner elects not to have the obligations and duties described under this Section B.18 performed by the Architect/Engineer, or in the event no Architect/Engineer is employed by Owner on the project, all obligations and duties assigned to the Architect/Engineer hereunder shall be performed by the Owner.

B.19 SUBSTITUTIONS

The Contractor may make Substitutions only with the written consent of the Owner, after evaluation by the Owner and only in accordance with a Supplement Amendment or Construction Change Directive. Substitutions shall be subject to the requirements of the bid documents. By making requests for Substitutions, the Contractor: represents that the Contractor has personally investigated the proposed substitute product; represents that the Contractor will provide the same warranty for the Substitution that the Contractor would for the product originally specified unless approved otherwise; certifies that the cost data presented is complete and includes all related costs under this Contract including redesign costs, and waives all claims for additional costs related to the Substitution which subsequently become apparent; and will coordinate the installation of the accepted Substitution, making such changes as may be required for the Work to be completed in all respects.

B.20 USE OF PLANS AND SPECIFICATIONS

Plans, Specifications and related Contract Documents furnished to Contractor by Owner or Owner's Architect/Engineer shall be used solely for the performance of the Work under this Contract. Contractor and its Subcontractors and suppliers are authorized to use and reproduce applicable portions of such documents appropriate to the execution of the Work, but shall not claim any ownership or other interest in them beyond the scope of this Contract, and no such interest shall attach. Unless otherwise indicated, all common law, statutory and other reserved rights, in addition to copyrights, are retained by Owner.

B.21 FUNDS AVAILABLE AND AUTHORIZED

If Owner fails to receive funding, appropriations, allocations or other expenditure authority as contemplated by Owner's budget and Owner determines, in its assessment and ranking of the policy objectives explicit or implicit in Owner's budget, Owner may determine it is necessary to and may terminate the Reserve Contract and or any Reserve Contract Supplements.

B.22 NO THIRD PARTY BENEFICIARIES

Owner and Contractor are the only parties to this Contract and are the only parties entitled to enforce its terms. Nothing in this Contract gives, is intended to give, or shall be construed to give or provide any benefit or right, whether directly, indirectly, or otherwise, to third persons unless such third persons are individually identified by name herein and expressly described as intended beneficiaries of the terms of this Contract.

SECTION C WAGES AND LABOR

C.1 MINIMUM WAGE RATES ON PUBLIC WORKS

Contractor shall comply fully with the provisions of ORS 279C.800 through 279C.870. Documents establishing those conditions, as determined by the Commissioner of the Bureau of Labor and Industries (BOLI), are included as attachments to or are incorporated by reference in the Contract Documents. Pursuant to ORS 279C.830(1)(c), Contractor shall pay workers at not less than the specified minimum hourly rate of wage, and shall include that requirement in all subcontracts. If the Work is subject to both the state prevailing wage rate law and the federal Davis-Bacon Act, Contractor shall pay the higher of the applicable state or federal prevailing rate of wage. Contractor shall provide written notice to all workers of the number of hours per day and days per week such workers may be required to work.

C.2 PAYROLL CERTIFICATION AND FEE REQUIREMENTS

- C.2.1 In accordance with ORS 279C.845, the Contractor and every Subcontractor shall submit written certified statements to the Owner, on the form prescribed by the Commissioner of the Bureau of Labor and Industries, certifying the hourly rate of wage paid each worker which the Contractor or the Subcontractor has employed on the project and further certifying that no worker employed on the project has been paid less than the prevailing rate of wage or less than the minimum hourly rate of wage specified in the Contract, which certificate and statement shall be verified by the oath of the Contractor or the Subcontractor that the Contractor or Subcontractor has read the certified statement, that the Contractor or Subcontractor knows the contents of the certified statement, and, that to the Contractor's or Subcontractor's best knowledge and belief, the certified statement is true. The certified statements shall set out accurately and completely the payroll records for the prior week, including the name and address of each worker, the worker's correct classification, rate of pay, daily and weekly number of hours worked, deductions made, and actual wages paid. Certified statements for each week during which the Contractor or Subcontractor has employed a worker on the project shall be submitted once a month, by the fifth business day of the following month. The Contractor and Subcontractors shall preserve the certified statements for a period of ten (10) years from the date of completion of the Contract.
- C.2.2 Pursuant to ORS 279C.845 (7), the Owner shall retain 25 percent of any amount earned by the Contractor on this public works project until the Contractor has filed the certified statements required by section C.2.1. The Owner shall pay to the Contractor the amount retained under this subsection within 14 days after the Contractor files the required certified statements, regardless of whether a Subcontractor has failed to file certified statements.
- C.2.3 Pursuant to ORS 279C.845(8), the Contractor shall retain 25 percent of any amount earned by a first-tier Subcontractor on this public works project until the first-tier Subcontractor has filed with the Owner the certified statements required by C.2.1. Before paying any amount retained under this subsection, the Contractor shall verify that the first-tier Subcontractor has filed the certified statement. Within 14 days after the first-tier Subcontractor files the required certified statement the Contractor shall pay the first-tier Subcontractor any amount retained under this subsection.
- C.2.4 In accordance with statutory requirements and administrative rules promulgated by the Commissioner of the Bureau of Labor and Industries, the fee required by ORS 279C.825(1) will be paid by Owner to the Commissioner.

C.3 PROMPT PAYMENT AND CONTRACT CONDITIONS

- C.3.1 As a condition to Owner's performance hereunder, the Contractor shall:
- C.3.1.1 Make payment promptly, as due, to all persons supplying to Contractor labor or materials for the prosecution of the Work provided for in this Contract.
- C.3.1.2 Pay all contributions or amounts due the State Industrial Accident Fund from such Contractor or Subcontractor incurred in the performance of the Contract.
- C.3.1.3 not permit any lien or claim to be filed or prosecuted against the Owner on account of any labor or material furnished. Contractor will not assign any claims that Contractor has against Owner, or assign any sums due by Owner, to

Subcontractors, suppliers, or manufacturers, and will not make any agreement or act in any way to give Subcontractors a claim or standing to make a claim against the Owner.

- C.3.1.4 Pay to the Department of Revenue all sums withheld from employees pursuant to ORS 316.167.
- C.3.2 As a condition to Owner's performance hereunder, if Contractor fails, neglects or refuses to make prompt payment of any claim for labor or services furnished to the Contractor of a Subcontractor by any person in connection with the project as such claim becomes due, the proper officer(s) representing the Owner may pay the claim and charge the amount of the payment against funds due or to become due Contractor under this Contract. Payment of claims in this manner shall not relieve the Contractor or the Contractor's surety from obligation with respect to any unpaid claims.
- C.3.3 Contractor shall include in each subcontract for property or services entered into by the Contractor and a first-tier subcontractor, including a material supplier, for the purpose of performing a construction contract, a payment clause that obligates the Contractor to pay the first-tier Subcontractor for satisfactory performance under its subcontract within ten (10) Days out of such amounts as are paid to the Contractor by the public contracting agency under such contract.
- C.3.4 All employers, including Contractor, that employ subject workers who work under this contract in the State of Oregon shall comply with ORS 656.017 and provide the required Workers' Compensation coverage, unless such employers are exempt under ORS 656.126. Contractor shall ensure that each of its Subcontractors complies with these requirements.

C.4 PAYMENT FOR MEDICAL CARE

As a condition to Owner's performance hereunder, Contractor shall promptly, as due, make payment to any person, partnership, association or corporation furnishing medical, surgical, and hospital care or other needed care and attention, incident to sickness or injury, to the employees of such Contractor, all sums of which the Contractor agrees to pay for such services and all moneys and sums which the Contractor has collected or deducted from the wages of personnel pursuant to any law, contract or agreement for the purpose of providing or paying for such services.

C.5 HOURS OF LABOR

As a condition to Owner's performance hereunder, no person shall be employed to perform Work under this Contract for more than ten (10) hours in any one day or forty (40) hours in any one week, except in cases of necessity, emergency or where public policy absolutely requires it. In such instances, Contractor shall pay the employee at least time and a half pay:

- (a) For all overtime in excess of eight (8) hours a day or forty (40) hours in any one week when the work week is five consecutive Days, Monday through Friday; or
- (b) For all overtime in excess of ten (10) hours a day or forty (40) hours in any one week when the work week is four consecutive Days, Monday through Friday; and
- (c) For all Work performed on Saturday and on any legal holiday specified in ORS 279C.540.

This section C.5 will not apply to Contractor's Work under this Contract to the extent Contractor is currently a party to a collective bargaining agreement with any labor organization.

This Section C.5 shall not excuse Contractor from completion of the Work within the time required under this Contract.

**SECTION D
CHANGES IN THE WORK**

D.1 CHANGES IN WORK

D.1.1 The terms of this Contract shall not be waived, altered, modified, supplemented or amended in any manner whatsoever, without prior written agreement and then only after any necessary approvals have been obtained. A Supplement or Amendment is required, which shall not be effective until its execution by the parties to this Contract and all approvals required by public contracting laws have been obtained.

D.1.2 It is mutually agreed that changes in Plans, quantities, or details of construction are inherent in the nature of construction and may be necessary or desirable during the course of construction. Within the general scope of this Contract, the Owner may at any time, without notice to the sureties and without impairing the Contract, require changes consistent with this Section D.1. All changes to the Work shall be documented and Amendments shall be executed under the conditions of the Contract Documents. Such changes may include, but are not limited to:

- (a) Modification of specifications and design.
- (b) Increases or decreases in quantities.
- (c) Increases or decreases to the amount of Work.
- (d) Addition or elimination of any Work item.
- (e) Change in the duration of the project.
- (f) Acceleration or delay in performance of Work.
- (g) Deductive changes,
- (h) Changed conditions.

Deductive changes are those that reduce the scope of the Work, and shall be made by mutual agreement whenever feasible. In cases of suspension or partial termination under Section J, Owner reserves the right to unilaterally impose a deductive change and to self-perform such Work, for which the provisions of B.13 (Owner's Right to Do Work) shall then apply. Adjustments in compensation shall be made under the provisions of D.1.3, in which costs for deductive changes shall be based upon a Direct Costs adjustment together with the related percentage markup specified for profit, Overhead and other indirect costs, unless otherwise agreed to by Owner.

D.1.3 The Owner and Contractor agree that adjustments to or deletions from the Work shall be administered and compensated according to the following:

- (a) Unit pricing may be utilized at the Owner's option when unit prices or solicitation alternates were provided that established the cost for adjustments to Work, and a binding obligation exists under the Contract on the parties covering the terms and conditions of the adjustment to Work.
- (b) If the Owner elects not to utilize unit pricing, or in the event that unit pricing is not available or appropriate, fixed pricing may be used for adjustments to or deletions from the Work. In fixed pricing, the basis of payments or total price shall be agreed upon in writing between the parties to the Contract, and shall be established before the Work is done whenever feasible. Notwithstanding the foregoing, the mark-ups set forth in D.1.3(c) shall be utilized in establishing fixed pricing, and such mark-ups shall not be exceeded. Cost and price data relating to adjustments to or deletions from the Work shall be supplied by Contractor to Owner upon request, but Owner shall be under no obligation to make such requests.
- (c) In the event that unit pricing and fixed pricing are not utilized, then adjustments to or deletions from the Work shall be performed on a cost reimbursement basis for

Direct Costs. Such Work shall be compensated on the basis of the actual, reasonable and allowable cost of labor, equipment, and material furnished on the Work performed. In addition, the following markups shall be added to the Contractor's or Subcontractor's Direct Costs as full compensation for profit, Overhead and other indirect costs for Work directly performed with the Contractor's or Subcontractor's own forces:

On Labor.....	15%
On Equipment.....	10%
On Materials.....	10%

(d) When adjustments to or deletions from the Work under D.1.3(c) are invoiced by an authorized Subcontractor at any level, each ascending tier Subcontractor or Contractor will be allowed a supplemental mark-up on each piece of subcontract Work covered by a an Amendment as follows:

\$0.00 - \$5,000.00	10%, and then
Over \$5,000.00	5%

Notwithstanding the foregoing, the maximum aggregate markup to be billed shall not exceed 10% regardless of the number of subcontract tiers

Payments made to the Contractor shall be complete compensation for Overhead, profit, and all costs that were incurred by the Contractor or by other forces furnished by the Contractor, including Subcontractors, for adjustments to or deletions from the Work pursuant to a Supplement Amendment. Owner may establish a maximum cost for additional Work under this Section D.1.3, which shall not be exceeded for reimbursement without additional written authorization from Owner in the form of a Supplement Amendment. Contractor shall not be required to complete such additional Work without additional authorization.

Any necessary adjustment of Contract Time that may be required as a result of adjustments to or deletions from the Work must be agreed upon by the parties before the start of the revised Work unless Owner authorizes Contractor to start the revised Work before agreement on Contract Time adjustment. Contractor shall submit any request for additional compensation (and additional Contract Time if Contractor was authorized to start Work before an adjustment of Contract Time was approved) as soon as possible but no later than thirty (30) Days after receipt of Owner's request for additional Work. Contractor agrees that this thirty (30) Day notice period is adequate time for it to request and document the amount of additional compensation or adjustment of Contract Time. If Contractor's request for additional compensation or adjustment of Contract Time is not made within the thirty (30) Day time limit, Contractor agrees its requests pertaining to that additional Work shall be barred. The thirty (30) Day time limit for making requests shall not be extended for any reason, including without limitation Contractor's claimed inability to determine the amount of additional compensation or adjustment of Contract Time, unless an extension is granted in writing by Owner. If the Owner denies Contractor's timely request for additional compensation or adjustment of Contract Time, Contractor may proceed to file a Claim under Section D.3, Claims Review Process. No other reimbursement, compensation, or payment will be made, except as provided in Section D.1.5 for impact claims.

D.1.4 If any adjustment to Work under Section D.1.3 causes an increase or decrease in the Contractor's cost of, or the Contract Time required for the performance of any other part of the Work under this Contract, Contractor shall submit a written request to the Owner, setting forth the nature and specific extent of the

request, including all time and cost impacts against the Contract as soon as possible, but no later than thirty (30) Days after receipt of Owner's request for adjustments to or deletions from the Work by Contractor.

The thirty (30) Day time limit applies to claims of Subcontractors, suppliers, or manufacturers who may be affected by Owner's request for adjustments to or deletions from the Work and who request additional compensation or an extension of Contract Time to perform; Contractor has responsibility for contacting its Subcontractors, suppliers, or manufacturers within the thirty (30) Day time limit, and including their requests with Contractor's requests. If the request involves Work to be completed by Subcontractors, or materials to be furnished by suppliers or manufacturers, such requests shall be submitted to the Contractor in writing with full analysis and justification for the adjustments to compensation and Contract Time requested. The Contractor shall analyze and evaluate the merits of the requests submitted by Subcontractors, suppliers, and manufacturers to Contractor prior to including those requests and Contractor's analysis and evaluation of those requests with Contractor's requests for adjustments to compensation or Contract Time that Contractor submits to the Owner. Failure of Subcontractors, suppliers, manufacturers or others to submit their requests to Contractor for inclusion with Contractor's requests submitted to Owner within the time period and by the means described in this section shall constitute a waiver of these Subcontractor claims. The Owner will not consider direct requests or claims from Subcontractors, suppliers, manufacturers or others not a party to this Contract. The consideration of such requests and claims under this section does not give any Person, not a party to the Contract the right to bring a claim against Owner, whether in this claims process, in litigation, or in any dispute resolution process.

If the Owner denies the Contractor's request for adjustment to compensation or Contract Time, and the request is timely as set forth herein, the Contractor may proceed to file a Claim under Section D.3, Claims Review Process.

D.1.5 Contractor agrees that no request or Claim for additional costs or an adjustment of Contract Time shall be allowed if made after receipt of Final Payment application under this Contract. Final Payment application must be made by Contractor within the time required under Section E.6.4.

D.1.6 It is understood that changes in the Work are inherent in construction of this type. The number of changes, the scope of those changes, and the effect they have on the progress of the original Work cannot be defined at this time. The Contractor is notified that numerous changes may be required and that there will be no compensation made, unless and only to the extent otherwise provided in the Contract Documents, to the Contractor directly related to the number of changes. Each change will be evaluated for extension of Contract Time and increase or decrease in compensation based on its own merit.

D.2 DELAYS

D.2.1 Delays in construction include "Avoidable Delays", which are defined in Section D.2.1.1, and "Unavoidable Delays", which are defined in Section D.2.1.2. The effect of Avoidable Delays is described in Section D.2.2 and the effect of Unavoidable Delays is described in Section D.2.3.

D.2.1.1 Avoidable Delays include any delays other than Unavoidable Delays, and include delays that otherwise would be considered Unavoidable Delays but that:

- (a) Could have been avoided by the exercise of care, prudence, foresight, and diligence on the part of the Contractor or its Subcontractors.

- (b) Affect only a portion of the Work and do not necessarily prevent or delay the prosecution of other parts of the Work or the completion of the whole Work within the Contract Time.
- (c) Do not impact activities on the accepted CPM Construction Schedule.
- (d) Are associated with the reasonable interference of other contractors employed by the Owner that do not necessarily prevent the completion of the whole Work within the Contract Time.

D.2.1.2 Unavoidable Delays include delays other than Avoidable Delays that are:

- (a) To the extent caused by any actions of the Owner, or any other employee or agent of the Owner, or by separate contractor employed by the Owner.
- (b) To the extent caused by any site conditions that differ materially from what was represented in the Contract Documents or from conditions that would normally be expected to exist and be inherent to the construction activities defined in the Contract Documents. The Contractor agrees to notify the Owner immediately of differing site conditions before the area has been disturbed. The Owner will investigate the area and make a determination as to whether the conditions differ materially from either the conditions stated in the Contract Documents or those that could reasonably be expected in execution of this particular Contract. If Contractor and Owner agree that a differing site condition exists, any adjustment to compensation or Contract Time will be determined based on the process set forth in Section D.1.5 for adjustments to or deletions from Work. If the Owner disagrees that a differing site condition exists and denies Contractor's request for additional compensation or Contract Time, Contractor may proceed to file a Claim under Section D.3, Claims Review Process.
- (c) To the extent caused by Force Majeure acts, events or occurrences that could not have been avoided by the exercise of care, prudence, foresight, and diligence on the part of the Contractor or its Subcontractors.
- (d) To the extent caused by adverse weather conditions. Any adverse weather conditions must be substantiated by documentary evidence that weather conditions were abnormal for the specific time period claimed, could not have been anticipated by the Contractor, and adversely impacted the Project in a manner that could not be avoided by rescheduling the Work or by implementing measures to protect against the weather so that the Work could proceed. A rain, windstorm, high water, or other natural phenomenon for the specific locality of the Work, which might reasonably have been anticipated from the previous 10-year historical records of the general locality of the Work, shall not be construed as abnormal. The parties agree that rainfall greater than the following levels cannot be reasonably anticipated:

- (i) Daily rainfall equal to, or greater than, 0.50 inch during a month when the monthly rainfall exceeds the normal monthly average by twenty-five percent (25 %) or more.
- (ii) daily rainfall equal to, or greater than, 0.75 inch at any time.

The Office of the Environmental Data Service of the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce nearest the Project site shall be considered the official agency of record for weather information.

D.2.2 Contractor agrees it is not be entitled to additional compensation or additional Contract Time for Avoidable Delays.

D.2.3 In the event of Unavoidable Delays, based on principles of equitable adjustment, Contractor may be entitled to the following:

(a) Contractor may be entitled to additional compensation or additional Contract Time, or both, for Unavoidable Delays described in Section D.2.1.2 (a) and (b).

(b) Contractor may be entitled to additional Contract Time for Unavoidable Delays described in Section D.2.1.2(c) and (d).

In the event of any requests for additional compensation or additional Contract Time, or both, as applicable, arising under this Section D.2.3 for Unavoidable Delays, other than requests for additional compensation or additional Contract Time for differing site conditions for which a review process is established under Section D.2.1.2 (b), Contractor must submit a written notification of the delay to the Owner within two (2) Days of the occurrence of the cause of the delay. This written notification shall state the cause of the potential delay, the project components impacted by the delay, and the anticipated additional Contract Time extension or the additional compensation, or both, as applicable, resulting from the delay. Within seven (7) Days after the cause of the delay has been mitigated, or in no case more than thirty (30) Days after the initial written notification, the Contractor agrees to submit to the Owner, a complete and detailed request for additional compensation or additional Contract Time, or both, as applicable, resulting from the delay. If the Owner denies Contractor's request for additional compensation or adjustment of Contract Time, the Contractor may proceed to file a Claim under Section D.3, Claims Review Process, provided Contractor has complied with the requirement in this Section D.2.3. Contractor agrees any Claim it may have is barred if Contractor does not comply with the requirements herein.

If Contractor does not timely submit the notices required under this Section D.2, then unless otherwise prohibited by law, Contractor's Claim shall be barred.

D.3 CLAIMS REVIEW PROCESS

D.3.1 All Contractor Claims shall be referred to the Owner for review. Contractor's Claims, including Claims for adjustments to compensation or Contract Time, shall be submitted in writing by Contractor to the Owner within five (5) Days after a denial of Contractor's initial request for an adjustment of Contract terms, payment of money, extension of Contract Time or other relief, provided that such initial request has been submitted in accordance with the requirements and within the time limits established in these General Conditions. Within thirty (30) Days after the initial Claim, Contractor shall submit to the Owner a complete and detailed description of the Claim (the "Detailed Notice") that includes all information required by Section D.3.2. Contractor agrees that, unless the Claim is made in accordance with these time requirements, Contractor voluntarily waived all rights to prosecute its Claim.

D.3.2 The Detailed Notice of the Claim shall be submitted in writing by Contractor and shall include a detailed, factual statement of the basis of the Claim, pertinent dates, Contract provisions which support or allow the Claim, reference to or copies of any documents which support the Claim, the dollar value of the

Claim, and the Contract Time adjustment requested for the Claim. If the Claim involves Work to be completed by Subcontractors, the Contractor will analyze and evaluate the merits of the Subcontractor claim prior to forwarding it and that analysis and evaluation to the Owner. The Owner will not consider direct claims from Subcontractors, suppliers, manufacturers, or others not a party to this Contract. Contractor agrees that it will make no agreement, covenant, or assignment, nor will it commit any other act that will permit or assist any Subcontractor, supplier, manufacturer, or other to directly or indirectly make a claim against Owner.

D.3.3 The Owner will review all Claims and take one or more of the following preliminary actions within ten (10) Days of receipt of the Detailed Notice of a Claim: (1) request additional supporting information from the Contractor; (2) inform the Contractor and Owner in writing of the time required for adequate review and response; (3) reject the Claim in whole or in part and identify the reasons for rejection; (4) based on principles of equitable adjustment, recommend approval of all or part of the Claim; or (5) propose an alternate resolution.

D.3.4 The Owner's decision shall be final and binding on the Contractor unless appealed by written notice to the Owner within fifteen (15) Days of receipt of the decision. The Contractor must present written documentation supporting the Claim within fifteen (15) Days of the notice of appeal. After receiving the appeal documentation, the Owner shall review the materials and render a decision within thirty (30) Days after receiving the appeal documents.

D.3.5 The decision of the Owner shall be final and binding unless the Contractor delivers to the Owner its request for mediation, which shall be a non-binding process, within fifteen (15) Days of the date of the Owner's decision. The mediation process will be considered to have commenced as of the date the Contractor delivers the request. Both parties acknowledge and agree that participation in mediation is a prerequisite to commencement of litigation of any disputes relating to the Contract. Both parties further agree to exercise their best efforts in good faith to resolve all disputes within sixty (60) Days of the commencement of the mediation through the mediation process set forth herein.

In the event that a lawsuit must be filed within this sixty (60) Day period in order to preserve a cause of action, the parties agree that, notwithstanding the filing, they shall proceed diligently with the mediation to its conclusion prior to actively prosecuting the lawsuit, and shall seek from the Court in which the lawsuit is pending such stays or extensions, including the filing of an answer, as may be necessary to facilitate the mediation process. Further, in the event settlements are reached on any issues through mediation, the plaintiff shall promptly cause to be entered by the Court a stipulated general judgment of dismissal with prejudice, or other appropriate order limiting the cope of litigation as provided in the settlement.

D.3.6 Should the parties arrive at an impasse regarding any Claims or disputed Claims, it is agreed that the parties shall participate in mediation as specified in Section D.3.5. The mediation process will be considered to have been commenced as of the date one party delivers to the other its request in writing to mediate. The mediator shall be an individual mutually acceptable to both parties, but in the absence of agreement each party shall select a temporary mediator and the temporary mediators shall jointly select the permanent mediator. Each party shall pay its own costs for the time and effort involved in mediation. The cost of the mediator shall be split equally between the two parties. Both parties agree to exercise their best effort in good faith to resolve all disputes in mediation. Participation in mediation is a mandatory requirement of both the Owner and the Contractor. The schedule, time and place for mediation will be mutually

acceptable, or, failing mutual agreement, shall be as established by the mediator. The parties agree to comply with Owner's administrative rules governing the confidentiality of mediation, if any, and shall execute all necessary documents to give effect to such confidentiality rules. In any event, the parties shall not subpoena the mediator or otherwise require the mediator to produce records, notes or work product, or to testify in any future proceedings as to information disclosed or representations made in the course of mediation, except to the extent disclosure is required by law.

D.3.7 Unless otherwise directed by Owner, Contractor shall proceed with the Work while any Claim, or mediation or litigation arising from a Claim, is pending. Regardless of the review period or the final decision of the Owner, the Contractor shall continue to diligently pursue the Work as identified in the Contract Documents. In no case is the Contractor justified or allowed to cease or Delay Work, in whole or in part, without a written stop work order from the Owner.

SECTION E PAYMENTS

E.1 SCHEDULE OF VALUES

The Contractor shall submit, at least ten (10) Days prior to submission of its first application for progress payment, a schedule of values ("Schedule of Values") for the contracted Work. This schedule shall provide a breakdown of values for the contracted Work and will be the basis for progress payments. The breakdown shall demonstrate reasonable, identifiable, and measurable components of the Work. Unless objected to by the Owner, this schedule shall be used as the basis for reviewing Contractor's applications for payment. If objected to by Owner, Contractor shall revise the schedule of values and resubmit the same for approval of Owner.

E.2 APPLICATIONS FOR PAYMENT

E.2.1 Owner shall make progress payments on the Contract monthly as Work progresses, in accordance with the requirements of this Section E.2. Applications for payment shall be based upon estimates of Work completed and the Schedule of Values. As a condition precedent to Owner's obligation to pay, all applications for payment shall be approved by the Owner. A progress payment shall not be considered acceptance or approval of any Work or waiver of any defects therein. Owner shall pay to Contractor interest for overdue invoices at the rate of two-thirds of one percent per month on the progress payment, not including retainage, due the Contractor. Overdue invoices will be those that have not been paid within forty five (45) days from the latest of:

- (a) The date of the receipt of the accurate invoice;
- (b) The date Owner receives the correct application for payment if no invoice is received;
- (c) The date all goods and services have been received; or
- (d) The date a Claim is made certain by agreement of the parties or by operation of law.

Notwithstanding the foregoing, in instances when an application for payment is filled out incorrectly, or when there is any defect or impropriety in any submitted application or when there is a good faith dispute, Owner shall so notify the Contractor within fifteen (15) Days stating the reason or reasons the application for payment is defective or improper or the reasons for the dispute. A defective or improper application for payment, if corrected by the Contractor within seven (7) Days of being notified by the Owner, shall not cause a payment to be made later than specified in this section unless interest is also paid. Payment of interest

will be postponed when payment on the principal is delayed because of disagreement between the Owner and the Contractor. Owner reserves the right, instead of requiring the Contractor to correct or resubmit a defective or improper application for payment, to reject the defective or improper portion of the application for payment and pay the remainder of the application for such amounts which are correct and proper.

Owner, upon written notice to the Contractor, may elect to make payments to the Contractor only by means of Electronic Funds Transfers (EFT) through Automated Clearing House (ACH) payments. If Owner makes this election, the Contractor shall arrange for receipt of the EFT/ACH payments.

E.2.2 Contractor shall submit to the Owner an application for each payment and, if required, receipts or other vouchers showing payments for materials and labor including payments to Subcontractors. Contractor shall include in its application for payment a schedule of the percentages of the various parts of the Work completed, based on the Schedule of Values which shall aggregate to the payment application total, and shall include, on the face of each copy thereof, a certificate in substantially the following form:

"I, the undersigned, hereby certify that the above bill is true and correct, and the payment therefore, has not been received.

Signed: _____
Dated: _____"

E.2.3 Generally, applications for payment will be accepted only for materials that have been installed. Under special conditions, applications for payment for stored materials will be accepted at Owner's sole discretion. Such a payment, if made, will be subject to the following conditions:

- (a) The request for stored material shall be submitted at least thirty (30) Days in advance of the application for payment on which it appears. Applications for payment shall be entertained for major equipment, components or expenditures only.
- (b) The Contractor shall submit applications for payment showing the quantity and cost of the material stored.
- (c) The material shall be stored in a bonded warehouse and Owner shall be granted the right to access the material for the purpose of removal or inspection at any time during the Contract Period.
- (d) The Contractor shall name the Owner as co-insured on the insurance policy covering the full value of the property while in the care and custody of the Contractor until it is installed. A certificate noting this coverage shall be issued to the Owner.
- (e) Payments shall be made for materials and equipment only. The submitted amount in the application for payment shall be reduced by the cost of transportation from the storage site to the project site and for the cost of an inspector to verify delivery and condition of the goods at the storage site. The cost of storage and inspection shall be borne solely by the Contractor.
- (f) Within sixty (60) Days of the application for payment, the Contractor shall submit evidence of payment covering the material and/or equipment stored and of payment for the storage site.
- (g) Payment for stored materials and/or equipment shall in no way indicate acceptance of the materials and/or equipment or waive any rights under this Contract for the rejection of the Work or materials and/or equipment not in conformance with the Contract Documents.

(h) All required documentation shall be submitted with the respective application for payment.

E.2.4 The Owner reserves the right to withhold all or part of a payment, or may nullify in whole or part any payment previously made, to such extent as may be necessary in the Owner's opinion to protect the Owner from loss because of:

- (a) Work that is defective and not remedied, or that has been demonstrated or identified as failing to conform with Applicable Laws or the Contract Documents,
- (b) Third party claims filed or evidence reasonably indicating that such claims will likely be filed unless security acceptable to the Owner is provided by the Contractor;
- (c) Failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment (in which case Owner may issue checks made payable jointly to Contractor and such unpaid persons under this provision, or directly to Subcontractors and suppliers at any level under Section C.3.2.);
- (d) Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Price;
- (e) Damage to the Work, Owner or another contractor;
- (f) Reasonable evidence that the Work will not be completed within the Contract Time required by the Contract, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;
- (g) Failure to carry out the Work in accordance with the Contract Documents; or
- (h) Assessment of liquidated damages, when withholding is made for offset purposes.

E.2.5 Subject to the provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

- (a) Take that portion of the Contract Price properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the total Contract Price allocated to that portion of the Work in the Schedule of Values, less retainage as provided in Section E.5. Pending final determination of cost to the Owner of changes in the Work, no amounts for changes in the Work can be included in applications for payment until the Contract Price has been adjusted by a Supplement Amendment;
- (b) Add that portion of the Contract Price properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner pursuant to Section E.2.3, suitably stored off the site at a location agreed upon in writing), less retainage as provided in Section E.5;
- (c) Subtract the aggregate of previous payments made by the Owner; and
- (d) Subtract any amounts for which the Owner has withheld or nullified payment as provided in the Contract Documents.

E.2.6 Contractor's applications for payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay to a Subcontractor or material supplier.

E.2.7 The Contractor warrants to Owner that title to all Work covered by an application for payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an application for payment all Work for which payments are received from the Owner shall be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided financing, labor, materials and equipment relating to the Work.

E.2.8 If Contractor disputes any determination by Owner with regard to any application for payment, Contractor nevertheless shall continue to expeditiously perform the Work. No payment made hereunder shall be or be construed to be final acceptance or approval of that portion of the Work to which such partial payment relates or shall relieve Contractor of any of its obligations hereunder.

E.2.9 Contractor shall submit its initial MWESB Report within ten (10) Days of Contractor's execution of the Contract, or if there will be a Guaranteed Maximum Price (GMP) Amendment, then within ten (10) Days of Contractor's execution of the GMP Amendment. Contractor shall submit annual MWESB Reports on June 30 of each year the Contract is active. Contracts (or GMP Amendments) first executed by Contractor within ninety (90) Days before June 30 of the year of execution by Contractor may at the discretion of Owner be exempt from submitting the annual MWESB Report otherwise due on that June 30. The final MWESB Report shall be filed with the application for final payment. Timely receipt of MWESB Reports by Owner shall be a condition precedent to Owner's obligation to pay any progress payments or final payment otherwise due.

E.3 PAYROLL CERTIFICATION REQUIREMENT

Owner's receipt of payroll certification pursuant to Section C.2 of this Contract shall be a condition precedent to Owner's obligation to pay any progress payments or final payment otherwise due.

E.4 DUAL PAYMENT SOURCES

Contractor shall not be compensated for Work performed under this Contract from any state agency other than the agency that is a party to this Contract.

E.5 RETAINAGE

E.5.1 Retainage shall be withheld and released in accordance with the requirements set forth in OSU standards and policies.

E.5.1.1 Owner may reserve as retainage from any progress payment an amount not to exceed five percent of the payment. As Work progresses, Owner may reduce the amount of retainage on or may eliminate retainage on any remaining monthly Contract payments after 50 percent of the Work under the Contract is completed if, in the Owner's discretion, such Work is progressing satisfactorily. Elimination or reduction of retainage shall be allowed only at Owner's sole discretion and only upon written application by the Contractor, which application shall include written approval of Contractor's surety; except that when the Work is 97-1/2 percent completed the Owner may, at its discretion and without application by the Contractor, reduce the retained amount to 100 percent of the value of the Work remaining to be done. Upon receipt of written application by the Contractor, Owner shall respond in writing within a reasonable time.

E.5.1.2 Contractor may request in writing:

- (a) To be paid amounts which would otherwise have been retained from progress payments where Contractor has deposited acceptable bonds and securities of equal value with Owner or in

a custodial account or other mutually-agreed account satisfactory to Owner, with an approved bank or trust company to be held in lieu of the cash retainage for the benefit of Owner;

(b) For construction projects over \$1,000,000, that retainage be deposited in an interest bearing account, established through the State Treasurer for state agencies, in a bank, savings bank, trust company or savings association for the benefit of Owner, with earnings from such account accruing to the Contractor; or

(c) That the Owner allow Contractor to deposit a surety bond for the benefit of Owner, in a form acceptable to Owner, in lieu of all or a portion of funds retained, or to be retained. Such bond and any proceeds therefrom shall be made subject to all claims in the manner and priority as set forth for retainage.

When the Owner has accepted the Contractor's election of option (a) or (b), Owner may recover from Contractor any additional costs incurred through such election by reducing Contractor's final payment. Where the Owner has agreed to Contractor's request for option (c), Contractor shall accept like bonds from Subcontractors and suppliers on the project from which Contractor has required retainages.

E. 5.1.3 The retainage held by Owner shall be included in and paid to the Contractor as part of the Final Payment of the Contract Price. The Owner shall pay to Contractor interest at the rate of two-thirds of one percent per month on the final payment due Contractor, interest to commence forty five (45) Days after the date which Owner receives Contractor's final approved application for payment and Work under the Contract has been completed and accepted and to run until the date when final payment is tendered to Contractor. The Contractor shall notify Owner in writing when the Contractor considers the Work complete and deliver to Owner its final application for payment and Owner shall, within fifteen (15) Days after receiving the written notice and the application for payment, either accept the Work or notify the Contractor of Work yet to be performed on the Contract. If Owner does not within the time allowed notify the Contractor of Work yet to be performed to fulfill contractual obligations, the interest provided by this subsection shall commence to run forty five (45) Days after the end of the 15-Day period.

E.5.1.4 Owner will reduce the amount of the retainage if the Contractor notifies the controller of the Owner that the Contractor has deposited in an escrow account with a bank or trust company, in a manner authorized by the Owner, bonds and securities of equal value of a kind approved by the Owner and such bonds and securities have in fact been deposited.

E.5.1.5 Contractor agrees that if Contractor elects to reserve a retainage from any progress payment due to any Subcontractor or supplier, such retainage shall not exceed five percent of the payment, and such retainage withheld from Subcontractors and suppliers shall be subject to the same terms and conditions stated in Subsection E.5 as apply to Owner's retainage from any progress payment due to Contractor.

E.6 FINAL PAYMENT

E.6.1 Upon completion of all the Work under this Contract, the Contractor shall notify the Owner, in writing, that Contractor has completed Contractor's obligations under the Contract and shall prepare its application requesting final payment. Upon receipt of such notice and application for payment, the Owner will inspect the Work, and, if acceptable, submit to the Owner a recommendation as to acceptance of the completed Work and the final estimate of the amount due the Contractor. If the Work is not acceptable, Owner will notify Contractor within fifteen (15) Days of Contractor's request for Final Payment. Upon approval of this final application for payment by the Owner and

compliance by the Contractor with provisions in Section K, and Contractor's satisfaction of other provisions of the Contract Documents as may be applicable, the Owner shall pay to the Contractor all monies due under the provisions of these Contract Documents.

E.6.2 Neither Final Payment nor any remaining retained percentage shall become due until the Contractor submits to the Owner (1) a certificate evidencing that insurance required by the Contract Documents to remain in force after Final Payment is currently in effect and will not be canceled or allowed to expire until at least thirty (30) Days' prior written notice has been given to the Owner, (2) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (3) consent of surety, if any, to Final Payment and (4), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

E.6.3 Acceptance of Final Payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final application for payment.

E.6.4 Contractor agrees to submit its final payment application within ninety (90) Days after Substantial Completion, unless written extension is granted by Owner. Contractor shall not delay Final Payment application for any reason, including without limitation nonpayment of Subcontractors, suppliers, manufacturers or others not a party to this Contract, or lack of resolution of a dispute with Owner or any other person of matters arising out of or relating to the Contract. If Contractor fails to submit its Final Payment application within ninety (90) Days after Substantial Completion, and Contractor has not obtained written extension by Owner, all requests or Claims for additional costs or an extension of Contract Time shall be waived.

SECTION F JOB SITE CONDITIONS

F.1 USE OF PREMISES

Contractor shall confine equipment, storage of materials and operation of Work to the limits indicated by Contract Documents, Applicable Laws, permits or directions of the Owner. Contractor shall follow the Owner's instructions regarding use of premises, if any.

F.2 PROTECTION OF WORKERS, PROPERTY AND THE PUBLIC

F.2.1 Contractor shall maintain continuous and adequate protection of all of the Work from damage and shall protect the Owner, workers and property from injury or loss arising in connection with this Contract. Contractor shall remedy acceptably to the Owner any damage, injury, or loss, except such as may be directly due to errors in the Contract Documents or caused by authorized representatives or personnel of the Owner. Contractor shall adequately protect adjacent property as provided by law and the Contract Documents.

F.2.2 Contractor shall take all necessary precautions for the safety of all personnel on the job site or otherwise engaged in the

undertaking of the Work and shall comply with the Contract Documents, best practices and all applicable provisions of federal, state and municipal safety laws and building codes to prevent accidents or injury to persons on, about or adjacent to the premises where the Work is being performed. Contractor shall erect and properly maintain at all times, as required by the conditions and progress of the Work, all necessary safeguards for protection of workers and the public against any hazards created by construction. Contractor shall designate a responsible employee or associate on the Work site, whose duty shall be the prevention of accidents. The name and position of the person designated shall be reported to the Owner. The Owner has no responsibility for Work site safety. Work site safety shall be the responsibility of the Contractor.

F.2.3 Contractor shall not enter upon private property without first obtaining permission from the property owner or its duly authorized representative. Contractor shall be responsible for the preservation of all public and private property along and adjacent to the Work contemplated under the Contract and shall use every precaution necessary to prevent damage thereto. In the event the Contractor damages any property, the Contractor shall at once notify the property owner and make, or arrange to make, full restitution. Contractor shall, immediately and in writing, report to the Owner, all pertinent facts relating to such property damage and the ultimate disposition of the claim for damage.

F.2.4 Contractor shall be responsible for protection of adjacent work areas including impacts brought about by activities, equipment, labor, utilities, vehicles and materials on the site.

Contractor shall verify that all mechanical or electrical equipment in the construction areas that may be affected by the Work is in working order and shall notify the Owner, in writing, of any equipment not in working order prior to the start of the Work. Start of Work will be considered as acknowledgement that all equipment is in good working order. Contractor shall be required to restore equipment to its original, or better, condition upon completion of the project.

F.2.5 Contractor shall at all times direct its activities in such a manner as to minimize adverse effects on the environment. Handling of all materials shall be conducted so no release will occur that may pollute or become hazardous.

F.2.6 In an emergency affecting the safety of life or limb or of the Work or of adjoining property, the Contractor, without special instruction or authorization from the Owner, shall act reasonably to prevent threatened loss or injury, and shall so act, without appeal, if instructed by the Owner. Any compensation claimed by the Contractor on account of emergency work shall be determined in accordance with section D.

F.3 CUTTING AND PATCHING

F.3.1 Contractor shall be responsible for coordinating all cutting, fitting, or patching of the Work to make its several parts come together properly and fit to receive or be received by work of other contractors or Subcontractors shown upon, or reasonably implied by, the Contract Documents.

F.3.2 Contractor shall be responsible for restoring all cut, fitted, or patched surfaces to an original condition; provided, however, that if a different condition is specified in the Contract Documents, then Contractor shall be responsible for restoring such surfaces to the condition specified in the Contract Documents.

F.4 CLEANING UP

From time to time as may be prudent or ordered by the Owner and, in any event, immediately after completion of the Work, the Contractor shall, at its own expense, clean up and remove all refuse and unused materials of any kind resulting from the Work. If Contractor fails to do so within twenty-four hours after notification by the Owner the work may be done by others and the cost charged to the Contractor and deducted from payment due the Contractor.

F.5 ENVIRONMENTAL CONTAMINATION

F.5.1 Contractor shall be held responsible for and shall indemnify, defend (with counsel of Owner's choice), and hold harmless Owner from and against any costs, expenses, damages, claims, and causes of action, (including attorney fees), or any of them, resulting from all spills, releases, discharges, leaks and disposal of environmental pollution, including storage, transportation, and handling during the performance of the Work or Contractor's obligations under the Contract which occur as a result of, or are contributed by, the negligence or actions of Contractor or its personnel, agents, or Subcontractors or any failure to perform in accordance with the Contract Documents (except to the extent otherwise void under ORS 30.140). Nothing in this section F.5.1 shall limit Contractor's responsibility for obtaining insurance coverages required under Section G.3 of this Contract, and Contractor shall take no action that would void or impair such coverages.

F.5.1.1 Contractor agrees to promptly dispose of such spills, releases, discharge or leaks to the satisfaction of Owner and regulatory agencies having jurisdiction in a manner that complies with Applicable Laws. Cleanup shall be at no cost to the Owner and shall be performed by properly qualified and, if applicable, licensed personnel.

F.5.1.2 Contractor shall obtain the Owner's written consent prior to bringing onto the Work site any (i) environmental pollutants or (ii) hazardous substances or materials, as the same or reasonably similar terms are used in any Applicable Laws. Notwithstanding such written consent from the Owner, the Contractor, at all times, shall:

- (a) Properly handle, use and dispose of all environmental pollutants and hazardous substances or materials brought onto the Work site, in accordance with all Applicable Laws;
- (b) Be responsible for any and all spills, releases, discharges, or leaks of (or from) environmental pollutants or hazardous substances or materials which Contractor has brought onto the Work site; and
- (c) Promptly clean up and remediate, without cost to the Owner, such spills, releases, discharges, or leaks to the Owner's satisfaction and in compliance with all Applicable Laws.

F.5.2 Contractor shall report all reportable quantity releases, as such releases are defined in Applicable Laws, including but not limited to 40 CFR Part 302, Table 302.4 and in OAR 340-142-0050, to applicable federal, state, and local regulatory and emergency response agencies. Upon discovery, regardless of quantity, Contractor must telephonically report all releases to the Owner. A written follow-up report shall be submitted to Owner within 48 hours of the telephonic report. Such written report shall contain, as a minimum:

- (a) Description of items released (identity, quantity, manifest numbers, and any and all other documentation required by law.)

- (b) Whether amount of items released is EPA/DEQ reportable, and, if so, when reported.
- (c) Exact time and location of release, including a description of the area involved.
- (d) Containment procedures initiated.
- (e) Summary of communications about the release between Contractor and members of the press or State, local or federal officials other than Owner.
- (f) Description of cleanup procedures employed or to be employed at the site, including disposal location of spill residue.
- (g) Personal injuries, if any, resulting from, or aggravated by, the release.

F.6 ENVIRONMENTAL CLEAN-UP

F.6.1 Unless disposition of environmental pollution is specifically a part of this Contract, or was caused by the Contractor (reference F.5 Environmental Contamination), Contractor shall immediately notify Owner of any hazardous substance(s) which Contractor discovers or encounters during performance of the Work required by this Contract. "Hazardous substance(s)" means any hazardous, toxic and radioactive materials and those substances defined as "hazardous substances," "hazardous materials," "hazardous wastes," "toxic substances," or other similar designations in any federal, state, or local law, regulation, or ordinance, including without limitation asbestos, polychlorinated biphenyl (PCB), or petroleum, and any substances, materials or wastes regulated by 40 CFR, Part 261 and defined as hazardous in 40 CFR S 261.3. In addition to notifying Owner of any hazardous substance(s) discovered or encountered, Contractor shall immediately cease working in any particular area of the project where a hazardous substance(s) has been discovered or encountered if continued work in such area would present a risk or danger to the health or well-being of Contractor's or any Subcontractor's work force, property or the environment.

F.6.2 Upon being notified by Contractor of the presence of hazardous substance(s) on the project site, Owner shall arrange for the proper disposition of such hazardous substance(s).

F.7 FORCE MAJEURE

A party to this Contract shall not be held responsible for delay or default due to Force Majeure acts, events or occurrences unless they could have been avoided by the exercise of reasonable care, prudence, foresight, and diligence by that party. The Owner may terminate this Contract upon written notice after determining that delay or default caused by Force Majeure acts, events or occurrences will reasonably prevent successful performance of the Contract.

**SECTION G
INDEMNITY, BONDING, AND INSURANCE**

G.1 RESPONSIBILITY FOR DAMAGES / INDEMNITY

G.1.1 Contractor shall be responsible for all damage to property, injury to persons, and loss, expense, inconvenience, and delay that may be caused by, or result from, the carrying out of the Work to be done under this Contract, or from any act, omission or neglect of the Contractor, its Subcontractors, sub-subcontractors of any tier, suppliers, employees, guests, visitors, invitees and agents.

G.1.2 To the fullest extent permitted by law, Contractor shall indemnify, defend (with counsel approved by Owner) and hold harmless the Owner, Architect/Engineer, Architect/Engineer's

consultants, and their respective officers, directors, agents, employees, partners, members, stockholders and affiliated companies (collectively "Indemnitees") from and against all liabilities, damages, losses, claims, expenses (including reasonable attorney fees), demands and actions of any nature whatsoever which arise out of, result from or are related to, (a) any damage, injury, loss, expense, inconvenience or delay described in this Section G.1., (b) any accident or occurrence which happens or is alleged to have happened in or about the project site or any place where the Work is being performed, or in the vicinity of either, at any time prior to the time the Work is fully completed in all respects, (c) any failure of the Contractor or its Subcontractors, sub-subcontractors of any tier, suppliers, employees or consultants to observe or perform any duty or obligation under the Contract Documents which is to be observed or performed by the Contractor, or any breach of any agreement, representation or warranty of the Contractor contained in the Contract Documents or in any subcontract, (d) the negligent acts or omissions of the Contractor, a Subcontractor, sub-subcontractor of any tier suppliers, a consultant or anyone directly or indirectly employed by them or any one of them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder (except to the extent otherwise void under ORS 30.140), and (e) any lien filed upon the project or bond claim in connection with the Work. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section G.1.2.

G.1.3 In claims against any person or entity indemnified under Section G.1.2 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section G.1.2 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

G.2 PERFORMANCE AND PAYMENT SECURITY; PUBLIC WORKS BOND

G.2.1 When the Contract Price is \$100,000 or more (or \$50,000 or more in the case of Contracts for highways, bridges and other transportation projects), the Contractor shall furnish and maintain in effect at all times during the Contract Period a performance bond in a sum equal to the Contract Price and a separate payment bond also in a sum equal to the Contract Price. Contractor shall furnish such bonds even if the Contract Price is less than the above thresholds if otherwise required by the Contract Documents.

G.2.2 Bond forms furnished by the Owner and notarized by awarded Contractor's surety company authorized to do business in Oregon are the only acceptable forms of performance and payment security, unless otherwise specified in the Contract Documents.

G.2.3 Before execution of the Contract the Contractor shall file with the Construction Contractors Board, and maintain in full force and effect, the separate public works bond required by Oregon Laws 2015, Chapter 279C, and OAR 839-025-0015, unless otherwise exempt under those provisions. The Contractor shall also include in every subcontract a provision requiring the Subcontractor to have a public works bond filed with the Construction Contractors Board before starting Work, unless otherwise exempt, and shall verify that the Subcontractor has filed a public works bond before permitting any Subcontractor to start Work.

G.3 INSURANCE

G.3.1 General Requirements. The required insurance amounts set forth below do not in any way limit the amount or scope of liability of Contractor under this Contract. The amounts listed indicate only the minimum amounts of insurance coverage Owner is willing to accept to help insure full performance of all terms and conditions of this Contract.

G.3.1.1 Primary Coverage and Non-Contributory Coverage. Insurance carried by Contractor under this Contract shall be primary and non-contributory coverage. The coverages indicated are minimums unless otherwise specified in the Contract Documents.

G.3.1.2 Company Ratings. All policies of insurance must be written by companies having an A.M. Best rating of no less than "A-VII", or equivalent. Owner may, upon thirty (30) days written notice to Contractor, require Contractor to change any carrier whose rating drops below an "A-VII" rating. Eligible insurers include admitted insurers that have been issued a certificate of authority from the Oregon Department of Consumer and Business Services authorizing them to conduct an insurance business and issue policies of insurance in the state of Oregon, and certain non-admitted surplus lines insurers that satisfy the requirements of applicable Oregon law and which are subject to approval the Owner.

G.3.1.3 Additional Insured. Each liability policy, except Workers' Compensation and Professional Liability, shall be endorsed to include Owner, its officers, trustees, employees and agents as additional insured but only with respect to the Contractor's activities to be performed under this Contract

If Contractor cannot obtain an insurer to name the Owner as additional insured, Contractor shall obtain at Contractor's expense, and keep in effect during the term of this Contract, Owners and Contractors Protective Liability Insurance, naming the Owner as additional insured with minimum limits of \$2,000,000 per occurrence and \$2,000,000 aggregate. This policy must be kept in effect for 36 months following Final Completion. As evidence of coverage, Contractor shall furnish the actual policy to Owner prior to execution of the Contract.

G.3.1.4 Notice of Cancellation or Change. If the Contractor receives a non-renewal or cancellation notice from an insurance carrier affording coverage required herein, or receives notice that coverage no longer complies with the insurance requirements herein, Contractor agrees to notify Owner by fax within five (5) business days with a copy of the non-renewal or cancellation notice, or written specifics as to which coverage is no longer in compliance. When notified by Owner, the Contractor agrees to stop Work pursuant to this Contract, unless all required insurance remain in effect. Any failure to comply with the reporting provisions of this insurance, except for the potential exhaustion of aggregate limits, shall not affect the coverages provided to the Owner.

Owner shall have the right, but not the obligation, of prohibiting Contractor from entering the Work site until a new certificate(s) of insurance is provided to Owner evidencing the replacement coverage. The Contractor agrees Owner reserves the right to withhold payment to Contractor until evidence of reinstated or replacement coverage is provided to Owner.

G.3.1.5 Deductibles and Self-insured Retentions. Any deductible, self-insured retention and/or self-insurance in excess of \$50,000 may be subject to approval by the Owner in writing.

G.3.2 Workers' Compensation. All employees, including Contractor, that employs subject workers who work under this Contract in the State of Oregon shall comply with ORS

656.017 and provide the required Worker's Compensation coverage, unless such employers are exempt under ORS 656.126. This shall include Employer's Liability Insurance with minimum limits of \$1,000,000 each accident; \$1,000,000 disease-each employee; and \$1,000,000 disease-policy limit. Contractors who perform the Work without the assistance or labor of any employee need not obtain such coverage if the Contractor certifies so in writing. Contractor shall ensure that each of its Subcontractors complies with these requirements. The Contractor shall require proof of such Workers' Compensation coverage by receiving and keeping on file a certificate of insurance from each Subcontractor or anyone else directly employed by either the Contractor or its Subcontractors.

G.3.3 Commercial General Liability. Contractor shall obtain, and keep in effect at Contractor's expense for the term of the Contract, Commercial General Liability Insurance covering bodily injury and property damage in the amount of \$2,000,000 per occurrence and \$4,000,000 aggregate. This insurance shall include personal injury liability, products and completed operations, and contractual liability coverage for the indemnities provided under this Contract (to the extent contractual liability coverage for the indemnity is available in the marketplace).

G.3.4 Automobile Liability. Contractor shall obtain, at Contractor's expense, and keep in effect during the term of this Contract, Automobile Liability Insurance with "symbol 1" coverage (owned, hired and non-owned vehicles). The coverage may be written in combination with the Commercial General Liability Insurance. Contractor shall provide proof of insurance showing minimum limits of \$2,000,000 combined single limit. Contractor and its Subcontractors shall be responsible for ensuring that all non-owned vehicles maintain adequate Automobile Liability insurance while on site.

G.3.5 Umbrella Liability. Contractor shall obtain, at Contractor's expense, and keep in effect during the term of this Contract, Umbrella liability Insurance over and above the Commercial General Liability, Automobile Liability and Employers' Liability insurance coverage with minimum limits of \$5,000,000 per occurrence and \$5,000,000 aggregate.

G.3.6 Owner may adjust the insurance amounts required in Section G.3.4, G.3.4, and G.3.5 through the issuance of Supplemental General Conditions and a Contract.

G.3.7 Professional Liability. (if required by issuance of Supplemental General Conditions) Contractor shall obtain, at Contractor's expense, Professional Liability/Errors & Omissions insurance covering damages caused by any negligent error, omission, or professional misconduct of the Contractor. The policy may be either a practice based policy or a policy pertaining to the specific Project. Professional Liability insurance shall have minimum limits of \$3,000,000 each claim and \$3,000,000 aggregate. Contractor shall require that each of its Major Consultants and subcontractors (including structural, civil, mechanical, plumbing, electrical engineering, survey, geotechnical and materials testing) secures and maintains Professional Liability/Errors & Omissions with limits not less than \$2,000,000 each claim and \$2,000,000 aggregate. All other Consultants and subcontractors not listed above shall have limits not less than \$1,000,000 each claim and \$1,000,000 aggregate.

G.3.7.1 Tail Coverage. If the Professional Liability is arranged on a "claims made" basis, tail coverage will be required at the completion of this Contract for a duration of 36 months or the maximum time period available in the marketplace if less than 36 months. Contractor shall furnish certificates of insurance showing tail coverage as described or continuous "claims

made" liability coverage for 36 months following Final Completion. Continuous "claims made" coverage will be acceptable in lieu of tail coverage, provided its retroactive date is on or before the effective date of this Contract. Owner's receipt of the certificate of insurance and/or endorsement evidencing such coverage shall be a condition precedent to Owner's obligation to make final payment and to Owner's final acceptance of Work or services and related warranty (if any).

- G.3.8 Pollution Liability (if required by Owner through issuance of Supplemental General Conditions) Contractor shall obtain, at Contractor's expense, and keep in effect during the term of this Contract, Pollution liability Insurance in minimum amounts of \$3,000,000 per occurrence and \$3,000,000 aggregate, naming Owner as additional insured, as noted in the Additional Insured section.
- G.3.9 Builders' Risk Insurance – Completed Value Basis. Unless otherwise provided, the Contractor shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, Builders' Risk Insurance in the amount of the initial Contract Sum, plus value of subsequent modifications, change orders, and cost of material supplied or installed by others, comprising total value of the entire Project at the site on a replacement cost basis without optional deductibles. The earthquake and flood insurance sublimits will be equal to the maximum probable loss.
- G.3.9.1 Policy must provide coverage from the time any covered property becomes the responsibility of the Contractor, and continue without interruption during construction, renovation, or installation, including any time during which the covered property is being transported to the construction installation site, or awaiting installation, whether on or off site.
- G.3.9.2 The Builders' Risk Insurance shall include the Owner, the Contractor, subcontractors and sub-tier contractors in the Project as named insureds on the policy, and shall include a waiver of subrogation provision in favor of all parties.
- G.3.9.3 The Builders' Risk Coverage shall be written on a Special Covered Cause of Loss form and shall include theft, vandalism, malicious mischief, collapse, false-work, temporary buildings, transit, debris removal including demolition, increased cost of construction, architect's fees and expenses, flood (including water damage), earthquake, and if applicable, all below and above ground structures, piping, foundations including underground water and sewer mains, piling including the ground on which the structure rests and excavation, backfilling, filling, and grading.
- G.3.9.4 The Builders' Risk shall include a Beneficial Occupancy Clause. The policy shall specifically permit occupancy of the building during construction. Contractor shall take reasonable steps to obtain consent of the insurance company and delete any provisions with regard to restrictions within any Occupancy Clauses within the Builder's Risk Policy.
- G.3.9.5 Equipment Breakdown Coverage (a.k.a. Boiler & Machinery) shall be included as required by the Contract Documents or by law, which shall specifically covers insured equipment during installation and testing (including cold and hot testing).
- G.3.9.6 The Builders' Risk shall include loss of use due to delays in project completion caused by covered peril losses to the Project, including loss of income and rents and soft costs.
- G.3.9.7 The deductible shall not exceed \$50,000 for physical damage and shall be the responsibility of the Contractor. The deductible shall be paid by the Contractor if the Contractor is negligent. The earthquake and flood deductible shall not

exceed 2 percent of each loss or \$50,000, whichever is greater.

- G.3.9.8 OSU shall be provided with a certificate of insurance, as well as a copy of the policy.
- G.3.9.19 The Contractor shall be responsible for the payment of premium, giving or receiving notice of cancellation; and requesting amendments to this policy and accepting amendments to this policy made by the company.
- G.3.9.10 OSU reserves the right to purchase the Builder's Risk insurance policy.
- G.3.10 Builder's Risk Installation Floater. For Work other than new construction, Contractor shall obtain and keep in effect during the term of this Contract, a Builder's Risk Installation Floater for coverage of the Contractor's labor, materials and equipment to be used for completion of the work performed under this Contract. The minimum amount of coverage to be carried shall be equal to the full amount of the Contract. The policy will include as loss payees Owner, the Contractor and its Subcontractors as their interests may appear. Owner may waive this requirement at their sole and absolute discretion.
- G.3.11 Certificate(s) of Insurance. As evidence of the insurance coverage required by this Contract, the Contractor shall furnish certificate(s) of insurance to the Owner prior to the execution of the Contract. The certificate(s) will specify all of the parties who are additional insured or loss payees for this Contract, and the applicable endorsements will be attached. Additional insured endorsements must include completed operations without restriction to contractual requirements.
- G.3.12 Subcontractors. Subject to and following the written approval of the Owner as outlined in B.11.3 as related to Subcontracts and Assignment, the Contractor shall require Subcontractors to have insurance as outlined in section G.3.1 through G.3.4; however, the policy limits may be reduced, but no case shall the policy limits be less than \$1,000,000.
- G.3.13 Reserve Contracting Program: For the Reserve Contracting Program the term "Contract" as used in this Section G in the phrases "keep in effect during the term of this Contract" and "prior to execution of the Contract" shall mean each Reserve Contract Supplement issued under the Reserve Contract.

SECTION H SCHEDULE OF WORK

H.1 CONTRACT PERIOD

- H.1.1 Time is of the essence. The Contractor shall at all times carry on the Work diligently, without delay and punctually fulfill all requirements herein. If required by the Contract Documents, Contractor shall commence Work on the site within fifteen (15) Days of Notice to Proceed, unless directed otherwise.
- H.1.2 Unless specifically extended by Supplement Amendment, all Work shall be complete by the date contained in the Contract Documents. The Owner shall have the right to accelerate the completion date of the Work, which may require the use of overtime. Such accelerated Work schedule shall be an acceleration in performance of Work under Section D.1.2 (f) and shall be subject to the provisions of Section D.1.
- H.1.3 The Owner shall not waive any rights under the Contract by permitting the Contractor to continue or complete in whole or in part the Work after the date described in Section H.1.2 above.

H.2 SCHEDULE

- H.2.1 Contractor shall provide, by or before the pre-construction conference, a detailed Construction Schedule for review and

acceptance by the Owner. The submitted Construction Schedule must illustrate Work by significant project components, significant labor trades, long lead items, broken down by building and/or floor where applicable. Each Construction Schedule item shall account for no greater than 5% of the monetary value of the project or 5% of the available time. Construction Schedules with activities of less than one day or valued at less than 1% of the Contract shall be considered too detailed and shall not be accepted. Construction Schedules lacking adequate detail, or unreasonably detailed, shall be rejected. Included within the Construction Schedule are the following: Notice to Proceed, Substantial Completion, and Final Completion. Contractor shall provide an updated, full Project Construction Schedule with each payment request. In addition, twice monthly, the Contractor shall provide an updated three-week forward-looking schedule. Acceptance of the Construction Schedule by the Owner does not constitute agreement by the Owner as to the Contractor's sequencing, means, methods, or durations. Any positive difference between the Contractor's scheduled completion and the contract completion date is float owned by the Project. Use of the float shall be negotiated. In no case shall the Contractor make a claim for delays if the Work is completed within the Contract time but after Contractor's scheduled completion.

H.3 PARTIAL OCCUPANCY OR USE

H.3.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage, provided such occupancy or use is consented to by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have reasonably accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, insurance or self-insurance, maintenance, heat, utilities, and damage to the Work, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents with respect to such portion of the Work. Approval by the Contractor to partial occupancy or use shall not be unreasonably withheld. Immediately prior to such partial occupancy or use, the Owner and Contractor shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work. Partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

SECTION I CORRECTION OF WORK

I.1 CORRECTION OF WORK BEFORE FINAL PAYMENT

The Contractor warrants to the Owner that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects, and that the Work will conform to the requirements of the Contract Documents. Work failing to conform to these requirements shall be deemed defective. Contractor shall promptly remove from the premises and replace all defective materials and equipment as determined by the Owner, whether incorporated in the Work or not. Removal and replacement shall be without loss or expense to the Owner, and Contractor shall bear the cost of repairing all Work destroyed or damaged by such removal or replacement. Contractor shall be allowed a period of no longer than thirty (30) Days after Substantial Completion for completion of defective (Punch List) work. At the end of the thirty-day period, or earlier if requested by the Contractor, Owner shall arrange for inspection of the Work by the Architect/Engineer. Should the work not be complete, and all corrections made, the costs for all subsequent re-inspections shall be borne by the Contractor. If Contractor fails to complete the Punch List work within the thirty (30) Day period, Owner

may perform such work and Contractor shall reimburse Owner all costs of the same within ten (10) Days after demand without affecting Contractor's obligations.

I.2 WARRANTY WORK

I.2.1 Neither the final certificate of payment nor any provision of the Contract Documents shall relieve the Contractor from responsibility for defective Work and, unless a longer period is specified, Contractor shall correct all defects that appear in the Work within a period of one year from the date of issuance of the written notice of Substantial Completion by the Owner except for latent defects which will be remedied by the Contractor at any time they become apparent. The Owner shall give Contractor notice of defects with reasonable promptness. The Contractor shall perform the warranty Work by correcting defects within twenty-four (24) hours of notification by Owner, unless otherwise specified in the Contract Documents. Should the Contractor fail to respond within the specified response time, the Owner may, at its option, complete the necessary repairs using another contractor or its own forces. If Owner completes the repairs using Owner's own forces, Contractor shall pay Owner at the rate of one and one-half (1½) times the standard hourly rate of Owner's forces, plus related overhead and any direct non-salary costs. If Owner completes the repairs using another contractor, Contractor shall pay Owner the amount of Owner's direct costs billed by the other contractor for the work, plus the direct salary costs and related overhead and direct non-salary expenses of Owner's forces who are required to monitor that contractor's work. Work performed by Owner using Owner's own forces or those of another contractor shall not affect the Contractor's contractual duties under these provisions, including warranty provisions. In the event of warranty work consisting of emergency repairs, Owner may perform such work and Contractor shall reimburse Owner all costs of the same within ten (10) Days after demand, without affecting Contractor's obligations.

I.2.2 Nothing in this Section I.2 provision shall negate guarantees or warranties for periods longer than one year including without limitation such guarantees or warranties required by other sections of the Contract Documents for specific installations, materials, processes, equipment or fixtures.

I.2.3 In addition to Contractor's warranty, manufacturer's warranties shall pass to the Owner and shall not take effect until such portion of the Work covered by the applicable warranty has been accepted in writing by the Owner.

I.2.4 The one-year period for correction of Work shall be extended with respect to portions of Work performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work, and shall be extended by corrective Work performed by the Contractor pursuant to this Section, as to the Work corrected. The Contractor shall remove from the site portions of the Work which are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

I.2.5 Nothing contained in this Section I.2 shall be construed to establish a period of limitation with respect to other obligations which the Contractor might have under the Contract Documents. Establishment of the period for correction of Work as described in this Section I.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

J.2.6 If the Owner prefers to accept Work which is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Price will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

SECTION J

SUSPENSION AND/OR TERMINATION OF THE WORK

J.1 OWNER'S RIGHT TO SUSPEND THE WORK

J.1.1 The Owner has the authority to suspend portions or all of the Work due to the following causes:

- (a) Failure of the Contractor to correct unsafe conditions;
- (b) Failure of the Contractor to carry out any provision of the Contract;
- (c) Failure of the Contractor to carry out orders;
- (d) Conditions, in the opinion of the Owner, which are unsuitable for performing the Work;
- (e) Time required to investigate differing site conditions;
- (f) Any reason considered to be in the public interest.

J.1.2 The Owner shall notify Contractor and the Contractor's Surety in writing of the effective date and time of the suspension, and Owner shall notify Contractor and Contractor's surety in writing to resume Work.

J.2 CONTRACTOR'S RESPONSIBILITIES

J.2.1 During the period of the suspension, Contractor is responsible to continue maintenance at the project just as if the Work were in progress. This includes, but is not limited to, protection of completed Work, maintenance of access, protection of stored materials, temporary facilities, and clean-up.

J.2.2 When the Work is recommenced after the suspension, the Contractor shall replace or renew any Work damaged during the suspension, remove any materials or facilities used as part of temporary maintenance, and complete the project in every respect as though its prosecution had been continuous and without suspension.

J.3 COMPENSATION FOR SUSPENSION

J.3.1 Depending on the reason for suspension of the Work, the Contractor or the Owner may be due compensation by the other party. If the suspension was required due to acts or omissions of Contractor, the Owner may assess the Contractor actual costs of the suspension in terms of administration, remedial work by the Owner's forces or another contractor to correct the problem associated with the suspension, rent of temporary facilities, and other actual costs related to the suspension. If the suspension was caused by acts or omissions of the Owner, the Contractor may be due compensation which shall be defined using Section D, Changes in Work. If the suspension was required through no fault of the Contractor or the Owner, neither party shall owe the other for the impact.

J.4 OWNER'S RIGHT TO TERMINATE CONTRACT

J.4.1 The Owner may, without prejudice to any other right or remedy, and after giving Contractor seven (7) Days' written notice and an opportunity to cure, terminate the Contract in whole or in part under the following conditions:

- (a) If Contractor should, voluntarily or involuntarily, seek protection under the United States Bankruptcy Code and Contractor as debtor-in-possession or the Trustee for the estate fails to assume the Contract within a reasonable time;
- (b) If Contractor should make a general assignment for the benefit of Contractor's creditors;
- (c) If a receiver should be appointed on account of Contractor's insolvency;
- (d) If Contractor should repeatedly refuse or fail to supply an adequate number of skilled workers or proper materials to carry on the Work as required by the Contract Documents, or otherwise fail to perform the Work in a timely manner;
- (e) If Contractor should repeatedly fail to make prompt payment to Subcontractors or for material or labor, or should disregard laws, ordinances or the instructions of the Owner; or
- (f) If Contractor is otherwise in breach of any part of the Contract.
- (g) If Contractor is in violation of Applicable Laws, either in the conduct of its business or in its performance of the Work.

J.4.2 At any time that any of the above occurs, Owner may exercise all rights and remedies available to Owner at law or in equity, and, in addition, Owner may take possession of the premises and of all materials and appliances and finish the Work by whatever method it may deem expedient. In such case, the Contractor shall not be entitled to receive further payment until the Work is completed. If the Owner's cost of finishing the Work exceeds the unpaid balance of the Contract Price, Contractor shall pay the difference to the Owner.

J.5 TERMINATION FOR CONVENIENCE

J.5.1 Owner may terminate the Contract in whole or in part whenever Owner determines that termination of the Contract is in the best interest of Owner or the public.

J.5.2 The Owner shall provide the Contractor with seven (7) Days prior written notice of a termination for Owner's or for public convenience. After such notice, the Contractor shall provide the Owner with immediate and peaceful possession of the premises and materials located on and off the premises for which the Contractor received progress payment under Section E. Compensation for Work terminated by the Owner under this provision will be according to Section E. In no circumstance shall Contractor be entitled to lost profits for Work not performed due to termination.

J.6 ACTION UPON TERMINATION

J.6.1 Upon receiving a notice of termination, and except as directed otherwise by the Owner, Contractor shall immediately cease placing further subcontracts or orders for materials, services, or facilities. In addition, Contractor shall terminate all subcontracts or orders to the extent they relate to the Work terminated and, with the prior written approval of the Owner, settle all outstanding liabilities and termination settlement proposals arising from the termination of subcontracts and orders.

J.6.2 As directed by the Owner, Contractor shall, upon termination, transfer title and deliver to the Owner all Record Documents, information, and other property that, if the Contract had been completed, would have been required to be furnished to the Owner.

J.6.3 Upon Owner's notice of termination pursuant to either Section J.4 or J.5, if Owner shall so elect, Contractor shall assign the Owner such subcontracts and orders as Owner shall specify. In the event Owner elects to take assignment of any such subcontract or order, Contractor shall take such action and shall execute such documents as Owner shall reasonably require for the effectiveness of such assignment and Contractor shall ensure that no contractual arrangement between it and its subcontractors or suppliers of any tier or sub-tier shall prevent such assignment.

SECTION K CONTRACT CLOSE OUT

K.1 RECORD DOCUMENTS

As a condition of final payment (refer also to section E.6), Contractor shall comply with the following: Contractor shall provide Record Documents for the entire project to Owner. Record Documents shall depict the project as constructed and shall reflect each and every change, modification, and deletion made during the construction. Record Documents are part of the Work and shall be provided prior to the Owner's issuance of final payment. Record Documents include all modifications to the Contract Documents unless otherwise directed, and accurate MWESB Reports.

K.2 OPERATION AND MAINTENANCE MANUALS

As part of the Work, Contractor shall submit two completed operation and maintenance manuals ("O & M Manuals") for review by the Owner prior to submission of any pay request for more than 75% of the Work. Owner's receipt of the O & M Manuals shall be a condition precedent to any payment thereafter due. The O & M Manuals shall contain a complete set of all Submittals, all product data as required by the specifications, training information, telephone list and contact information for all consultants, manufacturers, installer and suppliers, manufacturer's printed data, record and shop drawings, schematic diagrams of systems, appropriate equipment indices, warranties and bonds. The Owner shall review and return one O & M Manual for any modifications or adjustments required. Prior to submission of its final pay request, Contractor shall deliver two (2) complete and approved sets of O & M Manuals in paper form and one (1) complete and approved set in electronic form to the Owner and Owner's receipt of the O & M Manuals shall be a condition precedent to Owner's obligation to make final payment.

K.3 COMPLETION NOTICES

K.3.1 Contractor shall provide Owner written notice of both Substantial and Final Completion. The certificate of Substantial Completion shall state the date of Substantial Completion, the responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and the time within which the Contractor shall finish all items on the Punch List accompanying the Certificate. Both completion notices must be signed by the Contractor and the Owner to be valid. The Owner shall provide the final signature on the notices. The notices shall take effect on the date they are signed by the Owner.

K.3.2 Substantial Completion of a facility with operating systems (e.g., mechanical, electrical, HVAC) shall be that degree of completion that has provided a minimum of thirty (30) continuous Days of successful, trouble-free operation, which period shall begin after all performance and acceptance testing has been successfully demonstrated to the Owner. All equipment contained in the Work, plus all other components necessary to enable the Owner to operate the facility in the manner that was intended, shall be complete on the Substantial Completion date. The Contractor may request that a Punch List be prepared by the Owner with submission of the request for the Substantial Completion notice.

K.4 TRAINING

As part of the Work, and prior to submission of the final application for payment, the Contractor shall schedule with the Owner training sessions for all equipment and systems as required by the Contract Documents. Contractor shall schedule training sessions at least two weeks in advance of the date of training to allow Owner to provide its personnel with adequate notice. The O & M Manual shall be used as a basis for training. In addition to any off-site training required by the Contract Documents, training shall include a formal session conducted at the Work site after the equipment and/or system is completely installed and operational in its normal operating environment.

K.5 EXTRA MATERIALS

As part of the Work, Contractor shall provide spare parts, extra maintenance materials, and other materials or products in the quantities specified in the Contract Documents prior to final payment. Delivery point for extra materials shall be designated by the Owner.

K.6 ENVIRONMENTAL CLEAN-UP

As part of the Final Completion notice, or as a separate written notice submitted with or before the notice of Final Completion, the Contractor shall notify the Owner that all environmental and pollution clean-up, remediation and closure have been completed in accordance with all Applicable Laws and pursuant to the authority of all agencies having jurisdiction, and Contractor shall provide Owner with any and all documentation related to the same, including but not limited to directives, orders, letters, certificates and permits related to or arising from such environmental pollution. The notice shall reaffirm the indemnification given under Section F.5.1 above. Contractor's completion of its obligations under this Section K.6 and Owner's receipt of documents evidencing such completion shall be a condition precedent to Owner's obligation to make final payment.

K.7 CERTIFICATE OF OCCUPANCY

Owner's receipt of an unconditioned certificate of occupancy from the appropriate state and/or local building officials shall be a condition precedent to Owner's obligation to make final payment, except to the extent failure to obtain an unconditional certificate of occupancy is due to the sole fault or neglect of Owner.

K.8 OTHER CONTRACTOR RESPONSIBILITIES

The Contractor shall be responsible for returning to the Owner all property of Owner issued to Contractor during construction such as keys, security passes, site admittance badges, and all other pertinent items. Upon notice from Owner, Contractor shall be responsible for notifying the appropriate utility companies to transfer utility charges from the Contractor to the Owner. The utility transfer date shall not be before Substantial Completion and may not be until Final Completion, if the Owner does not take beneficial use of the facility and the Contractor's forces continue with the Work.

K.9 SURVIVAL

All warranty and indemnification provisions of this Contract, and all of Contractor's other obligations under this Contract that are not fully performed by the time of Final Completion or termination, shall survive Final Completion or any termination of the Contract.

EXHIBIT D

OREGON STATE UNIVERSITY

PERFORMANCE BOND

Bond No. _____
Solicitation _____
Project Name _____

_____ (Surety #1)	Bond Amount No. 1:	\$ _____
_____ (Surety #2)*	Bond Amount No. 2:*	\$ _____
<i>* If using multiple sureties</i>	Total Penal Sum of Bond:	\$ _____

We, _____ as Principal, and the above identified Surety(ies), authorized to transact surety business in Oregon, as Surety, hereby jointly and severally bind ourselves, our respective heirs, executors, administrators, successors and assigns firmly by these presents to pay unto Oregon State University (OSU), the sum of (Total Penal Sum of Bond)

(Provided, that we the Sureties bind ourselves in such sum “jointly and severally” as well as “severally” only for the purpose of allowing a joint action or actions against any or all of us, and for all other purposes each Surety binds itself, jointly and severally with the Principal, for the payment of such sum only as is set forth opposite the name of such Surety), and

WHEREAS, the Principal has entered into contract No. _____ with the OSU, the plans, specifications, terms and conditions of which are contained within the Contract resulting from the above-referenced Solicitation;

WHEREAS, the terms and conditions of the Contract, together with applicable plans, standard specifications, special provisions, schedule of performance, and schedule of Contract prices, are made a part of this Performance Bond by reference, whether or not attached to the contract (all hereafter called “Contract”); and

WHEREAS, the Principal has agreed to perform the Contract in accordance with the terms, conditions, requirements, plans and specifications, and all authorized modifications of the Contract which increase the amount of the work, the amount of the Contract, or constitute an authorized extension of the time for performance, notice of any such modifications hereby being waived by the Surety:

NOW, THEREFORE, THE CONDITION OF THIS BOND IS SUCH that if the Principal herein shall (1) faithfully and truly observe and comply with the terms, conditions and provisions of the Contract, in all respects, (2) shall well and truly and fully do and perform all matters and things undertaken by Contractor to be performed under the Contract, upon the terms set forth therein, and within the time prescribed therein, or as extended as provided in the Contract, with or without notice to the Sureties, (3) shall save, defend, indemnify and hold harmless OSU and its officers, board members, employees, agents and other representatives, against any direct or indirect damages or claim of every kind and description that shall be suffered or claimed to be suffered in connection with or arising out of the performance of the Contract by

the Principal or its subcontractors, and (4) shall in all respects perform said contract according to law, then this obligation is to be void; otherwise, it shall remain in full force and effect.

Nonpayment of the bond premium will not invalidate this bond, nor shall OSU be obligated for the payment of any premiums.

This bond is given and received under authority of ORS Chapters 279C and 352, the provisions of which hereby are incorporated into this bond and made a part hereof.

IN WITNESS WHEREOF, WE HAVE CAUSED THIS INSTRUMENT TO BE EXECUTED AND SEALED BY OUR DULY AUTHORIZED LEGAL REPRESENTATIVES.

Dated this _____ day of _____, 20__.

PRINCIPAL: _____

By _____
Signature

Official Capacity

Attest: _____
Corporation Secretary

SURETY: _____

[Add signatures for each surety if using multiple bonds]

BY ATTORNEY-IN-FACT:

[Power-of-Attorney must accompany each surety bond]

Name

Signature

Address

City State Zip

Phone Fax

OREGON STATE UNIVERSITY

PAYMENT BOND

Bond No. _____
Solicitation _____
Project Name _____

_____ (Surety #1) Bond Amount No. 1: \$ _____
_____ (Surety #2)* Bond Amount No. 2:* \$ _____
* *If using multiple sureties* Total Penal Sum of Bond: \$ _____

We, _____, as Principal, and the above identified Surety(ies), authorized to transact surety business in Oregon, as Surety, hereby jointly and severally bind ourselves, our respective heirs, executors, administrators, successors and assigns firmly by these presents to pay unto Oregon State University (OSU) the sum of (Total Penal Sum of Bond) _____ (Provided, that we the Sureties bind ourselves in such sum “jointly and severally” as well as “severally” only for the purpose of allowing a joint action or actions against any or all of us, and for all other purposes each Surety binds itself, jointly and severally with the Principal, for the payment of such sum only as is set forth opposite the name of such Surety), and

WHEREAS, the Principal has entered into contract No. _____ with OSU, the plans, specifications, terms and conditions of which are contained within the Contract resulting from the above-referenced Solicitation;

WHEREAS, the terms and conditions of the contract, together with applicable plans, standard specifications, special provisions, schedule of performance, and schedule of contract prices, are made a part of this Payment Bond by reference, whether or not attached to the contract (all hereafter called “Contract”); and

WHEREAS, the Principal has agreed to perform the Contract in accordance with the terms, conditions, requirements, plans and specifications, and schedule of contract prices which are set forth in the Contract and any attachments, and all authorized modifications of the Contract which increase the amount of the work, or the cost of the Contract, or constitute authorized extensions of time for performance of the Contract, notice of any such modifications hereby being waived by the Surety:

NOW, THEREFORE, THE CONDITION OF THIS BOND IS SUCH that if the Principal shall (1) faithfully and truly observe and comply with the terms, conditions and provisions of the Contract, in all respects, (2) shall well and truly and fully do and perform all matters and things by it undertaken to be performed under said Contract and any duly authorized modifications that are made, upon the terms set forth therein, and within the time prescribed therein, or as extended therein as provided in the Contract, with or without notice to the Sureties, (3) shall save, defend, indemnify and hold harmless OSU, and its officers, board members, employees, agents and other representatives, against any claim for direct or indirect damages of every kind and description that shall be suffered or claimed to be suffered in connection with or arising out of the performance of the Contract by the Contractor or its subcontractors, (4) shall promptly pay all persons supplying labor, materials or both to the Principal or its subcontractors for prosecution of the work provided in the Contract; (5) shall promptly pay all contributions due the State Industrial Accident Fund and the State Unemployment Compensation Fund from the Principal or its

subcontractors in connection with the performance of the Contract; (6) shall pay over to the Oregon Department of Revenue all sums required to be deducted and retained from the wages of employees of the Principal and its subcontractors pursuant to ORS 316.167;(7) shall permit no lien nor claim to be filed or prosecuted against the State or OSU on account of any labor or materials furnished; and (8) shall do all things required of the Principal by the laws of this State, then this obligation shall be void; otherwise, it shall remain in full force and effect.

Nonpayment of the bond premium will not invalidate this bond, nor shall OSU be obligated for the payment of any premiums.

This bond is given and received under authority of ORS Chapters 279C and 352, the provisions of which hereby are incorporated into this bond and made a part hereof.

IN WITNESS WHEREOF, WE HAVE CAUSED THIS INSTRUMENT TO BE EXECUTED AND SEALED BY OUR DULY AUTHORIZED LEGAL REPRESENTATIVES:

Dated this _____ day of _____, 20__.

PRINCIPAL: _____

By _____
Signature

Official Capacity

Attest: _____
Corporation Secretary

SURETY: _____

[Add signatures for each if using multiple bonds]

BY ATTORNEY-IN-FACT:

[Power-of-Attorney must accompany each bond]

Name

Signature

Address

City State Zip

Phone Fax

EXHIBIT E

As indicated in the General Conditions of your contract(s) Section E.2.9, OSU requires that we gather MWESB (Minority, Women's Emerging Small Business) Contractor/Subcontractor information. This is an Oregon State University requirement and the information will be gathered annually and at time of final payment.

- **You must do this step first or the report will not let you add any information:** In Row 1 Column B there is a drop down menu. You must select yearend (if the job has not been completed) or final (if the job is completed and you have submitted for retention). Once you choose yearend or final in the drop down menu there will be areas highlighted in light green and red. Those are the areas that you are required to fill out. If you did not use or planning to use any MWESB then the left side of the report (Light Green area) still needs to be filled out and the red area needs to remain blank.
- If your agency is an MWESB or if you are using/used an MWESB subcontractor then you need to fill out the information in the report that is highlighted in light green and red (see instructions in the next bullet). If you are not an MWESB or used a Subcontractor that is an MWESB then you need to fill out the left side of the form (Light Green areas) and leave the red area blank.
- In row 2 Column B there is another drop down menu, click the drop down menu and choose Fiscal Year 2015.
- In Row 4 Column B there is another drop down menu, click there and choose OSU.

EXHIBIT F

Library Archive

Oregon State University

Project Manual

Divisions 01 - 33

100% CD Set
10 July 2020



**ROWELL
BROKAW**

1203 Willamette
Suite 210
Eugene, Oregon 97401
541 485 1003
rowellbrokaw.com

Architecture. Design. Strategy

**SECTION 00 0110
TABLE OF CONTENTS**

PROCUREMENT AND CONTRACTING REQUIREMENTS

1.01 DIVISION 00 -- PROCUREMENT AND CONTRACTING REQUIREMENTS

- A. 00 0110 - Table of Contents

SPECIFICATIONS

2.01 DIVISION 01 -- GENERAL REQUIREMENTS

- A. 01 1000 - Summary
- B. 01 2300 - Alternates
- C. 01 2476 - Applications for Payment
 - 1. Contract Payment Request Form
 - 2. Continuation Sheet
- D. 01 2500 - Product Substitution Procedures
 - 1. Substitution Request Form
- E. 01 3119 - Project Meetings
- F. 01 3323 - Shop Drawings, Product Data, Submittals
- G. 01 4213 - Abbreviations
- H. 01 4216 - Definitions
- I. 01 4219 - Reference Standards
- J. 01 4500 - Quality Control
- K. 01 5100 - Construction Facilities and Temp Control
 - 1. Safety Requirements
 - 2. OSU Construction and Maintenance Safety Form
 - 3. Model Site Safety Plan
- L. 01 5639 - Tree Planting and Protection
- M. 01 6000 - Product Requirements
- N. 01 7329 - Cutting and Patching
- O. 01 7400 - Cleaning
- P. 01 7700 - Contract Closeout

2.02 DIVISION 02 -- EXISTING CONDITIONS

- A. 02 4100 - Demolition

2.03 DIVISION 03 -- CONCRETE (NOT USED)

2.04 DIVISION 04 -- MASONRY (NOT USED)

2.05 DIVISION 05 -- METALS (NOT USED)

2.06 DIVISION 06 -- WOOD, PLASTICS, AND COMPOSITES (NOT USED)

2.07 DIVISION 07 -- THERMAL AND MOISTURE PROTECTION

- A. 07 2119 - Foamed-In-Place Insulation
- B. 07 6200 - Sheet Metal Flashing and Trim
- C. 07 9200 - Joint Sealants

2.08 DIVISION 08 -- OPENINGS

- A. 08 1113 - Hollow Metal Doors and Frames
- B. 08 7100 - Door Hardware
- C. 08 7100.1 - Hardware Schedule

2.09 DIVISION 09 -- FINISHES

- A. 09 9113 - Exterior Painting
- B. 09 9123 - Interior Painting

2.10 DIVISION 10 -- SPECIALTIES

- A. 10 2213 - Wire Mesh Partitions

2.11 DIVISION 11 -- EQUIPMENT (NOT USED)

2.12 DIVISION 12 -- FURNISHINGS

- A. 12 3600 - Countertops

2.13 DIVISION 13 -- SPECIAL CONSTRUCTION (NOT USED)

2.14 DIVISION 14 -- CONVEYING EQUIPMENT (NOT USED)

2.15 DIVISION 21 -- FIRE SUPPRESSION

- A. 21 0500 - General Fire Protection Provisions
- B. 21 1313 - Wet-Pipe Sprinkler Systems

2.16 DIVISION 22 -- PLUMBING (NOT USED)

2.17 DIVISION 23 -- HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

- A. 23 0500 - General HVAC Provisions
- B. 23 0513 - Common Motor Requirements for HVAC Equipment
- C. 23 0514 - Common Motor Control Devices for HVAC
- D. 23 0517 - Sleeves, Sleeve Seals, and Escutcheons for HVAC Piping
- E. 23 0529 - Hangers and Supports for HVAC Piping and Equipment
- F. 23 0548 - Vibration and Seismic Controls for HVAC
- G. 23 0553 - Identification for HVAC Piping and Equipment
- H. 23 0593 - Testing, Adjusting, and Balancing for HVAC
- I. 23 0713 - Duct Insulation
- J. 23 0719 - HVAC Piping Insulation
- K. 23 0925 - BAS Field Mounted Devices for HVAC
- L. 23 0929 - BAS Sequence of Operations for HVAC
- M. 23 2113 - Above Ground Hydronic Piping
- N. 23 2300 - Refrigerant Piping and Specialties
- O. 23 3113 - Metal Ductwork
- P. 23 3300 - Air Duct Accessories
- Q. 23 3400 - HVAC Fans
- R. 23 3713 - Air Outlets and Inlets
- S. 23 4100 - Particulate Air Filtration
- T. 23 8143 - Air-Source Heat Pumps
- U. 23 8216 - Air Coils
- V. 23 8217 - Electric Duct Heater

2.18 DIVISION 25 -- INTEGRATED AUTOMATION (NOT USED)

2.19 DIVISION 26 -- ELECTRICAL

- A. 26 0126 - Submittals and Shop Drawings
- B. 26 0500 - General Electrical Provisions
- C. 26 0501 - Electrical Demolition

- D. 26 0519 - Low Voltage Electrical Power and Cables
- E. 26 0533 - Raceways and Boxes for Electrical Systems
- F. 26 2726 - Wiring Devices
- G. 26 2913 - Motor and Circuit Disconnects
- H. 26 5100 - Lighting Fixtures
- 2.20 **DIVISION 27 -- COMMUNICATIONS (NOT USED)**
- 2.21 **DIVISION 28 -- ELECTRONIC SAFETY AND SECURITY (NOT USED)**
- 2.22 **DIVISION 31 -- EARTHWORK (NOT USED)**
- 2.23 **DIVISION 32 -- EXTERIOR IMPROVEMENTS**
 - A. 32 3113 - Chain Link Fences and Gates
- 2.24 **DIVISION 33 -- UTILITIES (NOT USED)**

END OF SECTION

SECTION 01 1100

SUMMARY OF WORK

PART 1 GENERAL

1.01 SUMMARY OF WORK

- A. The Work Contract consists of partial renovation of the basement of the OSU Research Way Building at 4700 Research Way, Corvallis, Oregon. The renovation includes but is not limited to the demolition of existing abandoned MEP distribution, installation of new HVAC equipment, spray-applied insulation, wire partitions, etc. to create a new storage area for the Valley Library archive.
- B. Work shall be started within ten (10) calendar days after signing of Contract on behalf of Oregon State University. The Contract may not be signed prior to approval of the Contractor's Certificate of Insurance by Construction Contract Administration (CCA), Oregon State University. Work shall be substantially complete by April 1, 2021 with final acceptance on or before May 1, 2021.

1.02 CONTRACTORS USE OF PREMISES

- A. Contractor shall limit use of the Premises for work and storage to allow for:
 - 1. Owner occupancy, day and night.
 - 2. Public use, day and night.
 - 3. Security.
 - 4. Safe entry and exit for vehicles and pedestrians.
 - 5. Fire egress.
- B. Coordinate all operations with the Owner's Authorized Representative during the construction period. A 96 hour notification is required prior to scheduled utility shutdowns or street closures, but more lead time is often required to schedule around other critical activities.
- C. Limit Contractor's employee parking to locations designated at the Pre-construction Conference.

1.03 OWNER OCCUPANCY

- A. The Owner will occupy the Premises during the entire period of construction for the conduct of normal operations. Cooperate with Owner's Authorized Representative in construction operations to minimize conflict and to facilitate the Owner's usage especially in the following areas:
 - 1. Restricted access and parking.
 - 2. Use of stairs.
 - 3. Storage space availability.
- B. The Owner will be utilizing a portion of the project area for active storage purposes for

the duration of construction. Contractor is to assume that the majority of storage items will not be able to be relocated during construction and will need to be protected accordingly. For items that must be relocated to facilitate construction activities, Contractor to coordinate with Owner's Authorized Representative to facilitate temporary relocation.

- C. Conduct operations in such a way to ensure the least inconvenience to the general public, including:
 - 1. Limitations and easements.
 - 2. Emergency vehicle access.
 - 3. Building access to the public, day and night.

1.04 ASBESTOS AND OTHER HAZARDOUS MATERIAL

- A. The Owner has made a reasonable attempt to locate and identify asbestos or other hazardous material that may be encountered during the course of the Work.
- B. If the Contractor observes or suspects the existence of asbestos, polychlorinated biphenyl (PCB) or other hazardous materials in the structure or components of the building, the Contractor shall immediately stop work and notify the Owner's Authorized Representative.
- C. The Owner will arrange for the removal of asbestos, polychlorinated biphenyl (PCB) or other hazardous materials as required by Facilities Services personnel or by separate contract.
- D. Schedule ten (10) days of slack or "down" time for the removal of hazardous materials without penalty to Owner for the delay of the Contract.

1.05 LEAD BASED PAINT

- A. The Owner may have tested existing paint in the project area and if levels are found the following conditions apply.
- B. Contractor shall remove paint as specified for surface preparation and capture removed material for disposal.
- C. Contractor shall follow OSHA guidelines involving exposure to workers.
- D. Owner will provide containers for Contractor's use at project site.
- E. Contractor shall comply with the requirements of DEQ and EPA and shall submit a lead abatement plan.
- F. Contractor shall separate lead contaminated material from effluent and water.
- G. Owner will dispose of lead paint and effluent resulting from stripping operation.
- H. Soil contaminated by stripping operations shall be replaced with topsoil.

END OF SECTION

SECTION 01 2300

ALTERNATES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. The alternates described in this Section may be exercised at the option of the Owner within 60 days of the execution of the Contract.
- B. It is generally the practice of the Owner to exercise alternates in numerical order.
- C. The Owner reserves the right to accept the alternates without regard to order or sequence; but, such acceptance shall not impair the selection of a low, responsible and responsive bidder to whom the Contract may be awarded under an equitable bid procedure.

1.02 QUALITY ASSURANCE

- A. For each alternate which is accepted, coordinate the work of the various trades involved, and modify surrounding work as required to complete the project as intended.
- B. In the change-in-price figure for each alternate, include incidental costs which are attributable to adjustments in the work of other trades which may be required to achieve the contemplated and final conditions.
- C. Questions:
 - 1. If there is a question regarding the extent, scope, nature, or intent of the alternates, contact the Owner's Authorized Representative for clarification.
 - 2. Failure on the part of the Contractor to clarify any unclear items shall not relieve the Contractor of the responsibility for performing the selected alternates in accordance with the intent and requirements of the Project Manual and Drawings.
 - 3. The description of the alternates hereinafter is qualitative and not quantitative; the Contractor shall determine the quantities of labor and materials and the extent of same required to execute the selected alternates in accordance with the intent and requirements of the Project Manual and Drawings.
 - 4. The applicable Sections of the Specifications apply to the work under each alternate.

1.03 LIST OF ALTERNATES

A. Alternate 1:

Baseline Bid: Provide demo of existing overhead abandoned utilities within library archives boundary and as necessary for new routing of MEP components as indicated per drawings (see E-101 and M-102). Demo steel bollards within library archive

boundary as indicated per drawings (see D-110). Cut/grind flush with floor level.

Alternate Bid: Demo additional overhead abandoned utilities north of Grid 5.5 as indicated per drawings (see E-101 and M-102, labeled Alternate #1). Demo additional steel bollards north of Grid 5.5 as indicated per drawings (see D-110, labeled in keynote D 010 as Alternate #1).

END OF SECTION

SECTION 01 2476

APPLICATIONS FOR PAYMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work of this Section includes forms and procedures for progress payments.
- B. Related work specified elsewhere.
 - 1. For the primary discussion of payments, refer to OSU General Conditions, Section E, as supplemented.
 - 2. In compliance with OSU General Conditions, Section K, no payments beyond 75% will be made by the Owner before draft Operation and Maintenance Manuals have been received for review by the Owner.

1.02 APPLICATION FORMS

- A. For applications for payment, use sample Contract Payment Request (see below), contract payment request on company letterhead, or AIA Document G702, supported by AIA Document G703, Continuation Sheet, or similar document.
- B. Prepare the Schedule of Values in such a manner that each major item of Work and each subcontracted item of Work is shown as a line item broken down in terms of material and labor costs on AIA Document G703, Application Certification of Payment, Continuation Sheet or similar format. The sample continuation sheet shall be the minimum Schedule of Values breakdown.
- C. The Schedule of Values shall be submitted for review by the Owner prior to the first application for payment; and may be used when, and only when, accepted in writing by the Owner.
- D. Payment request is to include the Contractor's Federal Tax Identification number and return address.

1.03 PAYMENTS

- A. The Owner will make progress payments on account of the Contract once monthly for the scheduled duration of the project (i.e. three (3) payments on a three-month project), based on the value of work accomplished or materials on the job site, as stated in the Schedule of Values on the Application and Certificate Payment.
- B. Notwithstanding the foregoing, as this project is scheduled to take 9 months to complete, Owner will only make 9 payments, plus a final retainage payment, as applicable.
- C. Complete and forward Application to the Owner on or about the 15th day of each month for work performed the previous month and include certified payroll statements as specified in the OSU General Conditions.

- D. Submit one (1) copy of forms requesting payment to the Owner.
- E. Payments will be made on protected materials on hand at the job site properly stored, protected, and insured.
- F. Estimated quantities shall be subject to the Owner's review and judgment.

1.04 EARLY PURCHASE AND PAYMENT OF MATERIALS AND EQUIPMENT

- A. Order materials and equipment requiring a long lead or waiting time early so as not to delay progress of the Work.
- B. The Contractor will be reimbursed for early order materials or equipment upon receipt and verification of quality and quantity against submittals and shipping documents by the Owner's Authorized Representative.
- C. Receipt shall be to the job site or stored at Owner's other premises in an orderly and safe manner, secured from normal weather damage.
- D. Security remains the responsibility of the Contractor.

END OF SECTION

CONTRACT PAYMENT REQUEST

DATE: _____

TO: University Financial Services
Oregon State University
3015 SW Western Blvd
Corvallis, OR 97333

Payment Request No. _____ Contract No. _____ Period from _____ to _____

Project: _____

Original Contract Amount \$ _____

Change Orders (Net Amount)..... \$ _____

Contract Total to Date \$ _____

=====

Total Completed and Stored to Date \$ _____

Less Retainage (5%), if applicable \$ _____

Total Earned, Less Retainage (if applicable) \$ _____

Less Previous Payments..... \$ _____

Net Amount Due this Request..... \$ _____

The undersigned Contractor certifies that, to the best of his/her knowledge, information, and belief, the Work covered by this request has been completed in accordance with the Contract Documents, that all amounts have been paid for Work for which previous applications for Payment were issued and payments received from the Owner, and that the amount shown herein is now due.

Contractor: _____

By: _____ Date: _____

Federal Tax ID Number: _____

Address: _____

CONTINUATION SHEET

NOTES:

Amounts are stated to the nearest penny.
 Use Column I on Contracts where variable retainage for line items may apply, or if retainage is required.

Change Orders are usually listed as the last items of the basic schedule.

Project Name: _____

Application No.: _____

Date: _____

Period To: _____

WRN No.: _____

A	B	C	D	E	F	G		H	I
Item No.	Description of work	Scheduled Value	Work Completed		Materials Presently Stored (Not in D or E)	TOTAL Completed & Stored (D+E+F)	% Completed (G/C)	Balance to Finish (C-G)	Retainage
			From Previous Applications	This Period					
TOTALS									

SECTION 01 2500

PRODUCT SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General requirements for the Work in relation to substitutions and product options.
- B. Submit to the Owner's property insurance carrier shop drawings, samples, and product data (such as manufacturer's standard schematic drawings and other literature) when required by individual Specifications sections.
- C. Related Work Specified Elsewhere
 - 1. Instructions to Bidders.
 - 2. OSU General Conditions.

1.02 REQUESTS FOR SUBSTITUTIONS

- A. Requests for substitution of products in place of those specified shall be in accordance with Instructions to Bidders, and as specified herein.

1.03 CONTRACTOR'S RESPONSIBILITIES

- A. Investigate proposed products and determine that they are equal or superior in all respects to products specified.
- B. Provide same guarantee for accepted substitutions as for products specified.
- C. Coordinate installation of accepted substitutions into the Work, making such changes as may be required for the Work to be complete in all respects.

1.04 SUBSTITUTIONS DURING BIDDING

- A. Submit two (2) copies of the following information with each request to the Owner:
 - 1. CSI substitution request form.
 - 2. Comparison of proposed substitution with product, material or system specified.
 - 3. Complete data, substantiating compliance of proposed substitution with the Contract Documents.
 - 4. Test numbers and supporting reports, indicating compliance with referenced standards.
 - 5. Evidence that warranty requirements are acceptable.
 - 6. Details indicating specific deviations proposed for the substitution.
 - 7. Reference and applicable Specification sections.
 - 8. Applicable product samples.
- B. All substitution requests shall be received in the Owner's office no less than ten (10) calendar days before bid opening. Requests received after this date will not be considered.

1.05 SUBSTITUTIONS DURING CONSTRUCTION

- A. Substitutions will normally not be considered after date of Contract except when required due to unforeseen circumstances.
- B. Within a period of thirty (30) days after date of Contract, the Owner may, at its option, consider formal written requests for substitution of products in place of those specified, when submitted in accordance with the requirements stipulated herein.
- C. One or more of the following conditions must be documented in any such request:
 - 1. Required for compliance with final interpretation of code or insurance requirements.
 - 2. Required due to unavailability of a specified product.
 - 3. Required because of the inability of the specified product to perform properly or to fit in the designated space.
 - 4. Substitution would be substantially in the best interest of the Owner in terms of cost, time, or other considerations.

1.06 SUBSTITUTIONS NOT PERMITTED

- A. If implied on submittals without first requesting approval thereof.
- B. If acceptance will require substantial revision of the Contract Documents.

END OF SECTION

SUBSTITUTION REQUEST FORM

TO: _____

PROJECT: _____

SPECIFIED ITEM:

Section	Page	Paragraph	Description
---------	------	-----------	-------------

The undersigned requests consideration of the following:

PROPOSED SUBSTITUTION: _____

Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes description of changes to Contract Documents which proposed substitution will require for its proper installation.

The undersigned states that the following paragraphs, unless modified on attachments, are correct:

1. The proposed substitution does not affect dimensions shown on Drawings.
2. The undersigned will pay for changes to the building design, including engineering design, detailing and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse effect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed substitution.

The undersigned further states that the function, appearance and quality of the Proposed Substitution are equivalent or superior to the Specified Item.

Submitted by:

Signature _____

Firm _____

Address _____

Date _____

Telephone _____

Attachments:

For use by Design Consultant:

Accepted Accepted as noted

Not Accepted Received too late

By _____

Date _____

Remarks _____

SECTION 01 3119

PROJECT MEETINGS

PART 1 GENERAL

1.01 PRE-CONSTRUCTION MEETING

- A. Architect/Engineer/Designer, Contractor and Owner will meet prior to start of the Work (within seven (7) days after notice to proceed) to discuss at least the following topics and any others of mutual interest.
1. Schedule of Values
 2. Permit Status/tree protection/erosion control
 3. List of sub-contractors
 4. Job inspections.
 5. Early purchase of, and/or lead time requirements for material and equipment/pre-purchase of equipment
 6. Monthly payment date/SOP for pay requests
 7. Portion of site to be occupied by construction.
 8. Parking/Staging areas
 9. Non-smoking campus requirements
 10. Maintenance of access and safety.
 11. Processing of field decisions and change orders
 12. Labor provisions/labor rates for subs
 13. Material submittals/deferred submittals
 14. Owner access during construction.
 15. Review of Contract Documents/review ADA requirements/cross-slopes
 16. Coordination procedures and separate contracts.
 17. Progress schedules.
 18. Critical Work sequencing.
 19. Safety and emergency procedures/24 hour contact numbers
 20. Security procedures.
 21. Hazardous materials.
 22. Progress meetings.
 23. Contract close-out.
- B. Location of Meeting: Project site

1.02 PROGRESS MEETINGS

- A. The Contractor will schedule and administer progress meetings and will:
1. Prepare agendas.
 2. Schedule progress meetings, frequency, time and day to be determined during pre-construction meeting.
 3. Make physical arrangements for and preside at meetings.
 4. Record minutes and include decisions.

5. Distribute copies of minutes to participants within four (4) days after meetings.
- B. Location of Meetings: Project site.
- C. Attendance:
1. The Owner or Owner's Authorized Representative.
 2. Contractor.
 3. Subcontractors affected by agenda.
 4. Project Architect/Engineer/as necessary.
 5. Owner will attend meeting to ascertain Work is expedited consistent with progress schedule and with Contract Documents.
- D. Minimum Agenda:
1. Review and approve minutes from previous meeting.
 2. Review Work progress since previous meeting.
 3. Discuss field observations, and problems.
 4. Review delivery schedules, construction schedule, and identify problems which impede planned progress.
 5. Review proposed changes.
 6. Material submittals.
 7. Note all new subcontractors performing Work at the job site.

END OF SECTION

SECTION 01 3323

SHOP DRAWINGS, PRODUCT DATA, SAMPLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submit to the Owner shop drawings, samples, and product data (such as manufacturer's standard schematic drawings and other literature) when required by individual Specifications sections.
- B. Related Work Specified Elsewhere
 - 1. Instructions to Bidders.
 - 2. OSU General Conditions.

1.02 SUBMITTAL SCHEDULING

- A. For items requiring review by the Owner only, submittals shall be sent to the Owner at least 15 calendar days before the date each is required for fabrication or installation.
- B. Submittals to be reviewed by Owner's consultants shall be sent to the Owner at least 20 calendar days before the date each is required for fabrication or installation.
- C. Submittals to be reviewed by Owner's property insurance carrier shall be sent to Owner as directed in individual specification sections.
- D. Submittals involving Substitution requests or other modifications requiring review by the Owner and/or the Owner's consultants shall be sent to the Owner at least 20 calendar days before the date each is required for fabrication or installation.

1.03 SUBMITTAL CONTENT AND FORMAT

- A. General Requirements:
 - 1. Shop Drawings: Submit in electronic format and, if requested by Owner's Authorized Representative, submit one reproducible transparency and 1 print of each drawing.
 - 2. Product Data: Submit electronically, and if requested by Owner's Authorized Representative, up to 6 hard copies.
 - 3. Samples: Submit the number and type stated in each Specification Section. Submit a minimum of three sets of color samples where color selection is required.
 - 4. Submittals shall include:
 - a. Date and revision dates return date requested.
 - b. Project title and number.
 - c. The names of the Contractor, subcontractor, supplier, and manufacturer.
 - d. Identification of product or material, with Specification Section number.
 - e. Relation to adjacent critical features of work or materials.
 - f. Field dimensions, clearly identified as such.

- g. Applicable standards, such as ASTM number or Federal Specification.
 - h. Identification of deviations from Contract Documents, and for products accompanied by Substitution request as required by Section 01 25 00.
 - i. Contractor's stamp legibly signed, essentially as follows:
 - 1) The undersigned, acting on behalf of the Contractor, certifies that this submittal has been reviewed and is approved; products have been verified as being as specified, field measurements and field construction criteria have been or will be coordinated, and the submittal is in compliance with Contract Documents.
5. Re-submission Requirements:
- a. Revise initial drawings as required and resubmit as specified for initial submittal.
 - b. Indicate on drawings any changes which have been made other than those requested by the Owner or the owner's consultants.
6. The Owner may return without review any submittal not meeting the requirements listed above.
- B. Shop Drawings:
- 1. Present data in a clear and thorough manner.
 - 2. Details shall be identified by reference to sheet and detail, schedule or room numbers shown on Contract Documents.
 - 3. Structural items shall be identified by location in the completed structure. Identify details by reference to contract sheet and detail numbers.
 - 4. Minimum sheet Size: 8 ½ x 11".
- C. Product Data:
- 1. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data:
 - a. Clearly mark each copy to identify pertinent product or models.
 - b. Show dimensions, weights, and clearances required.
 - c. Show performance data consisting of capabilities, ROM, KW, pressure drops, design characteristics and consumption; conforming as closely as possible to the test methods referenced in the Plans and Specifications.
 - d. Show wiring or piping diagrams and controls.
 - 2. Manufacturer's standard schematic drawings and diagrams:
 - a. Modify to delete information which is not applicable.
 - b. Supplement standard information to provide information specifically applicable to the Work.
- D. Samples:
- 1. Insure that samples are of sufficient size to indicate the general visual effect or color.
 - 2. Where samples must show a range of color, texture, finish, graining, or other property, submit sets of pairs illustrating the full scope of this range.

3. One (1) sample or one (1) set of approved samples will be retained by the Owner; final work will be measured against approved samples.

1.04 QUALITY ASSURANCE

- A. Process submittals in ample time for review, as applicable, so as to not delay the Work. All submittals shall be received by the Owner within ten (10) days after pre-construction.

1.05 DEFINITIONS

- A. The Owner will mark reviewed materials as follows:
 1. "No Exception Taken," which means fabrication, manufacture and/or installation may proceed.
 2. "Make Revisions Noted," which means fabrication, manufacture and/or installation may proceed with revisions as noted.
 3. "Revise and Resubmit," which means that fabrication, manufacture and/or installation may not proceed.
 4. "Rejected," which means do not proceed; make arrangements for the review of the proposed Work with the Owner as soon as possible.

1.06 PROCESSING

- A. Review submittals, make necessary corrections, and become familiar with the content of the submittals.
- B. Mark each item with Contractor's stamp.
- C. Accompany submittals with a transmittal letter bearing the project name, Contractor's name, number of items, and other pertinent data.
- D. Keep one copy of each reviewed submittal on the job site at all times.
- E. Be responsible for obtaining and distributing prints of shop drawings to the various suppliers, and the Owner once review process has been completed. Make prints of reviewed shop drawings only from transparencies which carry the appropriate stamp and endorsement.

END OF SECTION

SECTION 01 4213

ABBREVIATIONS AND SYMBOLS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Words which may be found elsewhere in the Project Manual and Drawings are abbreviated in accordance with the standards set forth in the following table:

A/C	air conditioning	CB	catch basin
AB	anchor bolt	CEM	cement
AC	asphaltic concrete	CF	cubic foot
ACT	acoustical tile	CFOI	contractor furnished owner installed
AD	area drain	CG	corner guard
ADD	addendum	CH	ceiling height
ADD'L	additional	CI	cast iron
ADH	adhesive	CJ	control joint
AFF	above finish floor	CKBD	chalkboard
AGG	aggregate	CL	centerline
AL	aluminum	CLG	ceiling
ALLOW	allowable	CLR	clear(ance)
ALT	alternate	CM	construction manager
ANOD	anodized	CMT	ceramic mosaic (tile)
AP	access panel	CMU	concrete masonry unit
APPRX	approximate	COL	column
ARCH	architect(ural)	COM	communications
ASPH	asphalt	CONC	concrete
AUTO	automatic	CONN	connect(ion)
AVE	avenue	CONST	construction
BD	board	CONT	continuous or continue
BIT	bituminous	CONTR	contract(or)
BLDG	building	CPT	carpet
BLKG	blocking	CRS	course(s)
BM	bench mark, beam(s)	CS	countersink
BOT	bottom	CSMT	casement
BRZ	bronze	CT	ceramic tile
BS	both side	CTR	center
		CVG	clear vertical grain
		CW	cold water

CWT	ceramic wall tile	EXH	exhaust
CY	cubic yard	EXP	exposed
		EXT	exterior
D	depth	FA	fire alarm
DEMO	demolish, demolition	FAF	fluid applied flooring
DEP	depressed	FARF	fluid applied resilient floor
DF	drinking fountain	FAS	fasten, fastener
DIA	diameter	FBD	fiberboard
DIAG	diagonal	FBT	finished blowing temperature
DIM	dimension	FD	floor drain, fire damper
DISP	dispenser	FE	fire extinguisher
DIV	division	FEC	fire extinguisher cabinet
DL	dead load	FF	factory finish
DMT	demountable	FGL	fiberglass
DN	down	FHMS	flathead machine screw
DP	dampproofing	FHWS	flathead wood screw
DR	door	FIN	finish(ed)
DS	downspout	FLCO	floor cleanout
DT	drain tile	FLR	floor(ing)
DTL	detail	FLUR	fluorescent
DW	dumbwaiter	FND	foundation
DWG	drawing(s)	FOC	face of concrete
DWR	drawer	FOIC	furnished by owner/installed by contractor
EA	each	FOIO	furnished by owner/installed by owner
EB	expansion bolt	FOM	face of masonry
EF	each face	FP	fireproofing, flash point
EJ	expansion joint	FPHB	freeze-proof hose bib
EL	elevation	FR	fire resistive, fire rated
ELEC	electric(al)	FRM	frame(d), (ing)
EMBED	embedment	FS	full size
EMER	emergency	FSS	finished structural slab
ENCL	enclose(ure)	FT	foot
EP	electrical panel board	FTG	footing
EQ	equal	FTS	finished topping slab
EQUIP	equipment		
EST	estimate	GA	gage, gauge
EVT	equiviscious temperature	GALV	galvanized
EW	each way	GB	grab bar or gypsum board
EWC	electric water cooler		
EX.EXIT	existing		

GC	general contractor	LAM	lamine(d)
GI	galvanized iron	LAV	lavatory
GL	glass, glazing	LBS	pounds
GLS	glass resin wall surfacing		
GP	gypsum	LH	left hand
		LL	live load
HB	hose bib	LONGIT	longitudinal
HBD	hardboard	LP	low point
HC	hollow core	LW	lightweight
HD	heavy duty		
HDR	header	MAX	maximum
HDW	hardware	MB	machine bolt
HM	hollow metal	M. MECH	mechanic(al)
HOR	horizontal	MFR	manufacture(r)
HP	high point	MH	manhole
HR	hour	Min	minimum, minute
HT	height	MISC	miscellaneous
HTG	heating	MO	masonry opening
HVAC	heating, ventilating, air conditioning	MO#	model number
		MOD	modular
HWD	hardwood	MPH	miles per hour
HWH	hot water heater	MS	machine screw
		MTL	metal
ID	inside diameter, identification	MULL	mullion
IN	inch	MWP	membrane waterproofing
INCIN	incinerator		
INCL	include(d), ion)	NAT	natural, natural finish
INT	interior	NIC	not in contract
INV	invert	NO	number
		NOM	nominal
JB	junction box	NTS	not to scale
JC	janitor's closet		
JT	joint	OA	overall
		OBS	obscure
KD	kiln dried	OC	on center(s)
KCP	Keene's cement plaster	OD	outside diameter
KO	knockout	OF	overflow
KP	kick plate	OFCI	owner furnished contractor installed
		OFOI	owner furnished owner installed
LAB	laboratory	OHMS	ovalhead machine screw

OHWS	ovalhead wood screw		
OPG	opening	SC	solid core
OPP	opposite	SCHEd	schedule
OZ	ounce(s)	SEC	section
		SF	square feet (foot)
P	paint(ed)	SHT	sheet
PB	push button	SHTHG	sheathing
PCF	pounds per cubic foot	SIM	similar
PCP	putting coat plaster	SL	sleeve
PERF	perforate(d)	SOG	slab on grade
PL	plate, property line	SPEC	specification(s)
PLAM	plastic laminate	SQ	square
PLAS	plaster	SS	storm sewer
PNL	panel	S4S	finished 4 sides
PP	push plate	SD	storm drain
PR	pair	ST	steel, street
PREP	prepare	ST ST	stainless steel
PSF	pounds per square foot	STD	standard
PSI	pounds per square inch	STR	structural
PT	point, pressure treated	SUPP	supplement
PTN	partition	SUPT	support
PVC	polyvinyl chloride	SUSP	suspended
PWD	plywood	SV	sheet vinyl
QT	quarry tile	T	tread
		TBM	top bench mark
R	rise	T&G	tongue and groove
RA	return air	TB	towel bar
RAD	radius	TC	top of curb
RCP	reflected ceiling plan	TEL	telephone
RD	roof drain	TEMP	tempered
REF	reference	THK	thickness
REFR	refrigerator	TKBD	tackboard
REINF	reinforce(ing)	TO	top of
REQ	required	TP	top of paving
RET'G	retaining	TRANS	transverse
REV	revision(s), revised	TS	top of slab
RH	right had	TV	television
RM	room	TW	top of wall
RO	rough opening	TYP	typical
RSF	resilient sheet flooring		

UNO	unless noted otherwise	W/	with
VAT	vinyl asbestos tile	W/O	without
VB	vapor barrier	WC	water closet
VCT	Vinyl Composition Tile	WD	wood, wood finish
VERT	vertical	WP	waterproof(ing)
VG	vertical grain	WNS	wainscot
VIF	verify in field	WR	water resistant
VWC	vinyl wall covering	WS	waterstop
W	width, wide, water	WW	window wall
		WWC	wood wall covering
		WWF	woven wire fabric

B. Words which may be found elsewhere in the Project Manual and Drawings are abbreviated in accordance with the standards set forth in the following table:

&	and
λ	angle
@	at
τ	diameter, round
"	inches
:	is, shall b
'	feet
ζ	perpendicular
/	per
%	percent
#	pound, number
X	by (as in 2 by 4)

END OF SECTION

SECTION 01 4216

DEFINITIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Words which may be found elsewhere in the Contract Documents are defined in accordance with the standards set forth in the following table:

Approve:

Where used in conjunction with Architect's response to submittals, requests, applications, inquiries, reports and claims by Contractor, the meaning of term "approved" will be limited to the Architect's responsibilities and duties as specified in General and Supplementary Conditions. In no case will "approval" by Architect be interpreted as a release of Contract requirements.

As Detailed, As Shown:

Where "as detailed", "as shown" or words of similar importance are used, it shall be understood that reference to the Drawings accompanying the Specifications is made unless otherwise stated.

As Directed, As Required, As Authorized, As Reviewed, As Accepted:

Where "as directed", "as required", "as authorized", "as reviewed", "as accepted" or words of similar importance are used, it shall be understood that the direction, requirement, permission, authorization, review, or acceptance of the Architect is intended, unless otherwise stated.

As Indicated:

Where "as indicated" is used it shall be understood that reference to Drawings and/or Specifications is made unless otherwise stated.

Directed, Requested, etc.:

Terms such as "directed," "requested," "authorized," "selected," will be understood as "directed by Architect," "requested by Architect," and similar phrases shall not be interpreted to extend Architect's responsibility into Contractor's responsibility for construction supervision.

Furnish:

Except as otherwise defined in greater detail the term "furnish" is used to mean supply and deliver to project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

Indicated:

The term "indicated" is a cross-reference to graphic representations, notes or schedules on drawings, to other paragraphs or schedules in the specifications and to similar means of recording requirements in Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used in lieu of "indicated," it is for purpose of helping reader locate cross-reference and no limitation of location is intended except as specifically noted.

Install:

Except as otherwise defined in greater detail, the term "install" is used to describe operations at project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations, as applicable in each instance.

Installer:

The term "installer" is defined as the entity (person or firm) engaged by Contractor, or its subcontractor or sub-subcontractor for performance of a particular unit of Work at project site, including installation, erection, application and similar required operations. It is a general requirement that such entities (Installers) be expert in operations they are engaged to perform.

Provide:

Except as otherwise defined in greater detail, term "provide" means furnish and install, complete and ready for intended use, as applicable in each instance.

END OF SECTION

SECTION 01 4219

REFERENCE STANDARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Quality Assurance.
- B. Location of References.
- C. Schedule of References.

1.02 QUALITY ASSURANCE

- A. For products or quality of work specified by association, trade, or federal standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current on date of Contract Documents.
- C. General Applicability of Standards: Except where Contract Documents include more stringent requirements, applicable standards of the construction industry have the same force and effect as if bound or copied directly into Contract Documents.
- D. Such standards are made a part of the Contract Documents by reference.
- E. Individual sections indicate which codes and standards the Contractor must keep at the project site, available for reference.
- F. Referenced industry standards take precedence over standards which are not referenced but recognized in industry as applicable.
- G. Non-referenced standards are not directly applicable to the Work, except as a general requirement of whether the Work complies with standards recognized in the construction industry.

1.03 LOCATION OF REFERENCES

- A. Valley Library, Oregon State University.

1.04 SCHEDULE OF REFERENCED ASSOCIATIONS

AIA American Institute of Architects

	WWW.AIA.ORG
AISC	American Institute of Steel Construction WWW.AISC.ORG
AISI	American Iron and Steel Institute WWW.STEEL.ORG
ANSI	American National Standards Institute WWW.ANSI.ORG
APA	American Plywood Association WWW.APAWOOD.ORG
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers WWW.ASHRAE.ORG
ASTM	American Society for Testing and Materials WWW.ASTM.ORG
AWPA	American Wood Protection Association WWW.AWPA.COM
AWS	American Welding Society WWW.AWS.ORG
BIA	Masonry Institute of America WWW.MASONRYINSTITUTE.ORG
BOLI	Oregon Bureau of Labor and Industries WWW.BOLI.STATE.OR.US
CCB	Construction Contractors Board WWW.OREGON.GOV.CCB/
CDA	Copper Development Association WWW.COPPER.ORG
CISPI	Cast Iron Soil Pipe Institute WWW.CISPI.ORG
CSI	Construction Specification Institute WWW.CSINET.ORG
DEQ	Department of Environmental Quality (Oregon) WWW.OREGON.GOV/DEQ/

DHI	Door and Hardware Institute WWW.DHI.ORG
DOT	Department of Transportation WWW.DOT.GOV
EPA	U.S. Environmental Protection Agency WWW.EPA.GOV
FM	Factory Mutual System WWW.FMGLOBAL.COM
FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) WWW.GSA.GOV/PORTAL/CONTENT/103856
IBC	International Building Code WWW.ICCSAFE.ORG
ICBO	International Conference of Building Officials PUBLICECODES.CITATION.COM/ICOD/IBG/INDEX.HTM
IRS	Internal Revenue Service WWW.IRS.GOV
ISA	Instrumentation Systems and Automation Society WWW.ISA.ORG
NAAMM	National Association of Architectural Metal Manufacturers WWW.NAAMM.ORG
NBFU	National Board of Fire Underwriters WWW.NFPA.ORG
NEC	National Electric Code WWW.NECPLUS.ORG
NEMA	National Electrical Manufacturers' Association WWW.NEMA.ORG
NESC	National Electrical Safety Code WWW.IEEE.ORG
NFPA	National Fire Protection Association WWW.NFPA.ORG

NRCA	National Roofing Contractors' Association WWW.NRCA.NET
OAR	Oregon Administrative Rules ARCWEB.SOS.STATE.OR.US/404.HTML
OESP	State of Oregon Electrical Specialty Code http://www.bcd.oregon.gov/programs/online_codes.html
ORS	Oregon Revised Statutes LANDRU.LEG.STATE.OR.US/ORS/
OSHA	Occupational Safety and Health Administration WWW.OSHA.GOV
OSSC	Oregon Structural Specialty Code http://www.bcd.oregon.gov/programs/online_codes.html
PS	Product Standard STANDARDS.GOV/STANDARDS.CFM
SDI	Steel Door Institute WWW.STEELDOOR.ORG
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association WWW.SMACNA.ORG
SPRI	Single Ply Roofing Institute WWW.SPRI.ORG
SSPC	Steel Structures Painting Council WWW.SSPC.ORG
SWRI	Sealing, Waterproofing and Restoration Institute WWW.SWIRONLINE.ORG
UBC	Uniform Building Code (See ICBO)
UFC	Uniform Fire Code WWW.NFPA.ORG
UL	Underwriters' Laboratories, Inc. WWW.UL.COM
UMC	Uniform Mechanical Code WWW.UBC.COM

UPC Uniform Plumbing Code
 WWW.UBC.COM

WHL Warnock Hersey Laboratories
 WWW.INTEK.COM/MARKS/WH/

WCLIB West Coast Lumber Inspection Bureau
 WWW.WCLIB.ORG

WWPA Western Wood Products Association
 WWW.WWPA.ORG

END OF SECTION

SECTION 01 4500

QUALITY CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Codes, regulations and permits.
- B. Procedures for quality control.

1.02 OWNER RESPONSIBILITIES

- A. Owner will employ and pay for services of an independent testing laboratory to perform inspection, sampling and testing as required by local building authority.
- B. Owner's Authorized Representative will provide on-site observation during construction.

1.03 CODES, REGULATIONS AND PERMITS

- A. All Work shall conform with the Oregon Structural Specialty Code (OSSC) based on the International Building Code (IBC), as amended by the State of Oregon Building Codes Division and the edition designated by the governing authority.
- B. Contractor shall comply with all applicable state and local construction codes.
- C. References to codes, Specifications and standards referred to in the Contract Documents shall mean, and are intended to be, the latest edition, amendment or revision of such reference standard in effect as of the date of these Contract Documents.
- D. The Owner shall be responsible for all permits and City of Corvallis plan review fees; the Contractor shall be responsible for all licenses and associated fees required for the Project.
- E. Contractor shall arrange and attend all required permit inspections and furnish evidence of approved City inspection reports per Section 01 77 00.

1.04 QUALITY OF WORK

- A. It is the true and specific intent of these Specifications that quality of Work on all phases of the construction and embracing all the trade sections shall be of high quality performed by workers skilled in their trade and performing their Work only according to the standard of best practice of the trade.
- B. All manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with manufacturer's directions unless otherwise specified.
- C. If Work is required in a manner to make it impossible to produce first quality Work, or

should discrepancies appear among Contract Documents, request interpretation from Architect before proceeding with Work.

- D. Failure to secure interpretation may cause rejection by Architect or owner of installation.

1.05 LAYOUT

- A. Be responsible for properly laying out the Work and for lines and measurements for the Work.
- B. Verify the figures shown on the drawings before laying out the Work and report errors or inaccuracies to the Architect before commencing Work.
- C. Strict compliance with maximum slopes is required. Accessible parking spaces and adjacent access aisles with slope exceeding 2% in any direction, as determined by OSU, shall be removed and replaced by the contractor at their expense.
- D. Strict compliance with maximum slopes is required. New sidewalks exceeding 1:20 slope or with cross slope exceeding 2%, as determined by OSU, shall be removed and replaced by the contractor at their expense. Ramps exceeding 1:16 slope or with cross slope exceeding 2%, as determined by OSU, shall be removed and replaced by the contractor at their expense.

1.06 SUPERVISION

- A. The Contractor shall maintain effective supervision on the project at all times Work is being performed.
- B. The superintendent shall be the same person throughout the project and shall attend the preconstruction conference.

1.07 INSPECTIONS AND TESTING

- A. Contractor shall notify the Owner at least twenty-four (24) hours in advance of any required progress inspection or final inspection including final punch list inspection.
- B. Cooperate with laboratory personnel, provide access to Work and furnish incidental equipment material and labor required for field testing and sample taking.

1.08 EVALUATION OF TESTS AND INSPECTIONS

- A. Results of laboratory and/or field control tests and inspections shall be the principal basis upon which satisfactory completion of Work shall be judged.
- B. If results of tests and inspections indicate Work is below requirements of Contract Documents, that portion of Work is subject to rejection.

1.09 ADJUSTMENTS

- A. Remove and replace Work so rejected at Contractor's expense including costs of subsequent tests and inspections until Work meets requirements of Contract

Documents.

- B. The Owner reserves the right to perform any testing as may be required to determine compliance with the Contract Documents.
- C. Costs for such testing will be the Owner's responsibility unless testing indicates noncompliance. Cost for such testing indicating noncompliance shall be borne by the Contractor.
- D. Noncomplying Work shall be corrected and testing will be repeated until the Work complies with the Contract Documents.
- E. Contractor will pay costs for retesting noncomplying Work.

END OF SECTION

SECTION 01 5100

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security and protection.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction.
- B. Standards: Comply with NFPA Code 241, "Building Construction and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition".
- C. Electrical Service: Comply with NEMA, NEC and UL standards and regulations for temporary electric service; install service in compliance with National Electric Code (NFPA 70).
- D. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use; obtain required certifications and permits if required.

1.03 PROTECTION

- A. Protect sidewalks, asphalt paving, concrete, trees, shrubs, and lawn areas at all times from damage resulting from construction activities.
- B. Prevent materials from clogging catch basins and yard drains; leave drains clean and in proper working condition.
- C. Protect Existing Irrigation Systems:
 - 1. In the event damage occurs to an underground irrigation system as a direct result of a Contractor's activities, the Contractor shall repair/replace or be assessed a charge at the discretion of the Owner.
 - 2. If repairs are to be made by the Contractor, the repairs will be inspected by the Owner's Authorized Representative prior to backfilling.
 - 3. Any galvanized pipe that requires repair shall be repaired at a threaded coupling, not by use of a compression coupling.
- D. Protect Existing Air Handling Systems:
 - 1. Contractor shall be responsible for protection of the cleanliness of the existing air handling system at all times. This protection shall include:
 - a. During site work or building demolition, prefilters shall be provided and maintained on all building outside air intakes at all times throughout the construction duration.

- b. During any interior work that may create dust in the interior space and adjacent corridor/hallways, air filters shall be provided and maintained on all affected air return and exhaust grilles. Where air flow in or out of the space is not required, all air duct openings shall be temporarily blanked off with plywood or sheet metal.
 - c. Prior to starting any work, the Contractor shall record and submit to the Owner's Authorized Representative, pressure readings across all existing air handler air filter banks before installation of new prefilters.
 - d. Upon completion of all Work affecting existing air handling systems, the Contractor shall remove all temporary filters, covers and associated parts and restore the system to its original operating condition unless otherwise stated elsewhere in the Contract Documents
- E. Clean, repair, resurface, or restore existing surfaces to their original, or better, condition, or completely replace such surfaces to match existing, where damaged by construction operations.
- F. Security is the responsibility of the Contractor.
- G. Construction Debris:
- 1. Debris shall not be allowed to remain around the buildings during performance of Work, but shall be disposed of as rapidly as it accumulates.
 - 2. On completion of Work, the buildings and grounds shall be left in a condition that is equal to or better than original condition.
 - 3. In case of failure to do so, the Owner may remove rubbish and charge the cost to the Contractor.
- H. The Contractor shall manage a safe job environment for both the safety of all the people around the Work site as well as the safety of the Owner's and general public's property.
- I. The Contractor shall provide and maintain suitable barricades, shelters, lights, and danger signals during the progress of the Work; they shall meet the requirements of the local building code and OSHA.

1.04 DRAINAGE

- A. Verify that all rain drains in the construction areas are in working order and notify the Owner's Authorized Representative in writing of any rain drains that are plugged, prior to the start of the Work.
- B. Start of Work will be considered as acknowledgment that all drains are clear and in good working order.
- C. All drains shall be left in a clean and proper working condition.

1.05 CONSTRUCTION PROJECT SAFETY FORM

- A. Contractor shall submit to the Owner, prior to signing the Contract, the completed

"Construction Project Safety Form", which is provided with instructions at the end of this Section.

1.06 TEMPORARY UTILITIES

- A. Temporary Utilities:
 - 1. Prepare a schedule indicating dates for implementation and termination of each temporary utility.
 - 2. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of the permanent service.
- B. Conditions of Use:
 - 1. Keep temporary services and facilities clean and neat in appearance.
 - 2. Operate in a safe and efficient manner.
 - 3. Take necessary fire prevention measures.
 - 4. Do not overload facilities or permit them to interfere with progress.
 - 5. Do not allow hazardous, dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.
- C. Electrical Service:
 - 1. Service limited to 20 amp 120V circuits will be paid for by the Owner.
 - 2. Connection to the service shall be the responsibility of the Contractor, with the Owner's approval.
 - 3. Coordinate with the Owner's Authorized Representative.
- D. Water Service:
 - 1. Service in reasonable quantities for the Project will be paid for by the Owner.
 - 2. Connection to the service shall be the responsibility of the Contractor, with the Owner's approval.
 - 3. Coordinate with the Owner's Authorized Representative.

1.07 TEMPORARY SUPPORT FACILITIES

- A. Temporary Sanitary Facilities:
 - 1. Provide and maintain an adequate number of facilities for the use of all persons employed on the Work during construction.
 - 2. Provide enclosed, weatherproof facilities with heat as required.
 - 3. Use of new or existing Owner's facilities will not be permitted.
- B. Temporary Heat and Ventilation:
 - 1. As necessary, provide temporary heat and ventilation required by construction activities, for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.

- C. Telephone Equipment: Provide telephone communications at project site.
- D. Existing Services:
 - 1. Do not interrupt any existing service.
 - 2. Prior request and approval of the Owner's Representative will enable the Owner to shut down any utility required by the Work.
 - 3. Contractor shall not shut down utilities.

1.08 TEMPORARY BARRIERS AND ENCLOSURES

- A. Provide barriers and fencing to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage.
- B. Provide Commercial grade chain link fence construction.
- C. Provide 6 foot high fence around construction site as directed by Owner's Authorized Representative; equip with vehicular and pedestrian gates with lock.
- D. Exterior Closures: Provide temporary secured, weather-tight closures at exterior openings, to permit acceptable working conditions and protection of the Work.
- E. Interior Closures:
 - 1. Provide temporary floor to ceiling partitions (not plastic sheeting) and ceilings as required to separate work areas from Owner occupied areas, to prevent penetration of dust and moisture into Owner occupied areas, to reduce construction noise, and to prevent damage to existing materials and equipment.
 - 2. Paint surfaces exposed to view from Owner occupied areas.

1.09 ODORS

- A. Work that causes excessive odors shall be performed only after coordination with the Owner's Authorized Representative. Filtering of air intakes to units may be required to prevent odors and vapors from entering the buildings.
- B. Contractor shall provide 7 days advance notice to the Owner's Authorized Representative in order for advance notice to be forwarded to building occupants. Work stoppage may occur if advance notification has not been coordinated or odors and vapors from the work are found to generate complaints from building occupants.

1.10 FIRE SAFETY

- A. Ensure that required exit routes remain unobstructed while building is occupied.
- B. Abide by all fire safety requirements for buildings under construction, alteration or demolition as required by Article 87, of the Uniform Fire Code as adopted by the State of Oregon.
- C. An emergency telephone shall be provided on site. Cellular telephone equipment is acceptable.
- D. Fire Suppression Equipment:

1. Install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers", and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations".
2. Maintain equipment in working condition with current inspection certificate attached to each.
3. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
4. Store combustible materials in containers in fire-safe locations.
5. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways, and other access routes for fighting fires.
- 6.
6. Provide continual supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.
7. When possible, relocate hot work to a designated hot work area.
8. If the materials or equipment cannot be relocated to a designated hot work area, use the least hazardous form of hot work that will get the job done and prepare the area properly.
9. Manage mobile hot work using the formal hot work permit system. (mentioned in the next bullet point and also a directive in the OSU Hot Work Safety Program)
10. Make sure both fire protection and hot work equipment work properly.
11. Train all personnel involved in hot work operations and activities so that they have the understanding, knowledge, and skills necessary to safely perform their jobs.

1.11 CONSTRUCTION AIDS

- A. Scaffolding: comply with applicable OSHA requirements.
- B. Material Handling Equipment:
 1. Provide necessary cranes, hoists, towers, or other lifting devices.
 2. Use only experienced operators.
 3. Remove equipment as soon as possible after task is ended.
 4. Coordinate placement of such equipment with Owner's Authorized Representative.
 5. Obtain required permits and meet requirement of governing authorities regarding applicable regulations.
- C. Materials or debris shall not be allowed to free fall from building.
- D. The use of chutes or conveyors must be approved by Owner.

1.12 TEMPORARY CONTROLS

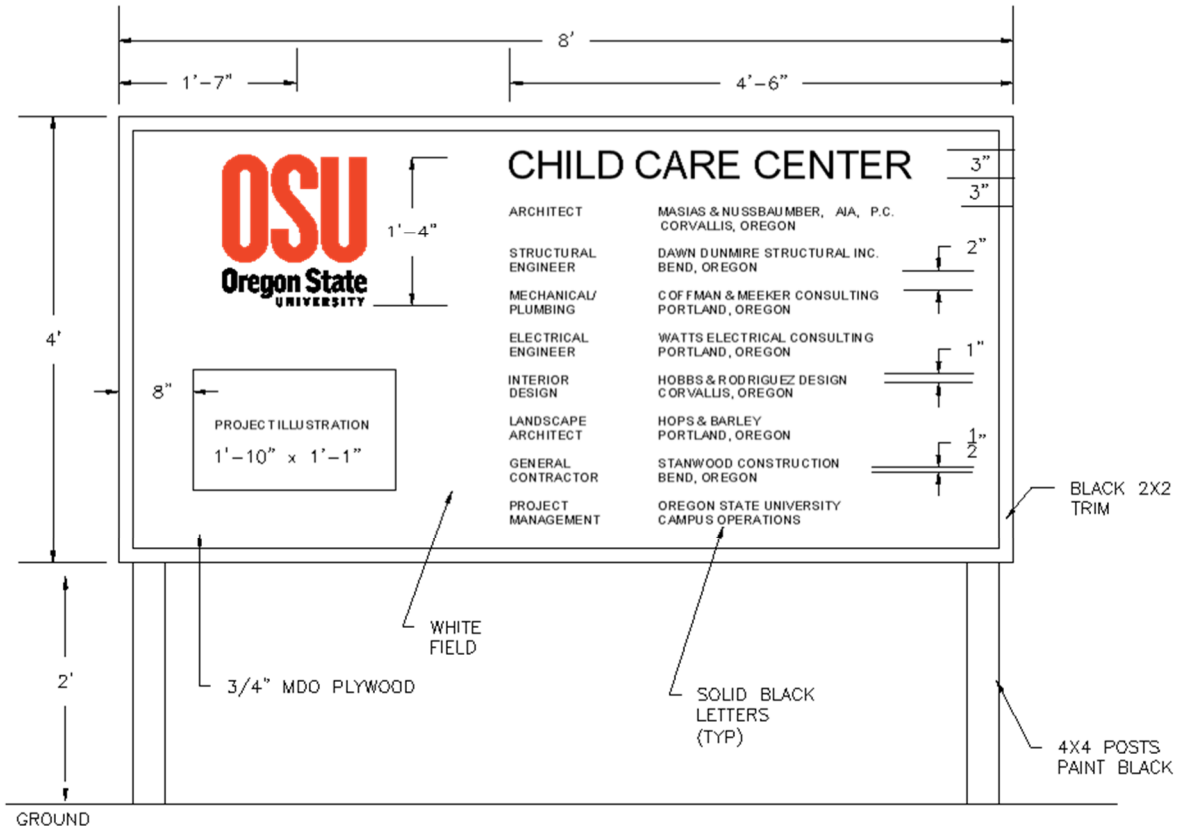
- A. Water Control:
 1. Maintain excavations free of water.
 2. Provide, operate, and maintain necessary pumping equipment.

- B. Protection:
 - 1. Protect installed Work and provide special protection where specified in individual specification sections.
 - 2. Prohibit traffic or storage upon waterproofed or roofed surfaces.
- C. Security:
 - 1. Provide security and facilities to protect Work and existing facilities and Owner's operations from unauthorized entry, vandalism, or theft.
 - 2. Coordinate operations with Owner's Authorized Representative.
- D. Temporary Traffic Control /Pedestrian Accessibility
 - 1. A continuous route for all pedestrians, including persons with disabilities and bicyclists, shall be maintained at all times. When existing pedestrian facilities are disrupted, closed, or relocated in a construction zone, temporary pedestrian facilities shall be provided.
 - 2. Temporary pedestrian facilities should be safe and accessible. There should be no curbs or abrupt changes in grade that could cause tripping or be a barrier to wheelchair use.
 - 3. Signage shall be provided directing people to the temporary accessible route. The signage shall include the International Symbol of Accessibility.
 - 4. Contractors shall not block temporary walkways with vehicles, equipment, construction materials, signs, trash, or other objects that might prohibit pedestrian passage.
 - 5. Construction equipment and equipment operation must be separated from any open walkways. At construction zones, pedestrian fences or other protective barriers shall be provided to prevent access into the construction zone.

1.13 PROJECT SIGNAGE

- A. Contractor is permitted to post only one project identification sign based on the following example:

OSU TYPICAL JOB SIGN



1.14 PREPARATION

- Consult with Owner to review jobsite areas required for field offices, material storage and stockpiles, equipment storage, access to different locations, etc.

1.15 PERFORMANCE

- Confine equipment, apparatus, and storage of material to work limits. The Owner will not be responsible for protection of materials and equipment from damage, pilfering, etc.
- Install temporary facilities in such a manner that the installed work will not be damaged.
- Do not use facilities of existing building unless authorized in writing by the Owner.
- Effective September 1, 2012, OSU became a non-smoking campus and smoking is prohibited on all Campus property.
- Keep facilities well maintained.
- Relocate temporary facilities as required during job progress.

- G. At Substantial Completion, clean and renovate permanent facilities that have been used during the construction period, including but not limited to:
1. Replace air filters and clean inside of ductwork and housings.
 2. Replace significantly worn parts and parts that have been subject to unusual operating conditions.
 3. Replace lamps that are burned out or noticeably dimmed by substantial hours of use.

END OF SECTION

Oregon State University Construction and Maintenance Safety Requirements

EH&S, 130 Oak Creek Building, Corvallis, OR 97331-7405, (541) 737-2505,
FAX (541) 737-9090

Complete OSU Construction and Maintenance Safety Form - Send completed documents (including Site Safety Plan and all separate answer pages) to Construction Contract Administration along with the signed contract and bonds.

Project Isolation - All construction and remodeling activities regardless of size and/or scope must be fenced, barricaded, or otherwise protected to restrict entrance and to ensure the safety of those in the general area. See isolation requirements.

Site Safety Plan - A site safety plan will be required and will address:

- General Information
- Emergency Information
- Key Organization Personnel
- Hazard Evaluation/Facility Impact
- Emergency Procedures
- Work Zones
- Security Measures
- Fire Protection

A model plan is attached. This form can be used if another plan has not already been prepared. Contact OSU Environmental Health & Safety for more information 737-2505.

Isolation Requirements

General: All construction, maintenance, and remodeling activities, regardless of size or scope, must be fenced, barricaded, or otherwise isolated to restrict entrance and to ensure the safety of those in the general area.

Outdoor Activities: Outdoor projects require the following perimeter isolation:

- A six foot chain-link fence, with controlled access points, extending in all directions around the excavation or building site such that no area of the construction is accessible to pedestrians or unauthorized personnel or vehicles.
- Isolation area will include vehicle loading and unloading areas.
- At the University's option, other barricading plans may be accepted. These may apply to projects such as road resurfacing, parking lot striping, exterior building water proofing, deliveries, etc. Contact EH&S regarding other barricading plans.

Overnight: Any excavation across or adjacent to sidewalks or pathways which must be left open overnight, must be identified with working, blinking construction lights in addition to solid barricades

Indoor Activities: Indoor construction or maintenance projects which will create dust, potentially hazardous fumes or vapors, or offensive odors are subject to the following isolation:

- Areas where existing doors can provide isolation will be labeled "Construction Area--Authorized Personnel Only".

- All other areas will be isolated by a solid barrier. The minimum barrier allowed is 4 mil poly sheeting sealed to prevent migration of dust.
- Mechanical ventilation may be required.
- A solid wall is required if building envelope is opened to the outside.

Contractor Responsibilities

- The contractor will provide all barricading, isolation, and fencing material. OSU will not provide any materials.
- The contractor will also provide all appropriate warning and detour signs when sidewalks, exits, or roads are closed.
- Contractor will provide all other construction area signs.

OSU Construction and Maintenance Safety Form

Send completed safety documents to Construction Contract Administration with contract and bonds.

Date: _____ Project: _____

Start Date: _____ Completion date: _____

Contractor: _____ Contact: _____

Work # _____ 24 hr #: _____

OSU Project Mgr: _____ Work / 24hr #'s: _____

Dept Contact: _____ OSU EH&S Contact: _____

Preconstruction meeting? **Y N** Date/Time/Location: _____

For the following items, prepare answers on a separate sheet for all items marked "Yes". Precede each answer with the appropriate item number. All boxes need to be checked

Y	N	For This Project	If YES, then:
		1 Will any confined spaces be accessed?	Describe location of entry Specify location of permit Notify EH&S prior to entry See SAF 209
		2 Will hot work be performed (welding, cutting, brazing, etc.)?	Provide min. 5# 2A10BC extinguisher within 10 ft If indoors - provide and describe ventilation See SAF 214
		3 Any products brought to campus?	Provide MSDS on site prior to first use; Make available to OSU on request
		4 Will lead paint be impacted?	Describe plan to limit contamination
		5 Will asbestos-containing-material be impacted?	Coordinate with OSU asbestos manager
		6 Will <u>any</u> materials (construction debris, soil, water, etc) be removed from campus?	Describe in detail identity and disposition of material (how, where)
		7 Any open trenches or holes?	Describe isolation procedures (see Page 1)
		8 Will a crane be used?	Describe crane safety plan (include plan to prevent loads above occupied areas)
		9 Is this project building a new facility, a major remodel?	Provide Site Safety plan Describe isolation procedures (see Page 1)
		10 Is this a minor remodeling project?	Provide, or fill out model Site Safety Plan form (see Page 3) Describe isolation procedures (see Page 1)
		11 Will air contamination be produced (e.g. dust, CO, solvent vapors, VOCs, odors)?	Describe project ventilation and isolation Indicate position of building air intake(s)
		12 Will there be noise > 85 dB?	Describe noise minimization plan
		13 Will this project use a scaffold or an external chute?	Describe isolation, dust control, installation
		14 Will this project involve a working surface >6' above a lower level	Describe fall protection
		15 Will any "blind" saw-cuts or penetrations be made in existing foundations, floors, ceilings and/or walls?	Describe plan for detecting and protecting power lines or other building utility lines.

EH&S Review: _____ Date: _____

Model Site Safety Plan

1. General Information

Contractor name _____
 Address _____
 City, State, Zip _____
 Site Safety Officer _____ Project Dates _____
 Project Name _____

2. Emergency Information

Emergency Response	911	OSU EH&S and OSU Facilities Services must be notified in the event of an emergency
Hazardous Materials Spill		
MSDS on-site location		
OSU EH&S	(541) 737-2505	
Facilities Services	(541) 737-2969	

3. Contractor Key Personnel

	Name	Phone	Emergency Contact
Company Owner			
Project Manager			
Job Supervisor			
Site Safety Officer			
Other Responsible Individual			
24 Hour Notification			

List of employees on site _____

4. Hazard Evaluation/ Facility Impact	
Physical	Yes / No
Heavy Equipment	
Noise	
Heat	
Elevation	
Radiation Materials	
Excavations	
Underground Utilities	
Confined Spaces	
Fire Prevention	
Electrical	

5. Emergencies
Services
Evacuation Route
First Aid Location
Hazardous Materials Spill Procedure

6. Work Zones

Material Storage _____
 Parking locations _____
 Individuals with OSU keys _____
 Access issues _____

7. Security measures

8. Fire protection

SECTION 01 5639

TREE AND PLANTING PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Section includes temporary fencing, barricades, and guards to protect trees, plants and groundcovers not indicated to be removed, as necessary and required to prevent damage above and below grade.

1.02 DEFINITIONS

- A. Dripline: Outer perimeter of branches of any tree or plant.
- B. Groundcover: Includes but not limited to plants and grass.

1.03 PERFORMANCE REQUIREMENTS

- A. The Contractor shall exercise utmost care to protect existing trees and plants designated to remain and shall comply with all protection requirements provided by Owner and City of Corvallis as conveyed through the Owner's Authorized Representative.
- B. The Contractor shall install tree protection fencing as detailed and shall prevent damage to shrubs, groundcover, trees, root systems, soil, bark, foliage, branches and limbs due to construction activities, including but not limited to:
 - 1. Soil contamination, erosion, and compaction.
 - 2. Excessive wetting, and ponding due to storm water, and construction run-off.
 - 3. Alteration of grade, stockpiling of soil, debris, and materials.
 - 4. Damage to soil, roots, bark, trunk, limbs, branches, and foliage.
 - 5. Prevent unauthorized cutting, breaking, skinning and bruising of roots, branches, and bark.

1.04 SUBMITTALS

- A. Procedural proposal for tree and plant protection, describe methods of protection, and stabilization, provide drawings and supporting documentation as directed.
- B. Contractor's Condition Inspection; include written report and color photographs.

1.05 PROJECT CONDITIONS

- A. Install protection during initial mobilization at the Work site, and maintain until substantial completion.
- B. If, in the opinion of the Owner's arborist, additional protection is required, the Contractor shall install additional fencing as directed and without cost to the Owner.
- C. The location and requirements for additional fencing shall be determined by the

Owner's arborist prior to, and at any time during the course of the Work.

- D. Fencing:
 - 1. Fencing shall be installed at the tree and plant protection areas as detailed on Plans, or as directed by the Owner's Authorized Representative.
 - 2. Tree and plant protection fences shall remain in place until all Work is completed and shall not be removed or relocated without the approval of the Owner's Authorized Representative.
- E. Driving and Parking:
 - 1. Not permitted off paved surfaces without the approval of the Owner's Authorized Representative.
 - 2. When approved, the Contractor shall place plywood of sufficient thickness and width to support vehicles and prevent rutting on the area to be driven on.
 - 3. Care shall also be taken with respect to existing lawn sprinkler systems.
- F. Storage of materials and Debris: Not permitted off paved surfaces.

PART 2 PRODUCTS

2.01 MANUFACTURED COMPONENTS

- A. Chain Link Fencing: 11 gage galvanized chain link, six feet. tall, and 1.5 inch inside diameter galvanized steel line posts and 2.5 inch inside diameter corner posts, provide lockable gates as necessary.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Inspect trees, plants, and groundcovers, document existing conditions prior to installation of protection.

3.02 EXECUTION

- A. Pruning and Cutting of Roots, Branches and Foliage:
 - 1. Review conditions with Architect or Owner prior to need for work, and proceed as directed.
 - 2. All pruning to be done by Owner's landscape maintenance personnel or ISA Certified arborist under the direction of Owner's Landscape Management Department.
 - 3. Perform pruning and cutting with sharp instruments intended for the purpose; do not break or chop.
- B. Root Cuttings:
 - 1. Carefully and cleanly cut roots and branches of trees indicated to be left standing

- where such roots and branches obstruct new construction.
2. Protect exposed roots with wet burlap until they can be covered with soil.
- C. Excavation and Trenching Within Drip Lines:
1. Permitted where indicated, and at other specifically approved locations.
 2. Tunnel under or around roots by hand digging or boring.
 3. Do not cut main lateral roots and tap roots over one inch diameter; cut smaller roots which interfere with installation of new Work.
 4. Do not allow exposed roots to dry out before permanent backfill is placed; provide temporary earth cover, or pack with peat moss and wrap with burlap.
 5. Water and maintain roots in moist condition and temporarily support and protect from damage until permanently relocated and covered with backfill.
- D. Existing Grading: Maintain within drip line of trees and plants unless otherwise indicated on the drawing and approved by the Owner's Authorized Representative.
- E. Tree Protection:
1. Provide temporary fence complying with Section 01 51 00 for protection of trees to remain.
 2. Extend fencing ten feet beyond dripline, except where greater distance is required for protection of Elm trees.
 3. Prevent entry into protected areas except as authorized in writing by the Owner's Authorized Representative.

3.03 REPAIR AND REPLACEMENT OF TREES AND PLANTS

- A. Repair trees or shrubs damaged by construction operations as directed by the Owner.
- B. Make repairs promptly after damage occurs to prevent progressive deterioration of damaged trees.
- C. Damaged Trees, Shrubs and Groundcover:
1. Replace where Owner's Authorized Representative determines restoration to normal growth pattern is not possible; plant and maintain as directed.
 2. Replacement trees up to 13 inches caliper and shrubs up to 4 feet tall: Same size as damaged tree or shrub, species selected by the Owner's Authorized Representative.
 3. Trees over 13 inch caliper and shrubs greater than 4 feet tall: Compensate Owner as determined by an acceptable consulting arborist registered with the American Society of Consulting Arborists.
 4. Replacement groundcovers: Same size and quality as damaged species selected by Owner's Authorized Representative.

END OF SECTION

SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Summary:
 - 1. Product options.
 - 2. Owner-furnished products.
 - 3. Product delivery, storage and handling.

1.02 PRODUCTS

- A. Products:
 - 1. New material, machinery, components, equipment, fixtures, and systems forming the Work, but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work.
 - 2. Products may also include existing materials or components specifically identified for reuse.
- B. Use interchangeable components of the same manufacture for similar components.
- C. Unless otherwise specified, all material and equipment shall be new; free from defects impairing strength, durability, and appearance; of current manufacture.
- D. Items specified shall be considered minimum as to quality, function, capacity, and suitability for application intended.
- E. Items incorporated into the Work shall conform to applicable specifications and standards designated, and shall be of size, make, type, and quality specified.
- F. Design, fabricate, and assemble in accordance with current best engineering, industry, and shop practices.
- G. Manufacture like parts of duplicate units to standard size and gauge to make them interchangeable.
- H. Two or more items of the same kind shall be identical and made by the same manufacturer.

1.03 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.
- C. Products Specified by Naming One [or More] Manufacturer[s]: Products of manufacturer[s] named and meeting specifications, no options or substitutions

allowed.

D. Substitution Procedure: Under Section 01 25 00.

1.04 REUSE OF EXISTING PRODUCTS

- A. Except as specifically indicated or specified, materials and equipment removed from existing construction shall not be used in the completed Work.
- B. For material and equipment specifically indicated or specified to be reused in the Work:
 - 1. Use care in removal, handling, storage, and reinstallation to assure proper function in the completed Work.
 - 2. Arrange for transportation, storage, and handling of products which require off-site storage, restoration, or renovation.
 - 3. Remove and reinstall mechanical units, vents, guys, antennae, and electrical and grounding wires or conduits.

1.05 OWNER FURNISHED PRODUCTS

- A. Designate delivery dates of Owner-furnished items in the construction schedule.
- B. Receive, unload, store and handle Owner-furnished items at the site; protect from damage.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Transport, handle, store and protect products in accordance with manufacturer's instructions.
- B. Arrange deliveries in accordance with construction schedules; coordinate to avoid conflict with Work and site conditions.
- C. Deliver and store products in undamaged condition in manufacturer's original containers or packaging with identifying labels intact and legible.
- D. Inspect shipments to assure compliance with Contract Documents and reviewed submittals, and that products are undamaged.
- E. Prevent soiling or damage to products or packaging.
- F. Interior Storage: Maintain required temperature and humidity ranges. Verify that Owner furnished storage meets product manufacturer's requirements.
- G. Exterior Storage:
 - 1. Store materials above ground to prevent soiling and/or moisture infiltration.
 - 2. Cover materials with waterproof breathable sheet coverings; provide adequate ventilation.
 - 3. All storage locations to be approved in advance by the Owner.
- H. Arrange storage to provide access for inspection.

- I. Coordinate with Owner's Authorized Representative all on-site storage activities.
- J. Provide for security of stored products.

END OF SECTION

SECTION 01 7329

CUTTING AND PATCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Requirements and limitations for cutting and patching of Work.

1.02 RELATED SECTIONS

- A. Section 01 25 00, Product Substitution Procedures.
- B. Section 01 33 23, Shop Drawings, Product Data, Samples

1.03 SUBMITTALS

- A. Submit written request in advance of cutting or alteration which affects:
 - 1. Structural integrity of any element of the Work.
 - 2. Efficiency, maintenance, or safety of any operational element.
 - 3. Visual qualities of sight exposed elements.
 - 4. Work of Owner or separate contractor.
- B. Include in request:
 - 1. Identification of project.
 - 2. Location and description of affected work.
 - 3. Necessity for cutting or alteration.
 - 4. Description of proposed work, and products to be used.
 - 5. Alternatives to cutting and patching.
 - 6. Effect on work of Owner or separate contractor.
 - 7. Written permission of affected separate contractor.
 - 8. Date and time work will be executed.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Primary Products: Those required for original installation.
- B. Product Substitution: For any proposed change in materials, submit request for substitution under provisions of Section 01 25 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Inspect existing conditions prior to commencing Work, including elements subject to

damage or movement during cutting and patching.

- B. After uncovering existing work, inspect conditions affecting performance of Work.
- C. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

- A. Provide temporary supports to ensure structural integrity of the Work.
- B. Provide devices and methods to protect other portions of the Work from damage.
- C. Provide protection from elements for areas which may be exposed by uncovering work.

3.03 CUTTING AND PATCHING

- A. Execute cutting, fitting and patching to complete work.
- B. Fit products together, to integrate with other work.
- C. Remove and replace defective or non-conforming work.
- D. Provide openings in the work for penetration of mechanical and electrical work.

3.04 PERFORMANCE

- A. Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.
- B. Cut rigid materials using masonry saw or core drill. Pneumatic tools are not allowed without prior approval from Owner's Authorized Representative.
- C. Restore work with new products in accordance with requirements of Contract Documents.
- D. At penetrations of fire rated walls, partitions, ceiling or floor construction, completely seal voids with approved fire rated material, to full thickness of the penetrated element.
- E. Refinishing:
 - 1. Refinish surfaces to match adjacent finish.
 - 2. For continuous surfaces, refinish to nearest intersection or natural break.
 - 3. For an assembly, refinish entire unit.

END OF SECTION

SECTION 01 7400

CLEANING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Related requirements specified elsewhere, cleaning for specific products or work: Specification section for that work.
- B. Maintain premises and public properties free from accumulations of waste, debris, and rubbish, caused by operations.
- C. At completion of Work remove waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all sight-exposed surfaces; leave project clean and ready for occupancy.

1.02 QUALITY ASSURANCE

- A. Standards: Maintain project in accord with applicable safety and insurance standards.
- B. Hazard Control:
 - 1. Store volatile wastes in covered metal containers.
 - 2. Provide adequate ventilation during use of volatile or noxious substances.

1.03 MATERIALS

- A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.
- B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

1.04 DURING CONSTRUCTION:

- A. Wet down dry materials and rubbish to lay dust and prevent blowing dust.
- B. At reasonable intervals during progress of Work clean site and public properties, and dispose of waste materials, debris and rubbish.
- C. Provide on-site containers for collection of waste materials, debris and rubbish.
- D. Remove waste materials, debris and rubbish from site and legally dispose of at public or private dumping areas off Owner's property.
- E. Vacuum clean interior building areas when ready to receive finish painting, and continue vacuum cleaning on an as-needed basis until project is ready for Substantial Completion or occupancy.
- F. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.

1.05 FINAL CLEANING

- A. Employ experienced workers, or professional cleaners, for final cleaning.
- B. In preparation for Substantial Completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.
- C. Remove grease, dust, dirt, stains, labels, and other foreign materials from exposed interior and exterior finished surfaces.
- D. Remove putty, paint, labels, lubricants, etc., from windows, mirrors, and sash, and then polish, taking care not to scratch glass.
- E. Vacuum carpeting (shampoo where required), removing debris and excess nap.
- F. Repair, patch and touch up marred surfaces to specified finish, to match adjacent surfaces.
- G. Replace air filters where units were operated during construction.
- H. Maintain cleaning until project, or portion thereof, is occupied by Owner.

END OF SECTION

SECTION 01 7700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 DESCRIPTION

- A. The requirements specified in this section relate to all Contractors individually performing under these Contract Documents:
 - 1. Project Record Documents.
 - 2. Final review and payment.
- B. Related work specified elsewhere:
 - 1. OSU General Conditions.
 - 2. Shop Drawings, Product Data and Samples, Section 01 33 23.

1.02 PROJECT RECORD DOCUMENTS

- A. The Project Record Documents shall be organized to include the following information:
 - 1. Table of Contents
 - 2. Project Team List
 - 3. Specifications (Including Addenda and Change Orders)
 - 4. Drawings
 - 5. Inspection Reports, as applicable
 - 6. Signed Warranty(ies)
 - 7. Maintenance Instructions
- B. Draft Project Record Documents shall be submitted for review upon 75% completion of the Work.
- C. Project Record Documents shall be submitted electronically to the Owner. Hard copies will not be accepted.
- D. The project team list shall include the name, address, and phone number of the Owner, Contractor, Inspector, Subcontractors, and the materials manufacturers.
- E. Legibly mark each Specification section to indicate actual as-built condition indicating changes in the Work made by addenda or change order or actual materials used and actual manufacturer(s) used.
- F. Maintain current and accurate as-built mark-ups during construction and make available to Owner's Authorized Representative upon request.
- G. Legibly mark the drawings to indicate actual as-built conditions indicating changes in the Work made by addenda or change order or actual conditions which differ from the drawings.
- H. Redraw or provide new drawings as required for a complete as-built set of drawings. The Contractor shall maintain current and accurate as-built mark-ups during

construction and make available to Owner's Authorized Representative.

- I. Include inspection reports if applicable.
- J. Include, in a single section, all copies of the Project's labor and material warranties clearly marked to identify the Owner's responsibilities under the terms of each warranty and the section of Work that each warranty covers. One set must be clearly marked as containing original documents.
- K. In the case of an elevator installation, the Contractor's and manufacturer's warranty shall provide for the Owner's right to respond to emergency/car failure situations for the purpose of extricating individuals trapped in the elevator.
- L. Include maintenance instructions complete with technical information and name, address, and phone number of the Contractor(s) and manufacturer(s) of each material and product.

1.03 FINAL REVIEW AND PAYMENT

- A. Prior to completion, the Contractor shall inspect the Work and make a Punch-list noting all items that are incomplete and/or incorrect.
- B. The Contractor shall notify all Subcontractors in writing of incomplete and/or incorrect items. Notify far enough in advance of the completion date that the Work can be completed on schedule. Said Work shall be immediately corrected.
- C. Should conditions prevail which prohibit some elements of the Work from being accomplished, but the work-in-place will perform the primary function (i.e., painting cannot be completed due to high moisture content of masonry walls.) the Contractor shall record the reason with this Punch-list item requesting temporary delay in completion from the Owner in writing.
- D. Notify the Owner in writing that all items are completed and ready for final review or else that the Work product is fully usable, but some listed deficiencies remain to be completed. Submit all record documents at this time.
- E. The Owner will review all documents. When the documents include a Contractor's request for delay in completion, the Owner will review all Work which is certified as complete to the best knowledge of the Contractor. The Owner will also review the listed incomplete Work and assign a value to such uncompleted work.
- F. The Contractor shall make the required corrections to the Work expeditiously. A letter will be addressed to the Contractor informing the Contractor of the project status.
- G. When Contract closeout procedures are completed and all Punch-list deficiencies have been corrected, provide Owner with final corrected Project Record Documents based on Owner's preliminary review. Correct Project Record Documents shall be in electronic format.
- H. Final Completion by the Owner will be documented and the Contractor will receive

written notice of acceptance of the Work and notification that final payment may be billed and released.

- I. All warranties shall commence and become effective beginning on the date of Substantial Completion.

END OF SECTION

**SECTION 02 4100
DEMOLITION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of building elements for alteration purposes.
- B. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

- A. Section 01 1100 - Summary of Work
- B. Section 01 5100 - Construction Facilities and Temp Control
- C. Section 01 7329 - Cutting and Patching
- D. Section 01 7400 - Cleaning
- E. Section 01 7700 - Contract Closeout

PART 3 EXECUTION

2.01 SCOPE

- A. Remove items as indicated per drawings.

2.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 3. Provide, erect, and maintain temporary barriers and security devices.
 - 4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 5. Do not close or obstruct roadways or sidewalks without permit.
 - 6. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 - 7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Protect existing structures and other elements that are not to be removed.
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.

2.03 EXISTING UTILITIES

- 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. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

2.04 **SELECTIVE DEMOLITION FOR 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 demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Coordinate with Owner access around existing storage items within project area. Relocation of existing storage items by Owner is subject to approval by Owner.
- C. Protect existing storage items within area of demo from dust, debris, and damage.
- D. Separate areas in which demolition is being conducted from other areas that are still occupied.
- E. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
- F. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings.
- G. HVAC screen removal:
 - 1. Demo section of HVAC screen as indicated on drawings.
 - 2. Protect and store components, including fence boards, for re-installation as part of new fence boundary.
- H. Concrete Masonry Unit (CMU) removal:
 - 1. Layout penetrations and demo extents for design team approval prior to demo.
 - 2. Maintain and protect adjacent CMU coursing, headers and other reinforced zones as indicated.
 - 3. Demo extents to align with vertical and horizontal mortar joints. At new vertical and horizontal wall edges, remove loose mortar and grind flush to newly exposed face of cmu module.
 - 4. Grind and patch as required to create a finished edge of wall surface around the opening.
 - 5. Do not overcut the opening.
- I. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 - 2. 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.
 - 3. Verify that abandoned services serve only abandoned facilities before removal.
 - 4. Remove abandoned pipe, ducts, conduits, and equipment; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- J. 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.
 - 4. Patch as specified for patching new work.

2.05 **DEBRIS AND WASTE REMOVAL**

- A. Remove debris, junk, and trash from site.
- 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 07 2119
FOAMED-IN-PLACE INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Foamed-in-place insulation.
- B. Protective intumescent coating.

1.02 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2017.
- B. ASTM D1621 - Standard Test Method for Compressive Properties Of Rigid Cellular Plastics 2016.
- C. ASTM D1622/D1622M - Standard Test Method for Apparent Density of Rigid Cellular Plastics 2014.
- D. ASTM D1623 - Standard Test Method for Tensile And Tensile Adhesion Properties of Rigid Cellular Plastics 2017.
- E. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics 2019.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- H. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).
- I. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials 2013.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.04 SUBMITTALS

- A. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.
- B. Certificates: Certify that products of this section meet or exceed specified requirements.
- C. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience.

1.06 MOCK-UP

- A. Provide 1 mock-up of the foamed-in-place insulation as specified, minimum 18 feet long by 30 feet wide; include insulation overcoat in mock-up. Include specified coverage on structural steel within zone of mockup.
- B. Locate as indicated on drawings.
- C. Mock-up may remain as part of the Work.
- D. Mock-up is to be complete 60 days prior to starting the remaining installation of the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Foamed-In-Place Insulation:

1. Accella Polyurethane Systems; Winter blend HFO: www.accellapolyurethane.com/#sle.
2. BASF Corporation; ST 178: www.spf.basf.com/#sle.
3. Gaco Western; OnePass - Winter formula: www.gaco.com/#sle.
4. Icynene-Lapolla; Cold-weather HFO (GWP:1): www.icynene.com/#sle.

2.02 MATERIALS

- A. Foamed-In-Place Insulation: 2lb closed cell, rigid or semi-rigid polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
 1. Regulatory Requirements: Comply with applicable code for flame and smoke concealment, and overcoat limitations.
 2. Thermal Resistance: R-Value of 6.5 minimum, per inch thickness at 75 degrees F mean temperature when tested in accordance with ASTM C518.
 3. Air Permeance: 0.00 cfm/sq ft, when tested at intended thickness in accordance with ASTM E2178 at 1.57 psf.
 4. Vapor Permeance: <0.5 perms at 1 inch when tested in accordance with E96 - Method A.
 - a. Product is to meet the requirement for a Class II vapor retarder per the International Code Council and ASHRAE when installed at intended thickness.
 5. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
 6. Basis of Design:
 - a. Gaco OnePass Winter Formula F1850W
 7. Manufacturers:
 - a. Listed in Section 2.01 above provided that the product meets the specified performance criteria.

2.03 ACCESSORIES

- A. Primer: As required by insulation manufacturer.
- B. Protective Coating: Intumescent coating of type recommended by insulation manufacturer and as required to comply with applicable codes.
 1. Product: DC315 manufactured by International Fireproof Technology Inc..

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify work within construction spaces or crevices is complete prior to insulation application.
- B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

3.02 PREPARATION

- A. Remove fiberglass debris from surface to receive foam and clean surfaces per manufacturer's recommendations.
- B. Mask and protect adjacent surfaces from over spray or dusting.
- C. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

- A. Apply insulation in accordance with manufacturer's instructions.
- B. Apply to a minimum cured thickness of 2 inch.
- C. Apply specified minimum thickness continuous over underside of floor deck and supporting structural elements (beams, joists, columns) within the area of application.
 1. At columns, the specified coverage shall extend from the underside of decking to 9 ft above finish floor.
- D. Surface temperature of deck to receive SPF will be 36-50 deg F.
 1. The deck is cooled from above, and thus the metal deck surface temp will shift closer to 36 deg F as the foam is applied and cures.
- E. Apply Protective Intumescent Coating at manufacturer tested thickness to achieve Thermal Barrier for specific SPF product utilized.

1. Apply monolithically, without voids to full cover foam insulation at required mil thickness.

F. Patch damaged areas.

3.04 **PROTECTION**

A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

**SECTION 07 6200
SHEET METAL FLASHING AND TRIM**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, exterior penetrations, GWB z-trim, and other items indicated in Schedule.
- B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.03 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2019a.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).
- F. CDA A4050 - Copper in Architecture - Handbook current edition.
- G. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.04 SUBMITTALS

- A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239) inch thick base metal, shop pre-coated with PVDF coating.
 - 1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
- B. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gage, (0.0156 inch) thick; smooth No. 4 - Brushed finish.

2.02 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

2.03 EXTERIOR PENETRATION FLASHING PANELS

- A. 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.

2.04 ACCESSORIES

- A. Fasteners: Stainless steel, with soft neoprene washers.
- B. Primer: Zinc chromate type.
- C. Concealed Sealants: Non-curing butyl sealant.
- D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- E. Plastic Cement: ASTM D4586/D4586M, Type I.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

- A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- B. Apply plastic cement compound between metal flashings and felt flashings.
- C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

END OF SECTION

**SECTION 07 9200
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.
- B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- C. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- D. ASTM C1311 - Standard Specification for Solvent Release Sealants 2014.
- E. SCAQMD 1168 - Adhesive and Sealant Applications 1989 (Amended 2017).

1.03 SUBMITTALS

- A. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes 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.
- B. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- C. 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.

PART 2 PRODUCTS

2.01 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior 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. Joints between different exposed materials.
 - c. Other joints indicated below.
 - 2. 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.
 - 3. Do not seal the following types of joints.
 - a. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - b. Joints where installation of sealant is specified in another section.
- B. Type A - Exterior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
 - 1. Type C - Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
- C. Type B - Interior Joints: Use non-sag Acrylic emulsion latex sealant, unless otherwise indicated.

2.02 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.03 NONSAG JOINT SEALANTS

- A. Type A - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
 - 1. Color: Match adjacent finished surfaces.
- B. Type B - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
 - 1. Color: Standard colors matching finished surfaces, Type OP (opaque).
- C. Type C - Non-Curing Butyl Sealant: Solvent-based, single component, non-sag, non-skinning, non-hardening, non-bleeding; non-vapor-permeable; intended for fully concealed applications.

2.04 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.
- 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. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

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. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Install bond breaker backing tape where backer rod cannot be used.
- D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- E. 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.
- F. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

END OF SECTION

**SECTION 08 1113
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.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware.
- B. Section 09 9113 - Exterior Painting: Field painting.

1.03 ABBREVIATIONS AND ACRONYMS

- A. ANSI: American National Standards Institute.
- B. HMMA: Hollow Metal Manufacturers Association.
- C. NFPA: National Fire Protection Association.
- D. SDI: Steel Door Institute.

1.04 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (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 2011.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2011.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2019a.
- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable 2018.
- 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 2018a.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- I. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames 2016.
- J. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- K. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.
- L. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.
- M. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames 2007.
- N. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.
- O. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2013.

1.05 SUBMITTALS

- A. 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.

- B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- C. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

1.06 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.

1.07 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. Krieger Specialty Products: www.kriegerproducts.com/#sle.
 - 5. Mesker, dormakaba Group: www.meskeropeningsgroup.com/#sle.
 - 6. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
 - 7. Steelcraft, an Allegion brand: www.allegion.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized 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. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
 - 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 (galvanized) 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 SDI Standards: Provide at least A40/ZF120 (galvanized) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (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 4 - Maximum-duty.
 - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 2 - Seamless.
 - d. Door Face Metal Thickness: 14 gage, 0.067 inch, minimum.
2. Door Core Material: Polyisocyanurate, 2 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 Thermal Resistance: R-Value of 9.9, minimum, for installed thickness of polyisocyanurate.
4. Door Thickness: 1-3/4 inch, nominal.
5. Weatherstripping: Refer to Section 08 7100.
6. Door Finish: Factory primed and field finished.

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: Knock-down type.
 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
 2. Frame Metal Thickness: 18 gage, 0.042 inch, minimum.
 3. Frame Finish: Factory primed and field finished.
 4. Weatherstripping: Separate, see Section 08 7100.
- C. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

2.05 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

2.06 ACCESSORIES

- A. 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.
- B. Temporary Frame Spreaders: Provide for factory- or shop-assembled 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 with bituminous coating to a thickness of 1/16 inch.
- B. Fill exterior frames with spray foam insulation.

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. Install door hardware as specified in Section 08 7100.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.

END OF SECTION

HW SET # L-01

Openings

LIB-EXIT

Each door or doors to have:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
4	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM W/DEADBOLT	L9480BDC 03A 09-544 L283-711	630	SCH
1	EA	PERMANENT CORE	1C7 VERIFY, VERIFY KEYWAY	626	BES
1	EA	LOCK GUARD	LG10	630	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
3	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	566A-223	A	ZER
1			DOOR CONTACT(S) BY OTHERS		

HW SET # L-02

Openings

005B-1

005C-1

005D-1

005D-3

Each door or doors to have:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	VANDL STOREROOM LOCK	ND96BD SPA	626	SCH
1	EA	PERMANENT CORE	1C7 VERIFY, VERIFY KEYWAY	626	BES
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ WMS	689	LCN

Additional hardware provided by Wire Partition Manufacturer.

**SECTION 08 7100
DOOR HARDWARE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hardware for hollow metal and wire partition doors.
- B. Thresholds.
- C. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

- A. Section 08 1113 - Hollow Metal Doors and Frames.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. BHMA A156.1 - American National Standard for Butts and Hinges 2016.
- C. BHMA A156.2 - American National Standard for Bored and Preassembled Locks & Latches 2017.
- D. BHMA A156.3 - American National Standard for Exit Devices 2014.
- E. BHMA A156.4 - American National Standard for Door Controls - Closers 2013.
- F. BHMA A156.5 - American National Standard for Cylinders and Input Devices for Locks 2014.
- G. BHMA A156.6 - American National Standard for Architectural Door Trim 2015.
- H. BHMA A156.7 - American National Standard for Template Hinge Dimensions 2016.
- I. BHMA A156.8 - American National Standard for Door Controls - Overhead Stops and Holders 2015.
- J. BHMA A156.13 - American National Standard for Mortise Locks & Latches Series 1000 2017.
- K. BHMA A156.15 - American National Standard for Release Devices - Closer Holder, Electromagnetic and Electromechanical 2015.
- L. BHMA A156.18 - American National Standard for Materials and Finishes 2016.
- M. BHMA A156.21 - American National Standard for Thresholds 2014.
- N. BHMA A156.22 - American National Standard for Door Gasketing and Edge Seal Systems Sponsor 2017.
- O. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames 2016.
- P. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames 2004.
- Q. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- R. ITS (DIR) - Directory of Listed Products current edition.
- S. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2019.
- T. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2017.
- U. UL (DIR) - Online Certifications Directory Current Edition.
- V. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.
- W. UL 437 - Standard for Key Locks 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. Hardware is meet OSU Construction Standards.

- C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; attendance is required by affected installers and the following:
 - 1. Architect.
 - 2. Installer's Architectural Hardware Consultant (AHC).
 - 3. Hardware Installer.
 - 4. Owner's Security Consultant.
- D. Keying Requirements Meeting:
 - 1. Schedule meeting at project site prior to Contractor occupancy.
 - 2. Attendance Required:
 - a. Contractor.
 - b. Owner.
 - c. Installer's Architectural Hardware Consultant (AHC).
 - d. Hardware Installer.
 - 3. Agenda:
 - a. Establish keying requirements.
 - b. Verify locksets and locking hardware are functionally correct for project requirements.
 - c. Verify that keying and programming complies with project requirements.
 - d. Establish keying submittal schedule and update requirements.
 - 4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
 - a. Access control requirements.
 - b. Key control system requirements.
 - 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. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
- D. Keying Schedule:
 - 1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.
- E. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

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.

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. Warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion.
 - 1. Locksets and Cylinders: Three years, minimum.
 - 2. 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. Fire-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
 - 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 Preparation for Steel Doors and Steel Frames: BHMA A156.115.
- D. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. Refer to Door Hardware Schedule.
- E. 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 FINISHES

- A. Finishes: Identified in Door Hardware Schedule.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.
- C. Use templates provided by hardware item manufacturer.
- 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.
 - 2. For Wire Partition Gates: Install in compliance with DHI (LOCS) recommendations.
 - 3. Mounting heights in compliance with ADA Standards:
 - a. Locksets: 40-5/16 inch.

b. Exit Devices: 40-5/16 inch.

- E. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 ADJUSTING

- A. Adjust hardware for smooth operation.
B. 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. Do not permit adjacent work to damage hardware or finish.

END OF SECTION

**SECTION 09 9113
EXTERIOR PAINTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- 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, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.
 - 6. Floors, unless specifically indicated.
 - 7. Glass.
 - 8. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 09 9123 - Interior Painting.

1.03 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.
- B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating 2005 (Reapproved 2017).
- C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- E. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- F. SSPC-SP 2 - Hand Tool Cleaning 2018.
- G. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.05 SUBMITTALS

- A. 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(s) product is to be used in; include description of each system.
- B. 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.

1.06 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience and approved by manufacturer.

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. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
 - 1. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
 - 2. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.
- B. Paints:
 - 1. Benjamin Moore & Co.
 - 2. PPG Paints: www.ppgpaints.com/#sle.
 - 3. Rodda Paint Company: www.rodmapaint.com/#sle.
 - 4. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
 - 1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
 - 2. 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.
 - 3. 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.
 - 4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 5. Supply each paint material in quantity required to complete entire project's work from a single production run.

6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Flammability: Comply with applicable code for surface burning characteristics.
- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- D. Colors: To be selected from manufacturer's full range of available colors.
 1. Selection to be made by Architect after award of contract.

2.03 PAINT SYSTEMS - EXTERIOR

- A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete, concrete masonry units, brick, fiber cement siding, primed wood, and primed metal.
 1. Two top coats and one coat primer.
 2. Top Coat(s): Exterior Latex; MPI #15.
 3. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint ME-OP-2A - Ferrous Metals, Primed, Alkyd, 2 Coat: Applications include exterior hollow metal doors and frames and other exterior pre-primed metals.
 1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
 2. Semi-gloss: Two coats of alkyd enamel; MPI #94, #81..
 3. Primer: As recommended by top coat manufacturer for specific substrate.

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. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.

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. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Concrete:
 1. Clean concrete according to ASTM D4258. Allow to dry.
- G. Galvanized Surfaces:
 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 2. Prepare surface according to SSPC-SP 2.
- 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. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

- I. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

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. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance.
- F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. 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 09 9123
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. Mechanical and Electrical:
 - a. 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. Mechanical and Electrical:
 - a. All equipment, pipes, conduit, ductwork, collars, supports U.N.O.

1.02 RELATED REQUIREMENTS

- A. Section 09 9113 - Exterior Painting.

1.03 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.
- B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.
- C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- E. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- F. SSPC-SP 2 - Hand Tool Cleaning 2018.
- G. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.05 SUBMITTALS

- A. 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(s) product is to be used in; include description of each system.
 - 4. Manufacturer's installation instructions.
 - 5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.

- B. 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 definitely not required.
 - 3. Allow 30 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 masonry, have been approved.

1.06 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience and approved by manufacturer.

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. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
 - 1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
 - 2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
 - 3. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.
- B. Paints:
 - 1. Benjamin Moore & Co.
 - 2. Behr Process Corporation: www.behr.com/#sle.
 - 3. Cloverdale Paint, Brand Products of Rodda Paint Company: www.cloverdalepaint.com/#sle.
 - 4. Diamond Vogel Paints: www.diamondvogel.com/#sle.
 - 5. PPG Paints: www.ppgpaints.com/#sle.
 - 6. Rodda Paint Co: www.roddapaint.com/#sle.
 - 7. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
 - 1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
 - 2. 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.
 - 3. 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.
 - 4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 5. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- C. Colors: To be selected from manufacturer's full range of available colors.
 - 1. Selection to be made by Architect after award of contract.

2.03 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, brick, wood, plaster, uncoated steel, shop primed steel, galvanized steel, and aluminum.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): High Performance Architectural Interior Latex; MPI #140.
 - 3. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals:
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): Interior Epoxy-Modified Latex; MPI #115 or 215.
 - 3. Primer: As recommended by top coat manufacturer for specific substrate.

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. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Plaster and Stucco: 12 percent.

3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
5. Concrete Floors and Traffic Surfaces: 8 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. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Masonry:
 1. Prepare surface as recommended by top coat manufacturer.
- H. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- I. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- J. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- K. Galvanized Surfaces:
 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 2. Prepare surface according to SSPC-SP 2.
- L. 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. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- M. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

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. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- G. Sand wood and metal surfaces lightly between coats to achieve required finish.
- H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- I. 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 2213
WIRE MESH PARTITIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wire mesh systems for walls.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware: Cylinders for locksets. Closers.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.
- B. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2020.
- C. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel 2018.
- D. ASTM A580/A580M - Standard Specification for Stainless Steel Wire 2018.
- E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable 2018.
- F. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).

1.04 SUBMITTALS

- A. Product Data: Provide data for mesh materials, finishes.
- B. Shop Drawings: Indicate plan and vertical dimensions, elevations, component details; head, jamb, and sill details; location of hardware. Provide component details, anchorage, and type and location of fasteners.
 - 1. Show field measurements on shop drawings.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
 - 1. Member firm of the Woven Wire Products Association (WWPA).

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wire Mesh Partitions:
 - 1. Acorn Wire and Iron Works, Inc: www.acornwire.com/#sle.
 - 2. The G-S Company: www.g-sco.com/#sle.
 - 3. Spaceguard Products: www.spaceguardproducts.com/#sle.
 - 4. Wirecrafters: wirecrafters.com
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 WIRE MESH PARTITIONS

- A. Wire Mesh Partitions: Factory-fabricated modular assemblies of panels, doors, anchors, hardware, and accessories as required to provide a complete system.
 - 1. Design Criteria:
 - a. Design partition system to provide for movement of components without damage, undue stress on fasteners or other detrimental effects, when subject to design loads.
 - b. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.03 COMPONENTS

- A. Woven Wire Mesh: Standard duty.
 - 1. Material: ASTM A510/A510M uncoated crimped steel wire.
 - 2. Wire Size: 10 gage, 0.135 inch.

3. Mesh Opening Size: rectangular max opening of 2.25 sq in.
- B. Framing and Support Members:
 1. Material: ASTM A36/A36M steel shapes and ASTM A500/A500M cold-formed steel.
 2. Framing, Corner Posts, and Intermediate Support Members: Manufacturer's standard sizes for system specified and as indicated on drawings.
- C. Doors: Same material as partitions, fully framed; manufacturer's standard construction and hardware for swing and sliding operation as indicated on drawings.
 1. Provide manufacturer's standard detailing for door panels to receive hardware specified in Section 08 7100.
 - a. Include manufacturer's recommended detailing to prevent "reach through" access to operating hardware.
 2. Locking:
 - a. Swing Doors: Mortise type cylinder locks as specified in Section 08 7100.
 - b. Sliding Doors: Padlock hasp.
 3. Provide attachment plates and reinforcement as required for Closers specified in Section 08 7100.
 4. Attachment Hardware:
 - a. Swing Doors: Provide manufacturer's recommended hinges.
 - b. Sliding Doors: Provide manufacturer's recommended track and guides for smooth/balanced operation.

2.04 FASTENERS

- A. Bolts, Nuts and Washers: Hot dip galvanized.
- B. Anchorage Devices: Provide power driven, powder actuated, and drilled expansion bolts.

2.05 ACCESSORIES

- A. Bracing: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.
- B. Plates, Gussets, Clips: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.
- C. Post Caps: Manufacturer's standard.
- D. Floor and Ceiling Pilaster Shoe: Manufacturer's standard.
- E. Floor Base: Manufacturer's standard.

2.06 FABRICATION

- A. Fit and assemble in largest practical sections for delivery to site, ready for installation.
- B. Make exposed joints flush or tight.
- C. Partition will extend to underside of the overhead steel beams. No extension is required to close the beam pocket gap.
- D. Provide components required for anchorage to adjacent construction.
- E. Frame openings made for penetrating mechanical and electrical components.

2.07 FINISHES

- A. Painted Finish: Manufacturer's standard powder coat finish.
 1. Color: To be selected by Architect from manufacturer's standard options..

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated on shop drawings.
- B. Verify that substrate surfaces and required openings are ready to receive work.

3.02 PREPARATION

- A. Clean substrate surfaces.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install items plumb and level, accurately fitted, free from distortion or defects.

3.04 TOLERANCES

- A. Maximum Variation From Plumb or Level: 1/4 inch.
- B. Maximum Misalignment From True Position: 1/4 inch.

3.05 ADJUSTING

- A. Adjust doors to achieve free movement.

3.06 CLEANING

- A. Remove temporary protection to prefinished surfaces.

END OF SECTION

**SECTION 12 3600
COUNTERTOPS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for manufactured casework.

1.02 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards 2014, with Errata (2018).
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1 2017, with Errata (2019).
- D. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
- E. PS 1 - Structural Plywood 2009.

1.03 SUBMITTALS

- A. 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.
- B. Shop Drawings: Complete details of materials and installation .
- C. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.05 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.

1.06 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. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
 - 1. Laminate Sheet, Type []: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
 - a. Manufacturers:
 - 1) Arborite: www.arborite.com/#sle.
 - 2) Formica Corporation: www.formica.com/#sle.
 - 3) Panolam Industries International, Inc; Nevamar Standard HPL: www.panolam.com/#sle.
 - 4) Panolam Industries International, Inc; Pionite Standard HPL: www.panolam.com/#sle.
 - 5) Wilsonart: www.wilsonart.com/#sle.
 - 6) Substitutions: See Section 01 6000 - Product Requirements.

- b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 - c. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
 - d. Finish: Matte or suede, gloss rating of 5 to 20.
 - e. Surface Color and Pattern: As selected by Architect from the manufacturer's full line.
2. Exposed Edge Treatment: Molded rubber edge with T-spline, sized to completely cover edge of panel.
 - a. Color: As selected by Architect from the manufacturer's full line.
 3. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.

2.02 MATERIALS

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 1 inch thick; join lengths using metal splines.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

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.

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. Countertop is to be secured to OFOI supports/systems furniture.

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

SECTION 21 0500
GENERAL FIRE PROTECTION PROVISIONS

PART 1 - GENERAL

1.01 CONTRACT DOCUMENTS

- A. General fire protection provisions apply to all work performed in Division 21.
- B. The Contract Documents are complementary. What is required by anyone, as affects this Division, shall be as binding as if repeated herein.
- C. Separation of this Division from other Contract Documents shall not be construed as segregation of the Work.
- D. Particular attention is called to Instructions to Bidders, General Conditions, Drawings and Specifications, and modifications incorporated in the documents before execution of the Agreement.
- E. Location of equipment on Drawings is approximate. Plan exact location with respect to site measurements and work of other trades prior to starting work. If measurements differ slightly, modify work. If measurements differ substantially, notify Architect/Engineer and Owner's Authorized Representative prior to fabrication.
- F. Make minor changes in equipment connections and equipment locations as directed or required before rough-in without extra cost.

1.02 DEFINITIONS

- A. Authority Having Jurisdiction (AHJ): The governmental agency or sub-agency which regulates the construction process.
- B. Owner's Authorized Representative (OAR): Owner's representative with authority to act on Owner's behalf.

1.03 COORDINATION

- A. Check drawings of other trades to avert possible installation conflicts. Should major changes from original drawings be necessary to resolve such conflicts, notify Architect/Engineer and secure written approval and agreement on necessary adjustments before start of work.
- B. Architectural drawings govern all other drawings. Consult in detail the door swings, counter heights and similar items affecting work before rough-in.
- C. Coordinate identification systems with other trades. All mechanical systems shall use identical piping, valve, and equipment identification and regulatory signage.

1.04 SUBMITTALS AND SHOP DRAWINGS

- A. See Division 1.
- B. Action Submittal Content
 - 1. Action submittal information not expressly required by the specifications will not be reviewed.
 - 2. Action submittal information shall be provided in sufficient detail to establish conformance with specified requirements. Where submitted literature includes multiple models, features, or options, the specific models, features, or options proposed shall be clearly indicated. Where a brief inspection shows that product data is not complete, the submittal will be rejected without review.
 - 3. Action submittal data shall be clear, concise, legible, and relevant. Where data is not properly organized and contains significant information that is not relevant, the submittal will be rejected without review.
 - 4. Action submittal requirements will be listed in individual specification sections. The following definitions apply.
 - a. Materials List: Provide tabular list of materials including specification reference, specification product name, manufacturer, model/part number, and size and/or quantity

where appropriate. Do not include supplemental data, except where specifically requested.

- b. Catalog data: Manufacturer's standard product cut sheet.
 - c. Product Data: Detailed data including dimensions, weight, materials of construction, connections, and all other information needed to confirm that the product conforms to all requirements listed in the individual specification section.
 - d. Performance Data: Capacity, input, output, flow, etc as required to confirm that the product meets the performance requirements scheduled in the Specifications or on the Drawings.
 - e. Wiring Diagrams: Power and control wiring diagrams.
 - f. Shop Drawings: Construction drawings of items manufactured specifically for this project including dimensions, construction details, weights, and additional information to identify the physical features of the system or piece of equipment.
 - g. Installation Instructions
 - h. Special Requirements Listed: Additional requirements indicated in individual specification sections.
- C. Delegated Design
- 1. Delegated work will include:
 - a. Section 21 1313 "Wet-Pipe Sprinkler Systems"
 - 2. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - a. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Engineer.

1.05 **QUALITY ASSURANCE**

- A. All materials and equipment provided hereunder shall be installed and started in complete conformance with the manufacturer's recommendations.
- B. Asbestos products or equipment or materials containing asbestos shall not be used.

1.06 **DESIGN REQUIREMENTS**

- A. Materials and equipment provided hereunder shall be rated for the service conditions of the system to which they are connected including but not limited to temperature, pressure, and humidity.

1.07 **CODES AND STANDARDS**

- A. Applicable codes and standards shall determine minimum requirements for materials, methods, and labor practices not otherwise stated herein.
- B. Work shall comply with the Americans with Disabilities Act (ADA).

1.08 **TEMPORARY SERVICES**

- A. Provide in accordance with SECTION 01 5000 "Temporary Facilities and Controls" as required for completion of work.
- B. Maintain existing systems operational. Owner will be responsible to operate and maintain existing equipment during the course of the project. However, any damage to existing equipment resulting directly from work under this Contract shall be repaired by the Contractor at no expense to Owner.

1.09 **OPERATIONS AND MAINTENANCE MANUALS**

- A. Bind manuals in three-ring, high quality vinyl covered binders, clearly indexed and provided with thumb tabs for each item or product. Include a directory of all subcontractors and maintenance contractors with names, addresses, and telephone numbers, indicating the area of responsibility.

ity for each. Index tabs shall match submittal schedule and include any additional information required for operations and maintenance, whether in submitted schedule or not.

- B. Maintenance instructions shall indicate routine-type work with step-by-step instructions that should be performed to ensure long life and proper operations. Recommended frequency of performance shall also be included.
- C. Provide copy of approved submittal for each product included in manual
- D. Provide printed copy and electronic configuration files for all packaged equipment control systems furnished with equipment.
- E. Mark the model actually provided where the literature covers more than one model. Include four copies of all submittal data corrected to "as-built" conditions within the manual.
- F. Provide a composite summary table indicating each item of equipment listed in the operations and maintenance manual and its required maintenance and time period. This summary table shall be the first section in the O&M manual.
- G. Manual Content: Manuals shall contain complete information for each item of mechanical electrical or other operating equipment. Include as applicable:
 - 1. Manufacturer's instructions for installation, startup, operation, inspection, and maintenance
 - 2. Lubrication schedules
 - 3. Performance capacity
 - 4. Catalog data sheets
 - 5. Parts list
 - 6. Maintenance schedules

1.10 RECORD DRAWINGS

- A. Provide record "as-built" drawings in accordance with Division 1 requirements. Show all deviations from contract drawings and location of underground lines by accurate dimensions from building lines. Show depth of all stub outs and underground lines. Dimension all concealed piping from column grids or building lines. Transfer all information to one hard copy of drawings at completion of project. Alternately, provide electronically using .pdf markup of contract drawings.

1.11 DEMONSTRATION

- A. General: After installation is complete, demonstrate to Authority Having Jurisdiction and Owner's Authorized Representative's satisfaction as being complete and operational and entirely in conformance with Contract Documents.
- B. Arrange for demonstration with Owner and Authority Having Jurisdiction at least one week in advance of demonstration.

PART 2 - PRODUCTS

2.01 PRODUCTS AND MATERIALS

- A. All materials employed in permanent construction shall be new, full weight, in first class condition, and suitable for space provided. All similar materials shall be of one manufacturer.
- B. Equipment used as the basis of design is scheduled on drawings or designated in product specifications. If Contractor chooses to use equipment that is not the basis of design, Contractor is responsible for all re-design and construction costs associated with variations in arrangement, dimension, or capacity. Such work may include, but is not limited to, changes to facility structure or dimensions and revisions to associated mechanical and electrical systems needed to provide equal system performance and maintainability.

2.02 IDENTIFICATION

- A. Provide equipment identification and signage in accordance with NFPA 13.

PART 3 - EXECUTION

3.01 ACCESS TO EQUIPMENT AND ACCESSORIES

- A. Install equipment with sufficient access for service. Where not conveniently accessible by other means, provide adequately sized access doors for valves, dampers, motors, belts, and all other mechanical equipment requiring access for removal or maintenance. Type, size and exact location of access doors shall be coordinated with Architect prior to work.
- B. Provide clearances for maintenance access as indicated on Drawings or as recommended by manufacturer. If access requirements shown on Drawings conflict with manufacturer's recommendations, provide larger clearance of the two.
- C. If equipment location shown on Drawings does not allow required access, notify Architect/ Engineer prior to start of work.
- D. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract drawings and specifications to Architect/Engineer for resolution prior to starting work.
- E. Provide access doors as required for access to equipment. Doors required for access are not necessarily shown on Drawings. Consult with Architect for direction on placement of required doors not shown on Drawings.
 - 1. Comply with manufacturer's instructions for installation of access doors. Provide all necessary support and supplemental framing for assembly where the access doors are required. Set accurately in position, plumb, level, and flush to adjacent finish surfaces; and secure to support.

3.02 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

- A. Coordinate location of piping, sleeves, inserts, hangers and equipment. Locate piping, sleeves, inserts, hangers and equipment clear of windows, doors, openings, lights, electrical outlets, and other services and utilities.
- B. Equipment and Piping Support: Coordinate structural systems necessary for pipe and equipment support with pipe and equipment locations to permit proper installation.
- C. Minor Piping: Small diameter pipe runs from drips and drains and similar minor services are generally not shown but must be provided. Contractor is responsible to provide all such minor piping where needed.
- D. Work in Existing Building: Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Owner's Authorized Representative. Locate openings that will least affect structural slabs, columns, ribs or beams. Refer to the Architect/Engineer for determination of proper design for openings through structural sections and obtain layout approval prior to cutting or drilling into structure. After Architect/Engineer's approval, carefully cut opening through construction no larger than absolutely necessary for the required installation.

3.03 CLEANING SYSTEMS

- A. General: After all equipment and piping is installed, system shall be thoroughly cleaned. Remove all stickers and tags and clean all piping systems prior to painting.

3.04 START UP

- A. The Fire Protection Contractor shall be responsible for proper operation of all systems and shall coordinate startup procedures, calibration and system checkout. System operational problems shall be diagnosed and corrected as required for system operation prior to Substantial Completion inspection.

END OF SECTION

**SECTION 21 1313
WET-PIPE SPRINKLER SYSTEMS**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes pipes, fittings, and other accessories for revising a complete wet pipe sprinkler system providing full coverage for areas shown on drawings.
- B. Existing open basement storage area is currently configured for Ordinary Hazard wet coverage. Project renovation work includes applying foam spray insulation to underside of exiting structure, which will interfere with existing fire sprinkler piping and heads. Revise existing fire protection system piping installation to accommodate insulation.

1.02 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.03 ACTION SUBMITTALS

- A. General
 - 1. Pipe and fittings: Materials List
 - 2. Specialty Valves, Sprinkler Piping Specialties, Sprinklers, Alarm Devices, Control Panels: Provide catalog data. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Delegated Design Submittals:
 - 1. Delegated design shall be performed and documented in accordance with NFPA 13 by persons qualified in accordance with Authority Having Jurisdiction.
 - 2. Provide detailed scaled construction drawings showing fire protection piping, heads, valves, and accessories including pipe sizes, locations, elevations, slope of horizontal runs, wall and floor penetrations and connections. Include attachment details.
 - a. Submit preliminary drawings showing exposed piping and sprinkler layout to Architect for approval.
 - b. Upon approval by Architect, submit drawings to Authority Having Jurisdiction.
 - c. Upon approval by Authority Having Jurisdiction, submit final drawings with approval stamp to Architect.
 - 3. Provide hydraulic calculations.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- C. Fire-hydrant flow test report.
- D. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprin-

klers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Installer's responsibilities include designing, fabricating, and installing sprinkler systems. Base calculations on results of fire-hydrant flow test.
- B. Contractor shall have five years of experience in design and installation of equipment and systems similar to that specified hereunder. Contractor shall have an office within 100 miles radius of job site which can provide emergency maintenance service.
- C. The system designer shall be responsible for verifying site conditions, design requirements, and work being performed by other trades as related to the suppression system design. Design shall accommodate work being performed by other trades.
- D. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

1.08 FIELD CONDITIONS

- A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions:
 - 1. Notify Owner's Construction Manager no fewer than ten days in advance of proposed interruption of sprinkler service.
 - 2. Do not proceed with interruption of sprinkler service without Owner's Construction Manager's written permission.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Sprinkler system sizing, arrangement, equipment, specialties, accessories, installation, and testing shall comply with NFPA 13.
- B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- C. Design Requirements:
 - 1. Contractor shall obtain water service test data including static pressure and residual pressure/water flow available at the project site.
 - 2. Sprinkler system design shall be approved by authorities having jurisdiction.
 - 3. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 - 4. Sprinkler Occupancy Hazard Classifications:
 - a. General Storage Areas: Ordinary Hazard, Group 2.
 - 5. Provide minimum density as required by NFPA 13.
 - 6. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions according to NFPA 13 and ASCE/SEI 7.

2.02 STEEL PIPE AND FITTINGS

- A. Standard-Weight, Schedule 40 Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 10, Black-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, Schedule 10 in NPS 2 and smaller.
- C. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- D. Uncoated-Steel Couplings: ASTM A 865/A 865M, threaded.
- E. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- F. Malleable- or Ductile-Iron Unions: UL 860.
- G. Cast-Iron Flanges: ASME 16.1, Class 125.
- H. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

1. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.
- I. Grooved-Joint, Steel-Pipe Appurtenances:
 1. Pressure Rating: 175-psig minimum.
 2. Painted Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
 3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.03 **SPRINKLERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Reliable Automatic Sprinkler Co., Inc. (The).
 2. Tyco Fire Products LP.
 3. Victaulic Company.
- B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- C. Pressure Rating for Automatic Sprinklers: 175-psig minimum.
- D. Automatic Sprinklers with Heat-Responsive Element:
 1. Nonresidential Applications: UL 199.
 2. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- E. Sprinkler Finishes: bronze.
- F. Sprinkler Guards:
 1. Standard: UL 199.
 2. Type: Wire cage with fastening device for attaching to sprinkler.

PART 3 - EXECUTION

3.01 **PREPARATION**

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.02 **PIPING INSTALLATION**

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
- C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve. Size and locate according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.

- I. Install hangers and supports and seismic restraint for sprinkler system piping according to NFPA 13.
- J. Fill sprinkler system piping with water.
- K. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.03 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for above-ground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- I. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.04 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26.

3.05 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 4. Energize circuits to electrical equipment and devices.
 - 5. Coordinate with fire-alarm tests. Operate as required.
 - 6. Coordinate with fire-pump tests. Operate as required.
 - 7. Verify that equipment hose threads are same as local fire department equipment.
- B. Prepare test and inspection reports.

3.06 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.07 PIPING SCHEDULE

- A. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be the following:
 - 1. Standard-weight, with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
- B. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 and Larger shall be one of the following:
 - 1. Standard-weight, black-steel pipe with cut or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - 2. Schedule 10, black-steel pipe with roll-grooved ends: uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.08 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
 - 1. Rooms without Ceilings: Upright sprinklers or Pendent sprinklers to revise or augment coverage.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
 - 1. Upright and Pendent Sprinklers; rough bronze.

END OF SECTION

**SECTION 23 0500
GENERAL HVAC PROVISIONS**

PART 1 - GENERAL

1.01 CONTRACT DOCUMENTS

- A. General HVAC provisions apply to all work performed in Division 23.
- B. The Contract Documents are complementary. What is required by any one, as affects this Division, shall be as binding as if repeated herein.
- C. Separation of this Division from other Contract Documents shall not be construed as segregation of the Work.
- D. Particular attention is called to Instructions to Bidders, General Conditions, Drawings and Specifications, and modifications incorporated in the documents before execution of the Agreement.
- E. Location of equipment on Drawings is approximate. Plan exact location with respect to site measurements and work of other trades prior to starting work. If measurements differ slightly, modify work. If measurements differ substantially, notify Architect/Engineer and Owner's Authorized Representative prior to fabrication.
- F. Make minor changes in equipment connections and equipment locations as directed or required before rough-in without extra cost.

1.02 DEFINITIONS

- A. Authority Having Jurisdiction (AHJ): A federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority.
- B. Owner's Authorized Representative (OAR): Owner's representative with authority to act on Owner's behalf.

1.03 COORDINATION

- A. Check drawings of other trades to avert possible installation conflicts. Should major changes from original drawings be necessary to resolve such conflicts, notify Architect/Engineer and secure written approval and agreement on necessary adjustments before start of work.
- B. Architectural drawings govern all other drawings. Consult in detail the door swings, counter heights and similar items affecting work before rough-in.
- C. Coordinate identification systems with other trades. All mechanical systems shall use identical piping, valve, and equipment identification and regulatory signage.

1.04 SUBMITTALS AND SHOP DRAWINGS

- A. See Division 1.
- B. Action Submittal Content
 - 1. Action submittal information not expressly required by the specifications will not be reviewed.
 - 2. Action submittal information shall be provided in sufficient detail to establish conformance with specified requirements. Where submitted literature includes multiple models, features, or options, the specific models, features, or options proposed shall be clearly indicated. Where a brief inspection shows that product data is not complete, the submittal will be rejected without review.
 - 3. Action submittal data shall be clear, concise, legible, and relevant. Where data is not properly organized and contains significant information that is not relevant, the submittal will be rejected without review.
 - 4. Action submittal requirements are listed in individual specification sections. The following definitions apply.
 - a. Materials List: Provide tabular list of materials including specification reference, specification product name, manufacturer, model/part number, and size and/or quantity

where appropriate. Do not include supplemental data, except where specifically requested.

- b. Catalog data: Manufacturer's standard product cut sheet.
 - c. Product Data: Detailed data including dimensions, weight, materials of construction, connections, and all other information needed to confirm that the product conforms to all requirements listed in the individual specification section.
 - d. Performance Data: Capacity, input, output, flow, etc. as required to confirm that the product meets the performance requirements scheduled in the Specifications or on the Drawings.
 - e. Wiring Diagrams: Power and control wiring diagrams.
 - f. Shop Drawings: Construction drawings of items manufactured specifically for this project including dimensions, construction details, weights, and additional information to identify the physical features of the system or piece of equipment.
 - g. Installation Instructions
 - h. Special Requirements Listed: Additional requirements indicated in individual specification sections.
- C. Delegated Design
- 1. Delegated work will include but is not limited to the following:
 - a. Section 23 0529 "Hangers and Supports for HVAC Piping and Equipment."
 - b. Section 23 0548 "Vibration and Seismic Controls for HVAC."
 - c. Section 23 0900 "Building Automation Systems."
 - 2. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - a. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Engineer.

1.05 QUALITY ASSURANCE

- A. All materials and equipment provided hereunder shall be installed and started in complete conformance with the manufacturer's recommendations.
- B. Asbestos products or equipment or materials containing asbestos shall not be used.
- C. Certify that each welder has passed the American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.

1.06 DESIGN REQUIREMENTS

- A. Equipment and systems provided hereunder shall be rated to provide performance specified and scheduled on Drawings at the elevation of the project site.
- B. Materials and equipment provided hereunder shall be rated for the service conditions of the system to which they are connected including but not limited to temperature, pressure, and humidity.

1.07 CODES AND STANDARDS

- A. Applicable codes and standards shall determine minimum requirements for materials, methods, and labor practices not otherwise stated herein.
- B. Work shall comply with the Americans with Disabilities Act (ADA).

1.08 TEMPORARY SERVICES

- A. Provide in accordance with Section 01 5000 "Temporary Facilities and Controls" as required for completion of work. Provide additional filters as required to keep areas clean during construction.
- B. Maintain existing systems operational. Owner will be responsible to operate and maintain existing equipment during the course of the project. However, any damage to existing equipment re-

sulting directly from work under this Contract shall be repaired by the Contractor at no expense to Owner.

1.09 OPERATIONS AND MAINTENANCE MANUALS

- A. Bind manuals in three-ring, high quality vinyl covered binders, clearly indexed and provided with thumb tabs for each item or product. Include a directory of all subcontractors and maintenance contractors with names, addresses, and telephone numbers, indicating the area of responsibility for each. Index tabs shall match submittal schedule and include any additional information required for operations and maintenance, whether in submitted schedule or not.
- B. Maintenance instructions shall indicate routine-type work with step-by-step instructions that should be performed to ensure long life and proper operations. Recommended frequency of performance shall also be included.
- C. Provide copy of approved submittal for each product included in manual
- D. Provide printed copy and electronic configuration files for all packaged equipment control systems furnished with equipment.
- E. Mark the model actually provided where the literature covers more than one model. Include four copies of all submittal data corrected to "as-built" conditions within the manual.
- F. Provide a composite summary table indicating each item of equipment listed in the operations and maintenance manual and its required maintenance and time period. This summary table shall be the first section in the O&M manual.
- G. Manual Content: Manuals shall contain complete information for each item of mechanical electrical or other operating equipment. Include as applicable:
 - 1. Manufacturer's instructions for installation, startup, operation, inspection, and maintenance
 - 2. Lubrication schedules
 - 3. Performance capacity
 - 4. Catalog data sheets
 - 5. Parts list
 - 6. Maintenance schedules

1.10 RECORD DRAWINGS

- A. Provide record "as-built" drawings in accordance with Division 1 requirements. Show all deviations from contract drawings and location of underground lines by accurate dimensions from building lines. Show depth of all stub outs and underground lines. Dimension all concealed piping from column grids or building lines. Alternately, provide electronically using .pdf markup of contract drawings.

PART 2 - PRODUCTS

2.01 PRODUCTS AND MATERIALS

- A. All materials employed in permanent construction shall be new, full weight, in first class condition, and suitable for space provided. All similar equipment and materials shall be of one manufacturer.
- B. Equipment used as the basis of design is scheduled on Drawings or designated in product specifications. If Contractor chooses to use equipment that is not the basis of design, Contractor is responsible for all re-design and construction costs associated with variations in arrangement, dimension, or capacity. Such work may include, but is not limited to, changes to facility structure or dimensions and revisions to associated mechanical and electrical systems needed to provide equal system performance and maintainability.

2.02 ELECTRICAL EQUIPMENT

- A. Electrical Disconnect Switch: Electrical disconnect switches specified for mechanical equipment shall conform to OSHA Lock-out/Tag-out requirements.

- B. All electrical equipment shall be listed as approved for its application by the Underwriters Laboratory or other testing agency approved by the State of Oregon Electrical and Elevator Board. Approval indicates agency meets testing standard requirements for electrical safety required by Oregon Revised Statutes 479.510 through 479.855 and Oregon Administrative Rules.
- C. Enclosure: Provide the following electrical equipment enclosure types.
 - 1. NEMA 1: Dry, enclosed locations where the ambient temperature will not be outside of the VFD temperature ratings.
 - 2. NEMA 3R, 4, or 4X with Temperature Control: Outdoors or in unconditioned spaces where ambient temperatures will be outside of the VFD temperature ratings.
 - 3. Enclosure will be provided with a ventilation fan and heater capable of maintaining enclosure temperature within the manufacturer's recommended range. Drive and enclosure shall be a single, UL-listed assembly with single point electrical connections.

PART 3 - EXECUTION

3.01 ACCESS TO EQUIPMENT AND ACCESSORIES

- A. Install equipment with sufficient access for service. Where not conveniently accessible by other means, provide adequately sized access doors for valves, dampers, motors, belts, and all other mechanical equipment requiring access for removal or maintenance. Type, size and exact location of access doors shall be coordinated with Architect prior to work.
- B. Provide clearances for maintenance access as indicated on Drawings or as recommended by manufacturer. If access requirements shown on Drawings conflict with manufacturer's recommendations, provide larger clearance of the two.
- C. If equipment location shown on Drawings does not allow required access, notify Architect/ Engineer prior to start of work.
- D. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract drawings and specifications to Architect/Engineer for resolution prior to starting work.
- E. Provide access doors as required for access to mechanical equipment. Doors required for access are not necessarily shown on Drawings. Consult with Architect for direction on placement of required doors not shown on Drawings.
 - 1. Comply with manufacturer's instructions for installation of access doors. Provide all necessary support and supplemental framing for assembly where the access doors are required. Set accurately in position, plumb, level, and flush to adjacent finish surfaces; and secure to support.

3.02 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

- A. Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, lights, electrical outlets, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.
- B. Equipment and Piping Support: Coordinate structural systems necessary for pipe and equipment support with pipe and equipment locations to permit proper installation.
- C. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.
- D. Minor Piping: Small diameter pipe runs from drips and drains, water cooling, and similar minor services are generally not shown but must be provided. Contractor is responsible to provide all such minor piping where needed to maintain mechanical spaces clean and dry and to allow full equipment function and maintenance.

- E. Interconnection of Controls and Instruments: Generally not shown but must be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments, and computer workstations. Comply with NFPA-70.
- F. Work in Existing Building: Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Owner's Authorized Representative. Locate openings that will least affect structural slabs, columns, ribs, or beams. Refer to the Architect/Engineer for determination of proper design for openings through structural sections and obtain layout approval prior to cutting or drilling into structure. After Architect/Engineer's approval, carefully cut opening through construction no larger than absolutely necessary for the required installation.
- G. Inaccessible Equipment
 - 1. Where the Owner's Authorized Representative determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Owner.
 - 2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.03 EXISTING EQUIPMENT REUSED OR RELOCATED

- A. All equipment designated as existing or furnished by Owner shall be cleaned and repaired before reinstallation. Any items requiring repair shall be brought to the attention of the construction manager before the item is reinstalled. Damage not brought to the attention of the construction manager shall be deemed the result of reinstallation of the item and shall be repaired without expense to the Owner.

3.04 LUBRICATION

- A. Lubricate all devices requiring lubrication prior to initial operation. Field check all devices for proper lubrication.
- B. Equip all devices with required lubrication fittings or devices.
- C. All lubrication points shall be accessible without disassembling equipment, except to remove access panels.

3.05 CLEANING SYSTEMS

- A. General: After all equipment, pipes and duct systems are installed, system shall be thoroughly cleaned. Remove all stickers and tags from equipment or fixtures. Clean all piping systems prior to installation of insulation or painting.
- B. Air Distribution Duct System:
 - 1. Remove all debris from system before operation. Under no circumstances shall system be operated without filters. Replace filters used during construction with new filters.
 - 2. Repair or replace any discolorations or damage to system, building finish, or furnishings resulting from Contractor's failure to properly clean system.

3.06 START UP

- A. The Mechanical Contractor shall be responsible for proper operation of all systems and shall coordinate startup procedures, calibration and system checkout. System operational problems shall be diagnosed and corrected as required for system operation prior to Substantial Completion inspection.
- B. Start equipment in accordance with manufacturer's recommendations and under manufacturer's supervision where required. Ensure that associated filters, strainers, electrical overloads, and other devices intended to protect the equipment are installed and functional prior to startup.
- C. Verify that piping has been flushed and cleaned prior to startup.

- D. The Mechanical Contractor shall perform TAB system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. TAB system-readiness checklists will be provided by the TAB Specialist. See Section 23 0593 "Testing, Adjusting, and Balancing for HVAC."

3.07 DEMONSTRATION

- A. General: After installation is complete, demonstrate to Engineer and Owner's Authorized Representative satisfaction as being complete and operational and entirely in conformance with Contract Documents.
- B. Preparation: Prior to demonstration, submit check-off list indicating completeness of submittals and certificates of compliance for review to Owner's Authorized Representative. Operate completed system for one week. Verify that control verification is complete and verification report has been approved by Architect/Engineer.
- C. Arrange for demonstration with Owner's Authorized Representative, Engineer, required factory technicians, and installer at least one week in advance of demonstration.

3.08 TRAINING

- A. Instruct Owner in proper operation and maintenance of equipment and systems. Instruction shall generally include topics listed in manufacturer's operations and maintenance manual. Operator instructions shall cover all aspects of manual, automatic, and safety controls. Contractor shall also instruct the Owner in the general configuration of systems and location of equipment and components.

END OF SECTION

**SECTION 23 0513
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, squirrel-cage induction and electrically commutated motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.02 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.

2.02 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40°C and at altitude of 3,300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 POLYPHASE INDUCTION MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15 unless listed otherwise under section where motor is provided.
- D. Rotor: Random-wound, squirrel cage.
- E. Bearings: Re-greaseable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: Match insulation rating.
- G. Insulation: Class F.
- H. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- I. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.
- J. Enclosure Type: Provide open drip proof enclosure, except provide totally enclosed fan cooled enclosure for the applications listed below, or as expressly specified elsewhere, or as indicated on Drawings.
 - 1. Outdoor applications including roof exhaust fans, cooling towers, and similar equipment.
 - 2. Fan motors mounted in an unfiltered air stream.
 - 3. Motors on equipment related to life safety including smoke exhaust fans, fire pumps and similar equipment.
 - 4. Motors 10 HP and larger.
- K. Additional Requirements for Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Inverter Duty as defined in NEMA MG 1 with Class F temperature rise; Class H insulation.

2. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
3. Maximum RPM: 3600 rpm minimum, or 150% of as design motor speed, whichever is greater.
4. Speed Ratio:
 - a. Constant load applications: 4:1, except 1000:1 where high turndown motor is required.
 - b. Variable torque applications: 20:1, except 1000:1 where high turndown motor is required.
5. Bearing Protection Ring: For motors controlled by variable frequency drives, provide maintenance free, conductive microfiber, shaft grounding ring with a minimum of two rows of circumferential micro fibers to discharge electrical shaft currents within the motor and/or its bearings. AEGIS SGR or approved equal.

2.04 SINGLE-PHASE ELECTRICALLY COMMUTATED MOTORS

- A. General: Electrically commutated, variable-speed, DC, brushless, direct drive type. Motor rotor shall be permanent magnet type with near zero rotor losses.
- B. Bearings: Heavy duty, pre-lubricated, antifriction ball bearings.
- C. Motor Controller: Single-phase integrated controller/inverter that operates the wound stator and senses rotor position to electronically commutate the stator. Motors designed for synchronous rotation and to overcome reverse rotation.
 1. Operating Speed: Controllable from 100% to 20% of full speed.
 2. Motor Control: Remote digital input
 3. Speed Control: Provide either manual or remote speed control input as specified and as required to perform intended function:
 - a. Manual: Potentiometer dial mounted on the motor.
 - b. Remote modulating analog input: 4-20mA or 0-10 VDC.
 4. Soft-start function to reduce inrush current at start-up
 5. Overcurrent Protection
 6. Thermal Overload Protection
- D. Electrical Input: Single phase, 60 hertz. Voltage as required or as scheduled on drawings.
- E. Efficiency: Motor shall be minimum of 70% efficient over entire operating range.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify motor mounts are compatible with motor frame.

3.02 INSTALLATION

- A. Motors Used with Variable Frequency Controllers: Arrange location of motor, variable frequency controller and electrical wiring to ensure the distance from motor to inverter does not exceed manufacturer recommended maximum length.

3.03 APPLICATION

- A. Induction Motors
 1. Motors Less Than 1/2 HP: Single-Phase
 2. Motors 1/2 HP and larger: Polyphase.

END OF SECTION

**SECTION 23 0514
COMMON MOTOR CONTROL DEVICES FOR HVAC**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Variable Frequency Drives

1.02 RELATED SECTIONS

- A. Single Phase Motor Control: Refer to "23 09 25 – BAS Field Mounted Devices for HVAC" for single phase motor control relays.

1.03 DESIGN REQUIREMENTS

- A. Provide motor protection switches of the appropriate NEMA size. For units not using NEMA rating, use equivalent NEMA size.
- B. Provide motor protection switches in the proper enclosure as required by NEC for the location installed unless more stringent requirements otherwise noted on the Drawings or herein. Provide secondary enclosures where primary enclosures do not conform to NEC requirements.
- C. Variable speed drive control enclosures shall have a minimum Short Circuit Current Rating of 50,000 amps.

1.04 SUBMITTALS

- A. Where a thermostatically controlled enclosure is required, provide complete submittal on cabinet and drive assembly showing all enclosure characteristics. Provide full load amperage, minimum circuit ampacity, and over-current protection ratings for entire drive/enclosure assembly.

PART 2 - PRODUCTS

2.01 VARIABLE FREQUENCY DRIVE CONTROLLER

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ABB, similar to ABB ACH580.
- B. General: Digital PWM controller listed and labeled to provide variable speed control of a standard NEMA Design B, 3-phase, induction motor by adjusting output voltage and frequency. UL listed as a complete assembly.
- C. Performance:
 - 1. Output Rating: 3-phase, 1 to 120 hz, current rated at 8 kHz carrier frequency.
 - 2. Stepless motor control from 0.1% to 110% of motor base speed.
 - 3. Ambient Temperature: 0 to 40°C
 - 4. Capable of riding through short power dips without a controller trip.
 - 5. Capable of starting into a rotating load regardless of direction.
 - 6. All programmable settings held in non-volatile memory and not affected by power outages or dips.
 - 7. Slip compensation circuit for 1% speed regulation.
- D. Adjustable Control Parameters:
 - 1. Acceleration: 0.1 to 999.9 seconds
 - 2. Deceleration: 0.1 to 999.9 seconds
 - 3. Current Limit: 50 to 110% of maximum rating
 - 4. Carrier frequency: 4 to 8 khz
- E. Safety Features:
 - 1. Input surge suppression
 - 2. External fault protection allowing wiring of remote safety contacts
 - 3. Instantaneous overcurrent trip
 - 4. Loss of input or output phase protection
 - 5. Ground fault protection

6. Under and over voltage protection
 7. Output phase-to-phase short circuit protection
 8. Electronic overload circuit recognized by UL & NEC as adequate motor protection
- F. Control and Monitoring Features:
1. Panel mounted manual start/stop speed control, manual/automatic speed control selection and run/jog selection.
 2. Panel mounted digital display of voltage output, current output, input kW, totalized kWh consumption, elapsed run time, frequency output, motor rpm, time stamped fault indication, and DC bus volts.
 3. Automatic restart settable by number of restart attempts and time interval between restarts.
 4. Settable automatic and manual torque boosts.
 5. DC braking programmable in amplitude and direction.
 6. Multiple programmable preset speeds that will force VFD to preset speed upon user contact closure.
 7. Relay contacts for remote indication of drive fault or motor running.
 8. Multiple programmable frequency avoidance bands.
 9. Multiple programmable volts/hZ patterns.
 10. Speed controller capable of maintaining a constant motor speed or process setpoint using field mounted process input signal and/or remote setpoint input signal. PI control capability. Remote setpoint configurable using zero and space parameters.
 11. Input and output contacts programmable and capable of performing the following function:
 - a. Remote Start/Stop
 - b. Emergency drive shutdown
 - c. Drive run/off operating status
- G. Input/Output Points:
1. Digital Inputs
 - a. Remote Start/Stop
 - b. Emergency Stop
 2. Digital Output
 - a. Drive Run/Off Status.
 - b. Drive Alarm.
 3. Analog Input
 - a. Process Variable Control Input Signal: 4 to 20 mA DC.
 - b. Remote Speed Control Setpoint: 4 to 20 mA DC.
 4. Analog Output Speed Feedback: 4 to 20 mA or 0 to 10 VDC.
 5. Network Communications: BACnet or Modbus, Compatible with BAS system. Network outputs to include but are not limited to the following:
 - a. Speed
 - b. Output Frequency
 - c. Current
 - d. Power
 - e. Status
 - f. Configurable Alarm
 - g. Saved kWh
- H. Accessories:
1. Integral main disconnect mounted within the standard NEMA 1 enclosure.
 2. AC input line reactor: 3 phase, 3% impedance

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install devices in accordance with manufacturer's recommendations.

3.02 COMBINATION MOTOR PROTECTION SWITCH INSTALLATION

- A. In finished areas, mount motor protection switches flush and install suitable coverplates.
- B. Install heaters correlated with full load current of motors provided.
- C. Set overload devices according to measured current of motors provided.

3.03 VARIABLE FREQUENCY DRIVE CONTROLLER

- A. Maintain required clearances around unit enclosure.
- B. Set overload devices according to measured current of motor.
- C. Measure and document input voltage and current to drive.
- D. Adjustment
 - 1. Set V/Hz curve according to application.
 - 2. Adjust acceleration and deceleration parameters to obtain pump/fan speed-torque acceleration requirements within motor capacity.
 - 3. Adjust low and high frequency limit parameter for project conditions.
 - 4. Set current limit
 - 5. Configure VFD parameters to the motor automatically restarts after a power failure.
- E. Manufacturer's Field Service: Certified manufacturer's representative to provide the following services:
 - 1. Inspect after installation is complete. Complete manufacturers' installation and start-up report and submit copy to Engineer certifying that installation and operation is in accordance with manufacturer's recommendation.
 - 2. Perform initial start-up.
 - 3. Adjust configuration parameters for project conditions.
 - 4. Document initial configuration. Provide hard copy and electronic copy for inclusion in O&M manuals. Provide copies for each set of manuals.
 - 5. Provide minimum 4 hours of training including operation and maintenance. Coordinate training time with Owner's Authorized Representative minimum 14 days prior to training. Training shall be performed after Substantial Completion and will not occur on the same day as equipment start-up.

END OF SECTION

SECTION 23 0517

SLEEVES, SLEEVE SEALS, AND ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes sleeves, sleeve seals, escutcheons, and related materials.

1.02 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Non-shrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.02 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated or rough-brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. Split-Casting Brass Type: With polished, chrome-plated or rough-brass finish and with concealed hinge and setscrew.

PART 3 - EXECUTION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
- C. Use one-piece, deep-pattern escutcheons for new piping where fittings would protrude from the wall and be exposed if standard escutcheons were used
- D. Escutcheons for New Piping:
 - 1. Finished Areas: One-piece, cast-brass type with polished, chrome-plated finish.
 - 2. Unfinished Areas: One-piece, cast-brass type, rough brass finish.
- E. Escutcheons for Existing Piping:
 - 1. Finished Areas: Split-casting brass type with polished, chrome-plated finish.
 - 2. Unfinished Areas: Split-casting brass type with rough brass finish.

END OF SECTION

**SECTION 23 0529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes hangers and supports for HVAC piping and equipment.

1.02 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of the Valve and Fittings Industry Inc.

1.03 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Supports for multiple pipes, including pipe stands, shall be capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Equipment supports shall be capable of supporting combined operating weight of supported equipment and connected systems and components.

1.04 ACTION SUBMITTALS

- A. Provide submittals for products listed in the Product Table below in accordance with Section 23 0500 – General HVAC Provisions Submittal requirements indicated by column number designation as follows:
 - 1. Materials List
 - 2. Catalog Data
 - 3. Detailed Data
 - 4. Performance Data
 - 5. Wiring Diagrams
 - 6. Shop Drawings
 - 7. Installation Instructions
 - 8. Special Requirement listed herein.

PRODUCT TABLE	1	2	3	4	5	6	7	8
Pipe Hangers and Supports		X						
Thermal Hanger Shield Inserts		X						

1.05 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper-Coated Pipe Hangers:
 - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.02 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. B-line, an Eaton business
 - b. Thomas & Betts Corporation, a member of the ABB Group
 - c. Unistrut, part of Atkore International
 - 2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
 - 3. Standard: MFMA-4.
 - 4. Channels: Continuous slotted steel channel with in-turned lips.
 - 5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
 - 7. Metallic Coating: Hot-dipped galvanized, ASTM A123 or A153, 2.6 MIL

2.04 INSULATION INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. National Pipe Hanger Corporation
 - 2. Pipe Shields Inc.
 - 3. Insulshield
 - 4. Uni-Grip
- B. General: Insulation insert for use with MSS Type 40 protection shield
- C. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.05 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.06 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Non-staining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89 Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89 Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Fastener System Installation:
 - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying Coordinate with Section 23 0548 Vibration and Seismic Controls for interrelated work.
- I. Install building attachments within concrete slabs or to structural steel where possible. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes.
- L. Insulated Piping:
 - 1. Piping Operating Above Ambient Air Temperature:
 - a. Provide MSS Type 40 protection shield.
 - 2. Piping Operating Below Ambient Air Temperature:
 - a. Provide MSS Type 40 protection shield.
 - 3. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - 4. Insulation Inserts: Same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.05 HANGER SPACING

A.

HYDRONIC PIPING SPACING TABLE	Maximum Horizontal Span	Maximum Vertical Spacing
Carbon Steel		
1-1/4 inch and smaller	7 feet	15
1-1/2 inch to 2-1/2 inch	10 feet	15
3 inch and larger	12 feet	15
Copper Tubing		
3/4 inch and smaller	5 feet	10
1 inch to 2 inch	7 feet	10
2-1/2 inch and larger	10 feet	10

3.06 ROD SIZES

- A. Select rod diameter to not exceed the maximum safe load listed in Table 2 of MSS SP-58-2009.

3.07 HANGER AND SUPPORT TYPE SCHEDULE

- A. Single Pipe, Hung and Uninsulated
 - 1. NPS 1/2 to NPS 3: Adjustable Steel Band Hanger, MSS Type 7.
- B. Single Pipe, Hung and Insulated
 - 1. Operating Temperature Less Than Ambient: Steel Clevis, MSS Type 1
 - 2. Operating Temperature Greater Than Ambient.
 - a. NPS 1/2 to NPS2: Steel Clevis, MSS Type 1.
 - b. NPS 3 and Larger: Adjustable Roller Hanger: Type 43.
- C. Multiple Pipe Trapeze or Pipe Rack: Trapeze Hanger, MSS Type 59.
 - 1. Uninsulated Piping: Steel Strap.
 - 2. Insulated Piping: Adjustable Roller, MSS Type 43.
- D. Single Pipe Floor Support: Adjustable Pipe Support Saddle: MSS Type 38.
- E. Vertical Piping: See Section 23 0548 "Vibration and Seismic Controls for HVAC" for riser support and restraint.
- F. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

- G. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- H. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- I. Use copper-plated pipe hangers and attachments for copper piping and tubing.
- J. Use padded hangers for piping that is subject to scratching.
- K. To eliminate the need for seismic restraint, for piping installation where the distance from the top of the pipe to the structure is 12 inches or less for the entire run, select hanger-rod and building attachments to allow pipe movement without stress on hangers and attachments.
- L. Hanger-Rod Attachments: Unless otherwise indicated, provide the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450°F piping installations.
 - 3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - 4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450°F piping installations.
- M. Building Attachments: Unless otherwise indicated, provide the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 5. C-Clamps (MSS Type 23): For structural shapes.
 - 6. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 - 7. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 - 8. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 - 9. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 - 10. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 - 11. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 - 12. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications.
- P. Comply with MFMA-103 for metal framing system selections and applications.

- Q. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

**SECTION 23 0548
VIBRATION AND SEISMIC CONTROLS FOR HVAC**

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Design and installation of equipment attachment to structure, vibration isolation systems, piping riser support, and seismic restraint components listed for new mechanical equipment, ductwork, and piping provided in Division 23 as scheduled or described herein.

1.02 DEFINITIONS

- A. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal:

1. Provide a delegated submittal package comprised of drawings, details, and calculations signed and sealed by an engineer specializing in the associated work and registered in Oregon. Submittals shall indicate full compliance with the device specification in Part 2. Any deviation shall be specifically noted and subject to engineer approval. Submittals shall include device dimensions, placement, and attachment and anchorage requirements.
2. All restraining devices shall have a pre-approval number from California OSHPD or some other organization acceptable to the Authority Having Jurisdiction. Where pre-approved devices are not available, provide submittals based on independent testing or calculations stamped by a registered professional engineer with at least five years of seismic design experience and licensed in the state of Oregon.
3. Ductwork and Piping Restraint:
 - a. Provide full or half size copies of ductwork and piping plans from the Contract Documents or coordination drawings, showing location and type of each vibration isolation component and seismic restraint to be installed. Drawings shall consist of mechanically reproduced copies of the Contract Documents, or new drawings custom drafted specifically for the Work of this Project. Each drawing shall be printed on a single sheet.
 - b. Provide piping and ductwork restraint assembly construction and installation details. Assemblies may be pre-engineered or custom designed for the application.
 - c. Where walls, floors, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for ducts and pipe must be included and approved before the condition is accepted for installation. Restraint manufacturers' submittals must include spacing, static loads and seismic loads at all attachment and support points.
4. Equipment Restraint

- a. Select vibration isolators and accessories as scheduled and as required to meet seismic restraint requirements.
 - b. Provide equipment seismic restraint assembly construction and installation details. Assemblies may be pre-engineered or custom designed for the application. Include method of attachment to supporting structure.
 - c. Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.
 - d. For equipment mounted outdoors, include wind load in determining the necessary attachment and restraint requirements.
5. Calculations: Provide design calculations to verify that seismic and wind load restraint will comply with the Oregon Structural Specialty Code for the site and the building type listed.

1.04 INFORMATIONAL SUBMITTALS

- A. Provide three copies of the seismic restraint system Engineer's inspection report.
- B. Provide a written authorization letter from the seismic restraint Engineer authorizing a representative to provide the inspection if a designated representative is used. Describe the representative's qualifications.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Provide seismic and wind load design in accordance with 2019 Oregon State Structural Specialty Code and ASCE/SEI 7.
- B. Risk Category: II
- C. Component Importance Factors (Ip)
 1. All components Ip=1.0

2.02 FREE STANDING SPRING MOUNTS

- A. Laterally Stable, Open-Spring Mount: (SM-1).
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kinetics Noise Control, Inc.
 - b. Mason Industries, Inc.
 - c. Vibro-Acoustics
 2. Basis of Design: Mason Industries Type SLF
 3. General: Free-standing spring isolators. Laterally stable without housing. Complete with molded neoprene cup or ¼-inch neoprene acoustical friction pad between the baseplate and the support.
 4. Provided with leveling bolts rigidly bolted to the equipment.
 5. Spring diameters not less than 80% of the spring height at rated load.
 6. Minimum additional travel to solid equal to 50% of the rated deflection.
- B. Freestanding, Seismically Restrained, Open-Spring Isolators: (SM-2)
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kinetics Noise Control, Inc.
 - b. Mason Industries, Inc.
 - c. Vibro-Acoustics
 2. Basis of Design: Mason Industries Type SSLFH
 3. Free standing laterally supported with neoprene cup or ¼ inch neoprene acoustical friction pads between spring and support. Leveling bolts.
 4. Spring diameter no less than 80 percent of the compressed height of the spring at rated load.

5. Spring to have an additional minimum travel to solid equal to 50 percent of the rated deflection.
6. Ductile iron or steel housing to resist motion due to earthquake loads in all directions. Minimum 0.5 G rating.
7. Minimum clearance of ¼-inch to be maintained between the restraining bolts and a molded neoprene bushing so as not to interfere with spring action
8. The housing shall be out of contact during normal operating.
9. Deflection as scheduled.

2.03 **SPRING HANGERS**

- A. Spring and Neoprene Hanger with Vertical Restraint: (SH-1)
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kinetics Noise Control, Inc.
 - b. Mason Industries, Inc.
 - c. Vibro-Acoustics
 2. Basis of Design: Mason Industries Type RW30N
 3. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 4. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 5. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 8. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 9. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 10. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.04 **RESTRAINT CHANNEL BRACINGS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. B-line, an Eaton business.
 2. Hilti, Inc.
 3. Mason Industries, Inc.
 4. Vibro-Acoustics
- B. Basis of Design: Mason Industries SSBS/SHB
- C. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end. Provide other matching components. Corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.05 **RESTRAINT CABLES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Kinetics Noise Control, Inc.
 2. Mason Industries, Inc.
 3. Vibro-Acoustics

- B. Basis of Design: Mason Industries SCB/H
- C. Restraint Cables: ASTM A 603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.06 MECHANICAL ANCHOR BOLTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-line, an Eaton business
 - 2. Hilti, Inc.
 - 3. Kinetics Noise Control, Inc.
 - 4. Mason Industries
 - 5. Vibro-Acoustics
- B. Basis of Design: Mason Industries SASE, SAST
- C. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.07 SEISMIC-RESTRAINT ACCESSORIES

- A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.
- B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.
- D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.
- E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

PART 3 - EXECUTION

3.01 GENERAL

- A. Coordinate locations and sizes of structural supports with locations of vibration isolators and seismic/wind restraints (e.g., roof curbs, cooling towers, air-cooled chillers, etc.).
- B. Block and shim all bases level so that all ductwork, piping and electrical connections can be made to a rigid system at the proper operating level, before isolators are adjusted. Ensure that there are no rigid connections or incidental physical contacts between isolated equipment and the building structure or nearby systems.
- C. Ensure housekeeping pads have adequate space to mount equipment and isolator housings and shall also be large enough to ensure adequate edge distance for isolator anchors.
- D. Select and locate vibration isolation equipment to give uniform loading and deflection, according to weight distribution of equipment.

3.02 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic- and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine rough-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.04 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Install all equipment in accordance with manufacturer's recommendations and as shown on seismic design documents.
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Elastomeric Isolation Pads: Provide for entire weight bearing surface of equipment base, or as recommended by equipment manufacturer.
- D. Equipment Restraints:
 - 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- E. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
 - 2. Space lateral supports a maximum of 40 feet on center and longitudinal supports a maximum of 80 feet on center.
 - 3. Brace a change of direction longer than 12 feet.
- F. Install cables so they do not bend across edges of adjacent equipment or building structure.
- G. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- H. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- I. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- J. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- K. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and pro-

gressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.

5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.05 FIELD QUALITY CONTROL

- A. After installation of seismic and vibration control devices is complete and verified as fully functional, Contractor shall notify Engineer and seismic restraint designer that equipment is ready for inspection.
- B. Seismic restraint system Engineer shall inspect the installation to verify that seismic restraints are installed and adjusted in conformance with approved shop drawings and no additional restraints are necessary based on field conditions. Alternately, the restraint system Engineer may designate a qualified representative to provide the inspection. The representative may not be an employee of the installing Contractor or Subcontractor.
- C. Prepare inspection reports.

3.06 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3.07 HVAC VIBRATION CONTROL AND SEISMIC RESTRAINT DEVICE SCHEDULE

A.

VIBRATION ISOLATION AND SEISMIC RESTRAINT SCHEDULE			
EQUIPMENT	SPECIFICATION	SLAB ON GRADE	ABOVE GRADE
		STATIC DEFLECTION	STATIC DEFLECTION
Outdoor Heat Pump, HP-1	Rails & Spring Isolators, SM-1	2-inches	
Supply Fans	Spring Isolators, SH-1		

END OF SECTION

**SECTION 23 0553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Pipe labels.
 - 3. Valve tags.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.03 COORDINATION

- A. Coordinate with Division 22. Match manufacturer, type, and style of identification used.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brady Corporation.
 - 2. Marking Services, Inc.
 - 3. Seton Identification Products.

2.02 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: 0.025-inch aluminum. Predrilled or stamped holes for attachment hardware.
 - 2. Letter Color: Black.
 - 3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 - 5. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch-thick, and having predrilled holes for attachment hardware.
 - 2. Engraved to show white lettering on black background except for labels attached to ceiling grid or located within finished spaces shall have black lettering on white background.
 - 3. Maximum Temperature: Able to withstand temperatures up to 160°F.
 - 4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for

greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering. Lettering on labels attached to ceiling grid largest size practical.

6. Fasteners: Stainless-steel rivets or self-tapping screws.
 7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number.
- D. Equipment Label Schedule: For each item of equipment to be labeled, prepare equipment label schedule on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.03 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- B. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.04 VALVE TAGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brady Corporation.
 2. Marking Services Inc.
 3. Seton Identification Products..
- B. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
1. Tag Material: Polished brass, 0.025-inch aluminum and having predrilled or stamped holes for attachment hardware.
 2. UOCS requires rectangular tags with specific information. Select second option for UO projects.
 3. Minimum Tag Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4-inch.
 4. Fasteners: Brass wire-link chain or S-hook.
- C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment. Label ceilings or ceiling grid (not the tile) to indicate key access points for equipment, valves, and other components requiring quick access or routine maintenance. Provide a clear adhesive label and bold black lettering with equipment and valve identification information.

3.03 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.04 PIPE LABEL INSTALLATION

- A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations and on both sides of walls, floors, ceilings, and inaccessible enclosures.
 - 4. Near major equipment items and other points of origination and termination.
 - 5. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
- B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- C. Pipe Label Color Schedule: Letter and background color in accordance with ANSI A13.1.

3.05 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, faucets, convenience and lawn-watering hose connections, and isolation valves for HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves with captions as indicated in the following subparagraphs:
 - 1. Valve-Tag Information: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch valve tag numbers.
 - a. Valve-Tag Information: Stamped or engraved with 1/4-inch letters and 1/2-inch valve tag numbers as listed below:
 - b. Valve tag number.
 - c. System abbreviation.
 - d. Area served.
 - e. Normal position.

END OF SECTION

SECTION 23 0593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Balancing air systems and equipment.
 - 2. Testing, adjusting, and balancing existing systems and equipment.
 - 3. Duct leakage tests.
 - 4. Control system measurement and verification.

1.02 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. BAS: Building automation systems.
- C. NEBB: National Environmental Balancing Bureau.
- D. TAB Specialist: An independent entity meeting qualification to perform TAB work.
- E. TAB Project Supervisor: Certified individual employed by balancing contractor having administrative and technical responsibility for work performed under this Section.
- F. TAB: Testing, adjusting, and balancing.

1.03 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 15 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in Part 1 "Quality Assurance" and Part 3 "TAB Specialist."
- B. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- C. Instrument Calibration Report: Within 60 days of Contractor's Notice to Proceed. Report to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.
- D. TAB reports.
 - 1. Draft TAB Report
 - 2. Certified Final TAB report.
 - 3. Sound Test Report
 - 4. Vibration Test Report
 - 5. Verification of TAB Report

1.04 QUALITY ASSURANCE

- A. All work under this Section shall be performed under the direction of the Certified TAB Supervisor.
- B. TAB Specialists Qualifications: Certified by AABC or NEBB.
 - 1. TAB Supervisor: Employee of the TAB specialist and certified by AABC or NEBB.
 - 2. TAB Technician: Employee of the TAB specialist working under the supervision of the TAB Supervisor.
- C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

1.05 FIELD CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contract Document Examination:
 - 1. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
 - 2. Confirm that balancing devices and provisions are included to facilitate TAB work. Provide listing of any devices and provisions required that are on included in the Contact Documents.
 - 3. Contract Documents Examination Report: Based on examination of the Contract Documents, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Construction Examination:
 - 1. Examine the approved submittals for HVAC systems and equipment.
 - 2. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
 - 3. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
 - 4. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
 - 5. Examine test reports specified in individual system and equipment Sections.
 - 6. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
 - 7. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
 - 8. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

- A. Strategies and Procedures Plan: Prepare a TAB plan that includes the following:
 - 1. Equipment and systems to be tested.
 - 2. Strategies and step-by-step procedures for balancing the systems.
 - 3. Instrumentation to be used.
 - 4. Sample forms with specific identification for all equipment.
- B. Prepare system-readiness checks of HVAC systems and equipment to be executed by the Mechanical Contractor to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:
 - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
 - b. Duct systems are complete with terminals installed.
 - c. Volume dampers are open and functional.
 - d. Clean filters are installed.

- e. Fans are operating, free of vibration, and rotating in correct direction.
- f. Variable-frequency controllers' startup is complete, and safeties are verified.
- g. Automatic temperature-control systems are operational.
- h. Suitable access to balancing devices and equipment is provided.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
 - 1. Comply with requirements in ASHRAE 62.1, "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, install test ports and duct access doors as required in Section 23 3300 "Air Duct Accessories." Otherwise, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 0713 "Duct Insulation," Section 23 0716 "HVAC Equipment Insulation," and Section 23 0719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- E. Verify that motor starters are equipped with properly sized thermal protection.
- F. Check dampers for proper position to achieve desired airflow path.
- G. Check for airflow blockages.
- H. Check condensate drains for proper connections and functioning.
- I. Check for proper sealing of air-handling-unit components.
- J. Verify that air duct system is sealed as specified in Section 23 3113 "Metal Ductwork."
- K. Fan Pressure Measurements:
 - 1. Measure static pressure directly at the fan outlet or through the flexible connection.
 - 2. Measure static pressure directly at the fan inlet or through the flexible connection.
 - 3. Measure static pressure across each component that makes up and air-handling system.
- L. Air Inlets and Outlets:
 - 1. Supply Grilles: Set airflow patterns of adjustable outlets for proper distribution without drafts.
 - 2. Return Grilles: Set airflow patterns of adjustable outlets for proper distribution without drafts.
- M. Control Parameters and Setpoints:
 - 1. Minimum Ventilation Rates: Measure and adjust outside-air, return-air, and relief-air dampers for proper position to achieve minimum outdoor-air conditions. Determine set-point values for specific control sequences controlling damper operation.

2. Record verification measurement, calibration parameters, and setpoints in Final TAB Report.

3.05 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each electric heating coil:
 1. Nameplate data.
 2. Airflow.
 3. Entering- and leaving-air temperature at full load.
 4. Voltage and amperage input of each phase at full load.
 5. Calculated kilowatt at full load.
 6. Fuse or circuit-breaker rating for overload protection.
- B. Measure, adjust, and record the following data for each refrigerant coil:
 1. Dry-bulb temperature of entering and leaving air.
 2. Wet-bulb temperature of entering and leaving air.
 3. Airflow.

3.06 PROCEDURES FOR MOTORS

- A. Motor Measurement and Verification:
 1. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - a. Manufacturer's name, model number, and serial number.
 - b. Motor horsepower rating.
 - c. Motor rpm.
 - d. Phase and hertz.
 - e. Nameplate and measured voltage, each phase.
 - f. Nameplate and measured amperage, each phase.
 - g. Starter size and thermal-protection-element rating.
 - h. Service factor and frame size.
 2. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.
- B. Motor Speed Adjustments:
 1. Obtain approval from Engineer for adjustment of fan motor speeds higher than the motor synchronous speed, indicated speed for induction motors
 2. Obtain approval from Engineer prior to making fan-speed adjustments that result in motor operation above the motor RLA. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required motor amperage.

3.07 DUCT LEAKAGE TESTS

- A. Witness the duct pressure testing performed by Installer.
- B. Verify that proper test methods are used and that leakage rates are within specified tolerances.
- C. Report deficiencies observed.

3.08 CONTROLS VERIFICATION

- A. In conjunction with system balancing, perform the following:
 1. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.
 2. Verify that the system static pressure sensor is located in the duct or piping system as specified or as shown on drawings.
 3. Verify the operation of valve and damper actuators. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.

- B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions in Final Report.

3.09 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work. TAB shall be performed to achieve system performance shown on Drawings and as specified. TAB shall be performed for interrelated equipment and systems which are not otherwise modified, but where testing, adjusting, and balancing is required to achieve overall system performance and to maintain existing equipment and systems that are unmodified operating at preconstruction conditions.
 - 1. Compare the indicated airflow of the renovated work to the measured fan airflows and determine the new fan speed and the face velocity of filters and coils.
 - 2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
 - 3. If calculations increase or decrease the airflow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
 - 4. Balance each air outlet.
- B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
 - 1. New filters are installed.
 - 2. Coils are clean and fins combed.
 - 3. Drain pans are clean.
 - 4. Fans are clean.
 - 5. Bearings and other parts are properly lubricated.
 - 6. Deficiencies noted in the preconstruction report are corrected.
- C. Prepare an Existing Conditions TAB Report documenting inspections and measurements.

3.10 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 10 percent or minus 5 percent.
 - 2. Air Outlets and Inlets: Plus or minus 10 percent.
 - 3. Heating-Water Flow Rate: Plus or minus 10 percent.
 - 4. Cooling-Water Flow Rate: Plus or minus 10 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.11 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - 2. Include a list of instruments used for procedures, along with proof of calibration.
 - 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.

4. Field test reports prepared by system and equipment installers. Test reports shall be fully executed reports forms confirming to standard NEBB or AABC documentation standards.
 5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
 2. Name and address of the TAB specialist.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Notes to explain why certain final data in the body of reports vary from indicated values.
 14. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Fan drive settings including settings and percentage of maximum pitch diameter.
 - e. Settings for supply-air, static-pressure controller.
 - f. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and refrigerant distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Duct, outlet, and inlet sizes.
 3. Pipe and valve sizes and locations.
 4. Position of balancing devices.
- E. Instrument Calibration Reports:
1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.
- F. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- G. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions. Prepare Seasonal Test Report of measurements and adjustments.

END OF SECTION

**SECTION 23 0713
DUCT INSULATION**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes insulation of HVAC ductwork.

1.02 ACTION SUBMITTALS

- A. Provide submittals in accordance with Section 23 05 00 – General HVAC Provisions as follows:
 - 1. Provide catalog data for all products. Indicate thermal conductivity, water vapor permeance, and jackets (both factory and field applied) if any.

1.03 QUALITY ASSURANCE

- A. Insulation materials and accessories shall be installed in a professional manner by skilled and experienced workers who specialize in commercial insulation work.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.04 COORDINATION

- A. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.05 SCHEDULING

- A. If duct leak testing is required, schedule insulation application after systems are tested and, where required. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290,. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation
 - b. Johns Manville, a Berkshire Hathaway company
 - c. Knauf Insulation
- F. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation

with factory applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation
 - b. Johns Manville, a Berkshire Hathaway company
 - c. Knauf Insulation

2.02 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- C. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

2.03 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
 1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 2. Service Temperature Range: Minus 20 to plus 180°F.
 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 4. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
 1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
 2. Service Temperature Range: Minus 50 to plus 220°F.
 3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 4. Color: White.

2.04 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 2. Fire- and water-resistant, flexible, elastomeric sealant.
 3. Service Temperature Range: Minus 40 to plus 250°F.
 4. Color: Aluminum.

2.05 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with Kraft paper backing; complying with ASTM C 1136, Type II.

2.06 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 1. Width: 3 inches.
 2. Thickness: 6.5 mils.
 3. Adhesion: 90 ounces force/inch in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch in width.
 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.07 SECUREMENTS

- A. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive-backed base with a peel-off protective cover.
5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel or aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
6. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces, free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.04 **PENETRATIONS**

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
- E. Insulation Installation at Floor Penetrations:
 1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 2. Seal penetrations through fire-rated assemblies.

3.05 **INSTALLATION OF MINERAL-FIBER INSULATION**

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, and manufacturer's recommended percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install support pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not over-compress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

- b. Install vapor stops for ductwork and plenums operating below 50°F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
 5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for manufacturer's recommended percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install support pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not over-compress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50°F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
 5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.06 FIELD-APPLIED JACKET INSTALLATION

- A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.07 FIELD QUALITY CONTROL

- A. Testing Agency: Owner reserves the right to perform tests and inspections.
- B. Tests will include removing field-applied jacket and insulation in layers in reverse order of their installation for each duct system schedule as directed by the Owner.
- C. If sample inspection reveals noncompliance with requirements, all similar insulation applications will be considered defective Work and will be replaced at no expense to the Owner.

3.08 INDOOR DUCT INSULATION SCHEDULE

- A. Insulate all plenums and ductwork as scheduled with the following exceptions.
 - 1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 - 2. Factory-insulated flexible ducts.
 - 3. Factory-insulated plenums and casings.
 - 4. Flexible connectors.
 - 5. Vibration-control devices.
 - 6. Factory-insulated access panels and doors.
- B. Insulate ductwork requiring condensation control including:
 - 1. Supply ductwork located in conditioned spaces where the air supply temperature may be below the space temperature.
 - 2. Outside air ductwork.
 - 3. Desiccant dehumidification unit regeneration exhaust ductwork located in unconditioned spaces.
 - 4. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.
- C. Insulate supply and return ductwork located indoors in mechanical rooms, unconditioned spaces, or inside a wall between a conditioned and unconditioned space.
 - 1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- D. Supply and outside air plenums located in mechanical rooms or unconditioned spaces.
 - 1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

END OF SECTION

**SECTION 23 0719
HVAC PIPING INSULATION**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes insulating of above grade HVAC piping.

1.02 ACTION SUBMITTALS

- A. Provide submittals for products listed in the Product Table below in accordance with Section 23 05 00 – General HVAC Provisions.
 - 1. Catalog Data.
 - 2. For each type of product listed, provide thermal conductivity and water-vapor permeance.

1.03 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.04 QUALITY ASSURANCE

- A. Insulation materials and accessories shall be installed in a professional manner by skilled and experienced workers who specialize in commercial insulation work.
- B. Surface-Burning Characteristics: Products shall have flame spread and smoke developed ratings based on test procedures in accordance with NFPA-255 and UL 723. Rating shall be indicated on the product or on the shipping containers.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.06 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.07 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC
- C. Pre-manufactured Removable Insulation Systems
 - 1. General: Removable and Re-useable insulation covers, custom engineered and manufactured for the specific application. Similar to Fit Tight Covers.

2. Construction
 - a. Jacket and Liner: Silicon Impregnated Fiberglass Fabric
 - b. Insulation: 1-inch Type E Glass Mat
 - c. Fastening: 1-inch straps and stainless-steel D-rings.
 - d. Thread: Kevlar/stainless steel thread.

2.02 ADHESIVES

- A. Materials compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric: Comply with MIL-A-24179A, Type II, Class I.

2.03 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 2. Service Temperature Range: Minus 20 to plus 180°F.
 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 4. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
 1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
 2. Service Temperature Range: Minus 50 to plus 220°F.
 3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 4. Color: White.

2.04 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. Metal Jacket:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. ITW Insulation Systems; Illinois Tool Works, Inc.
 2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing or factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and Kraft paper.
 - d. Moisture Barrier for Outdoor Applications: 2.5-mil- thick polysurlyn.
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) End caps.
 - 5) Beveled collars.
 - 6) Valve covers.
 - 7) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.05 TAPES

- A. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 1. Width: 2 inches.
 2. Thickness: 3.7 mils.

3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- C. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- D. Install multiple layers of insulation with longitudinal and end seams staggered.
- E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 1. Install insulation continuously through hangers and around anchor attachments.
 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- J. Apply insulation and jacket manufacturer approved adhesives, mastics, and sealants at recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

4. For below-ambient services, apply vapor-barrier mastic over staples.
 5. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 6. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- O. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.

3.04 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 23 05 00 "General HVAC Provisions" for firestopping and fire-resistive joint sealers.

3.05 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation

by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover for removable basket flange. For below-ambient services, provide a design that maintains vapor barrier.
 6. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 7. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 8. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at the following:
1. Valves
- E. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

3.06 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Fittings and Elbows:
 1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

- C. Insulation Installation on Valves and Pipe Specialties:
 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.07 FIELD-APPLIED JACKET INSTALLATION

- A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.08 FIELD QUALITY CONTROL

- A. Testing: The Owner reserves the right to perform tests and inspections of selected insulation sites.
- B. Tests will include removing field-applied jacket and insulation in layers in reverse order of their installation for each piping system scheduled. If testing reveals defective work, all similar insulation sites will be considered defective, and Contractor will be responsible for cost of inspection and repair.

3.09 PIPING INSULATION THICKNESS

- A. General
 1. For piping smaller than 1-1/2 inches and located in partitions within conditioned spaces, reduction of thickness by 1-inch permitted to a thickness not less than 1-inch.
- B. Flexible Elastomeric Insulation
 - 1.

FLEXIBLE ELASTOMERIC					
FLUID NORMAL OPERATING TEMPERATURE (°F)	NOMINAL PIPE OR TUBE SIZE (inches)				
	<1	1 to < 1.5	1.5 to < 4	4 to < 8	< 8
105-140	1	1	1.5	1.5	1.5
40-60	0.5	0.5	1	1	1
<40	0.5	1	1	1	1.5

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. For all systems with an operating temperature that may be below ambient conditions, a vapor barrier must be maintained.
- C. For piping smaller than 1-1/2 inches and located in partitions within conditioned spaces, reduction of thickness by 1-inch is permitted to a thickness not less than 1-inch.
- D. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 1. Drainage piping located in crawl spaces.
 2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping, Operating temperature 40°F to 120°F :
 1. Flexible Elastomeric

3.12 OUTDOOR PIPING INSULATION

- A. Refrigerant Suction and Hot-Gas Piping, Operating temperature 40°F to 120°F:
 - 1. Flexible Elastomeric

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Provide jacketing for all outdoor insulated piping.
- B. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- C. If more than one material is listed, selection from materials listed is Contractor's option.
- D. Piping, Concealed:
 - 1. None.
- E. Piping, Exposed:
 - 1. Aluminum, Stucco Embossed with Z-Shaped Locking Seam: 0.032 inch thick.

END OF SECTION

**SECTION 23 0923
BUILDING AUTOMATION SYSTEMS FOR HVAC**

PART 1 - GENERAL

1.01 SUMMARY

- A. Work hereunder includes a new equipment connecting to an existing Alerton controls system through the building network for control of systems and equipment specified in Division 23. Associated work includes but is not limited to:
 1. New controllers and required supporting devices.
 2. Control wiring
 3. Programming and graphics updates for equipment additions.
 4. Field Mounted Devices as specified in SECTION 23 09 50 – FIELD INSTALLED CONTROL SYSTEM COMPONENTS.
 5. Control sequences as specified in SECTION 23 09 93– SEQUENCE OF OPERATIONS.
 6. Other materials and devices not shown as part of other work but necessary to provide mechanical and electrical system control and monitoring sequences specified.

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Control Contractor to coordinate with other trades to ensure delivery and correct installation of products furnished but not installed under this section. Coordination to include a review of schedule, manufacturer’s installation requirements, and equipment locations. Such products include but are not limited to the following:
 1. Dampers
 2. Actuators

1.03 RELATED SECTIONS

- A. SECTION 23 09 25 – BAS FIELD MOUNTED DEVICES FOR HVAC
- B. SECTION 23 09 29 – BAS SEQUENCE OF OPERATIONS FOR HVAC

1.04 SUBMITTALS

- A. Provide submittals for products listed in the Product Table below in accordance with Section 23 05 00 – General HVAC Provisions. Submittal requirements indicated by column number designation as follows:
 1. Materials List
 2. Catalog Data
 3. Product Data
 4. Performance Data
 5. Wiring Diagrams
 6. Shop Drawings
 7. Installation Instructions
 8. Special Requirement listed herein.

PRODUCT TABLE	1	2	3	4	5	6	7	8
All Products This Section								X

- B. Special Requirements:
 1. Provide all control submittals including Sections 23 09 23 – BUILDING AUTOMATION SYSTEMS FOR HVAC, 23 09 25 – BAS FIELD MOUNTED DEVICES FOR HVAC, and 23 09 29 – BAS SEQUENCE OF OPERATIONS FOR HVAC as a single package.
 2. Submittals prior to starting work:
 - a. Submit in accordance with Section 01 33 00 – SUBMITTAL PROCEDURES and Section 23 05 00 – GENERAL HVAC PROVISIONS within 6 weeks of project award.
 - b. All required schematics and plans prepared on AutoCAD 2010 or higher.

- c. When manufacturers' product information applies to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the pertinent specification or drawing.
- d. Building Automation System Hardware:
 - i. Provide a complete bill of materials of building automation control system hardware indicating quantity, manufacturer, model number, and technical data. Technical data shall include performance curves, product specifications sheets, and installation/maintenance instructions.
 - ii. Network Communication Diagrams: Provide schematic diagram showing all BAS panels, communications cabling, and termination points. Identify power requirements and power source for each BAS panel. Identify equipment each BAS panel is controlling. Show termination numbers.
 - iii. Provide plans indicating locations of all BAS hardware.
 - iv. Provide panel interior and exterior layout details for prefabricated control panels. Details shall include equipment layout and routing of wiring and tubing.
 - v. Provide two copies of programming manuals for each BAS controller furnished.
 - vi. Provide a listing and description of all available training programs. Indicate a cost for each location that the training program is available.
 - vii. Provide schematic diagram of the central system including all control, communication, and power wiring. Label all cables and ports with computer manufacturers' model numbers and functions.
 - viii. Provide a list of color graphics screens to be provided. Indicate each screen content and relation to other screens.
- e. Controlled Systems:
 - i. Provide an instrumentation list for each controlled system including all controlled system elements in table format. Tables to show element name, type of device, manufacturer, model number, and product data sheet number.
 - ii. Provide a schematic diagram of each controlled system. Include control points labeled with appropriate point names. Graphically show the location of all control elements.
 - iii. Provide a schematic wiring diagram for each controlled system. Label all elements. Label all terminals.
 - iv. Provide a mounting, wiring, and routing plan-view drawing. Layout to account for HVAC, electrical, and other system design and layout requirements.
 - v. Provide a complete description of the function of each controlled system including sequence of operation.
 - vi. Provide a points list for each system controller including both input and output (I/O) points. Note point designations, point function, controlled device associated with the I/O point, location of the I/O device, and point alarm requirements.
- 3. Closeout Submittals
 - a. Submit in accordance with SECTION 01 78 39 - PROJECT RECORD DOCUMENTS.
 - b. Record documents shall include the following.
 - i. Project record drawings. Project record drawings will be as-built versions of the shop drawings. Include one set of magnetic media including CAD drawings in .DWG format.
 - ii. Provide copy of testing and commissioning reports. Include trend logs used for verification.
 - iii. Material to be included in Project Operation and Maintenance Manuals

- (i) Names, addresses and 24-hour telephone numbers of installing Contractors and the service representatives for each.
- (ii) Operators manual with procedures for operating the control systems including logging on/off, alarm handling, producing point reports, trending data, overriding computer control, and changing set points and other variables.
- (iii) A listing and documentation of all custom software created using the programming language including set points, tuning parameters, and object database.
- (iv) A list of recommended spare parts with part numbers and suppliers.
- (v) Recommended preventive maintenance procedures for all system components including a schedule of tasks, time between tasks, and task descriptions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Alerton, installed by Environmental Controls Corporation.

2.02 WORKSTATION GRAPHICS

- A. System Graphics: update existing graphics with new systems and equipment within the project scope.

2.03 SYSTEM CONTROLLERS

- A. Provide new application specific controllers as required.

2.04 WIRING AND RACEWAYS

- A. Provide wiring, plenum cable, and raceways in accordance with Division 26.
- B. All insulated wire to have copper conductor. UL labeled for 90°C service.

PART 3 – EXECUTION

3.01 COORDINATION

- A. Testing and Balancing
 - 1. Provide to the Testing and Balancing Contractor a set of all tools and temporary licenses necessary to interface to the control system for testing and balancing purposes. Tools to be returned at the completion of test and balancing work.
 - 2. Provide training in the use of the tools.
 - 3. Provide a qualified technician to assist in the testing and balancing process where required.
- B. Coordinate with controls specified in other sections or divisions. Other sections or divisions include controls and control devices to be part of or interfaced with the control system specified in this section. Integration and coordination with these controls shall be as follows.
 - 1. All communications media and equipment required to interface with equipment specified in other sections provided hereunder unless specifically stated otherwise.
 - 2. Each supplier of a control product is responsible for the configuration, programming, start-up, and testing of that product to meet the sequence of operation stated in SECTION 23 09 29 – BAS SEQUENCE OF OPERATIONS FOR HVAC.
 - 3. Coordinate and resolve any compatibility issues arising between control products provided hereunder and those provided under other sections or divisions.

3.02 WORKMANSHIP

- A. Install all equipment in accordance with manufacturers' recommendations.
- B. Install equipment, piping, and wiring/raceway parallel to building lines wherever possible.
- C. Provide sufficient slack and flexible connections in wiring and pneumatic tubing to allow for vibration of piping and equipment.
- D. Install all equipment in readily accessible locations as defined by Chapter 1, Article 100, Part A of the National Electric Code.

3.03 EXISTING EQUIPMENT

- A. Unless specifically stated elsewhere, Contractor is not responsible for the repair or replacement of existing control system equipment to be reused. Such equipment includes but is not limited to control devices, valves, dampers, or actuators. Should the Contractor find existing equipment requiring maintenance, Contractor shall notify the Owner immediately. Repair will be performed under separate Contract.

3.04 GENERAL WIRING

- A. All control and interlock wiring shall comply with national and electrical codes and Division 26. Where requirements of this section differ from those in Division 26, the requirements of this section shall take precedence.
- B. ALL line voltage wiring shall be UL listed in approved raceway according to NEC and Division 26 requirements.
- C. All low-voltage wiring shall meet NEC Class or Class 2 requirements. Low voltage power circuits shall be sub-fused when required.
- D. Where NEC Class 1 and Class 2 wires are in concealed and accessible locations, including ceiling plenum return air plenums, approved cable not in raceway may be used provided cables are UL listed for the intended application.
- E. All wiring in mechanical, electrical, or service rooms and wiring located where it may be subject to damage shall be installed in raceway.
- F. Do not install Class 2 wiring in raceways containing Class 1 wiring. Boxes and panels containing high-voltage wiring may not be used for low-voltage wiring except for the purpose of interfacing the two.
- G. Do not install wiring in raceway containing tubing.
- H. Where Class 2 wiring is installed exposed, wiring is to be routed parallel or perpendicular to building lines and neatly tied at a maximum of 10-foot intervals.
- I. Where plenum cables are used without raceway, support or anchor cable from building structure. Do not anchor or support cable from ductwork, electrical raceways, piping, or suspended ceiling systems.
- J. Provide all wire-to-device connections at terminal block or terminal strip. Provide all wire-to-wire connections at terminal block.
- K. Neatly bundle wiring located within enclosures to permit access to devices and terminals.
- L. Maximum allowable voltage for control wiring shall be 120V. If only higher voltages are available, Contractor shall provide a step-down transformer.
- M. All wiring shall be installed as continuous lengths with no splices permitted between termination points.
- N. Install plenum wiring in sleeves where it passes through walls and floors. Provide fire-stop foam where necessary to maintain fire rating.
- O. Provide size of raceway and size and type of wire as required by NEC and as required to meet manufacturers' recommendations for connected equipment.
- P. Include one pull string in each raceway 1-inch or larger.
- Q. Use color coded conductors throughout.
- R. Locate control and status relays in designated enclosures only. Such enclosures include packaged equipment control cabinets unless such cabinets also contain Class 1 starters.
- S. Conceal all raceways except within mechanical, electrical, or service rooms. Maintain minimum raceway clearance of 6-inches from high temperature equipment such as steam piping or boiler flues.
- T. Secure raceways with raceway clamps fastened to the structure and spaced in accordance with code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods.

Raceways may not be supported from ductwork, electrical raceways, piping, or suspended ceiling systems.

- U. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of all raceways.
- V. Maintain updated wiring diagrams (as built) at site with terminations identified.
- W. Flexible metal raceways and liquid-tight, flexible metal raceways shall not exceed 3-feet in length and shall be supported at both ends. Flexible metal raceway less than ½-inch electrical trade size shall not be used. In areas exposed to moisture, including but not limited to chiller and boiler rooms, liquid-tight, flexible metal raceways shall be used.

3.05 **COMMUNICATION WIRING**

- A. Install in accordance with 3.03 above.
- B. Follow manufacturers' recommendations for all communications cabling including but not limited to maximum pulling, tension, and bend radius.
- C. Do not install communications cabling in a raceway or enclosure containing Class 1 or other Class 2 wiring.
- D. Verify the integrity of the entire network immediately following cable installation using test measures appropriate for each cable.
- E. Provide a lightning arrestor between cables and grounds where cable enters or exits a building. Install arrestor in accordance with manufacturers' recommendations.
- F. All communications wiring shall be un-spliced length when that length is commercially available.
- G. All communications wiring shall be labeled to indicate origination and destination.
- H. Ground coaxial cable in accordance with NEC regulations article on "Communications Circuits, Cable and Protector Grounding."

3.06 **IDENTIFICATION OF HARDWARE AND WIRING**

- A. Label all wiring and cabling, including wiring and cabling terminating within factory-fabricated panels, within 2 inches of termination with the BAS address or termination number.
- B. Label all pneumatic tubing at each end within 2 inches of termination with a descriptive identifier.
- C. Permanently label or code each point of field terminal strips to show the instrument or item served.
- D. Identify control panels with minimum ½-inch letters on laminated plastic nameplate.
- E. Identify all other control components with permanent labels. All plug-in components shall be labeled so that removal of component does not remove label.
- F. Identify room sensors relating to terminal box or valves with nameplate located within sensor cover.
- G. Arrange components so that UL or CSA labels are visible after equipment is installed.
- H. Identifiers shall match record documents.
- I. Provide laminated network communication diagrams, point-to-point wiring diagrams, and process control diagrams in each control panel for control components contained therein.

3.07 **BAS CONTROLLER INSTALLATION**

- A. Provide a separate BAS controller for each air handling unit or other discrete system. A BAS controller may control more than one system provided that all points associated with the system are assigned to the same BAS controller. Points used for control loop reset, such as outside air temperature or space temperature, are exempt from this requirement.
- B. Building Controllers and Advanced Application Controllers shall be selected to provide a minimum of 15% spare I/O point capacity for each point type. If input points are not universal, 15% of each type is required. A minimum of one spare is required for each type of point used.
 - 1. Future use of spare capacity shall require providing the field device, field wiring, point database definition, and custom software. No additional controller boards or point modules shall be required to implement use of spare points.

- C. Provide sufficient internal memory for the specified sequences of operation and trend logging. Provide a minimum of 25% available memory free for future use.

3.08 PROGRAMMING

- A. Provide programming for the system as required to perform the sequence of operation. See SECTION 23 09 29 – BAS SEQUENCE OF OPERATIONS FOR HVAC. Provide all other programming necessary for proper operation of the system but not specified including but not limited to time delays, control deadbands, equipment interlocks, equipment sequencing, alarm notification, and control sequences recommended by equipment manufacturers.
- B. All control setpoints and loop tuning parameters accessible for review and adjustment at workstation graphics or through workstation menus without requiring modification of program code.
- C. For systems using text-based programming, imbed comments in the programming code to clearly describe each section of the program.
- D. Contractor to provide time scheduling functions as specified in the Sequence of Operations. Independent schedules shall be provided for each system, unless otherwise specified.
- E. Contractor to provide alarming functions as specified in the Sequence of Operations. Contractor shall also configure alarming functions as directed by Owner including setting alarm limits and differentials, states, type of notification, and alarm messages.
- F. Contractor shall configure trending functions as directed by Owner including trend data collection and report format.

3.09 GRAPHICS

- A. Update graphics for all controlled systems within the project scope.

3.10 CONTROL SYSTEM CHECKOUT AND TESTING

- A. Contractor shall completely test and verify specified control system performance. Compile test results and include with written certification.
- B. Contractor shall furnish all labor and test apparatus required to calibrate and prepare for service all instruments, controls, and accessory equipment furnished hereunder.
- C. Verify that all control and communications wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
- D. Alarms:
 - 1. Check each alarm separately by including appropriate signal at a value that will trip alarm.

3.11 DEMONSTRATION AND ACCEPTANCE

- B. Demonstrate operation of control system to Owner and Engineer including:
 - 1. Menu functions
 - 2. Point overrides
 - 3. Control loop response after point modification
 - 4. Alarm response time

END OF SECTION

**SECTION 23 0925
BAS FIELD MOUNTED DEVICES FOR HVAC**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Temperature Measurement
- B. Humidity Measurement
- C. Relays and Switches
- D. Actuators

1.02 RELATED SECTIONS

- A. SECTION 23 09 23 – BUILDING AUTOMATION SYSTEMS FOR HVAC
- B. SECTION 23 09 29 – BAS SEQUENCE OF OPERATIONS FOR HVAC

1.03 SUBMITTALS

- A. Provide submittals for products listed in the Product Table below in accordance with Section 23 05 00 – General HVAC Provisions. Submittal requirements indicated by column number designation as follows:
 - 1. Materials List
 - 2. Catalog Data
 - 3. Product Data
 - 4. Performance Data
 - 5. Wiring Diagrams
 - 6. Shop Drawings
 - 7. Installation Instructions
 - 8. Special Requirement listed herein.

PRODUCT TABLE	1	2	3	4	5	6	7	8
Temperature measurement		X						
Humidity measurement			X					
Gas concentration measurement			X					
Relays and switches		X						
Actuators		X						

1.04 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Control Contractor to coordinate with other trades to ensure delivery and correct installation of products furnished but not installed under this section. Coordination to include a review of schedule, manufacturer's installation requirements, and equipment locations.
- B. Control Contractor to provide all manufacturer's product information including recommended installation instructions to installing Contractor.

PART 2 - PRODUCTS

2.01 TEMPERATURE MEASUREMENT

- A. Temperature Sensors
 - 1. Acceptable Manufacturers: Mamac, Precon, Veris, or approved Direct Digital Control System manufacturer.
 - 2. Sensing element: Thermistor type, +/- 0.5oF from 32oF to 150oF accuracy, less than 0.25oF drift/year. Compatible with BMCS analog input requirements. Select sensor with smallest range available that will span anticipated sensed medium temperature range.
 - 3. Space Air Sensor: Range 40 to 90oF, wall mounted with vandal-resistant heavy plastic or stainless-steel cover. Provide stainless-steel cage or other approved enclosure where sensors are susceptible to damage or vandalism.

- a. Options: Provide the following space sensor options.
 - i. Local set point adjustment
 - ii. Override switch
 - iii. Temperature display
 - iv. Communications port.
- B. Temperature Transmitters
 1. Acceptable Manufacturer: Mamac, Precon, Veris, or approved Direct Digital Control System manufacturer.
 2. Sensing element: 100-ohm, platinum RTD, +/- 0.65oF @ 70oF.
 3. Transmitters: 4 to 20 mA output. Select sensor with smallest range available that will span anticipated sensed medium temperature range. NEMA Type 4 rated Instrument head suitable for housing RTD wiring terminations and temperature transmitter and temperature sensor.
 4. Outside Air Sensor: Operating range -40 to 140oF, stainless-steel sensor sheath mounted in a weatherproof enclosure.
 5. Ductwork Averaging Sensor: Multiple sensing elements contained in soft aluminum tubing. Sensors shall be a minimum of 1 foot in length for every 2 square feet of duct area.
 6. Ductwork Probe Sensor: Aluminum or stainless-steel sensor sheath, sensor probe length suitable for application.

2.02 HUMIDITY MEASUREMENT

- A. Relative Humidity Transmitter:
 1. Acceptable Manufacturer: Mamac, Veris, Vaisala
 2. Sensor: Solid state, copolymer wafer sensor. Operating range 0 - 100 RH.
 3. Accuracy: +/-2% accuracy, temperature compensated.
 4. Output: 0-5 VDC, 4/20 mA linear output compatible with BAS manufacturer.
 5. Power Supply: 24 VAC supply voltage with input power isolation
 6. Basis of Design: Mamac model HU-222

2.03 GAS CONCENTRATION MEASUREMENT

- A. Carbon Dioxide Transmitter:
 1. Acceptable Manufacturer: Vaisala, Veris
 2. General: Non-dispersive, dual-channel, infrared sensor. LCD display. Adjustment capabilities shall include output scaling, elevation adjustment, relay setpoint, relay dead-band, linear or exponential output, and single-point calibration. Similar to Veris CWLSXX.
 3. Outputs:
 - a. Analog: 0-10 VDC or 4-20 mA over 0 – 2000 ppm sensed range. Adjustable to 0 – 10,000 ppm range.
 - b. Relay: 2A rating, adjustable setpoint
 4. Input: 24 VAC.
 5. Accuracy over 0 – 2000 ppm range: The larger of +/- 30 ppm or +/- 2% of reading. Annual drift +/- 10 ppm. Minimum five-year recommended calibration interval.

2.04 RELAYS AND SWITCHES

- A. Push Buttons, Position Selector Switches, Manual Operating Switches.
 1. General: UL listed, industrial grade
- B. Single Phase Motor Control Relays:
 1. Acceptable Manufacturer: Greenheck, Veris,
 2. General: Industrial grade load-switching relay, current status switch, and Hand-Off-Auto switch for control or fractional horsepower single phase motors. The relay, current sensor,

and HOA switch are combined in a series circuit. Once an H5xx is wired in series between the power source and motor, all three components are installed.

3. Relay: Contacts rated for connected motor load, SPST relay is field-selectable for N.O. or N.C. operation. LED status indicator light.
 4. Current Status Switch: Adjustable setpoint.
 5. Housing: Surface mounted. The housing provides physical separation and multiple wiring exits to isolate control and high voltage wiring.
 6. Similar to Veris, Hawkeye Model 500 Series
- C. Current Status Switches for Variable Frequency Drive Application, Adjustable Trip
1. Acceptable Manufacturer: Hawkeye or approved equal.
 2. General: Factory programmed current sensor to detect motor undercurrent situations such as belt or coupling loss on variable loads. Sensor shall store motor current as operating parameter in non-volatile memory. Push-button to clear memory.
 3. Visual LED indicator for status
 4. Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 5 A to 135 A and from 5 to 75 Hz
 5. Normally open current sensor output. 0.1A at 30 VAC/DC
 6. Similar to Hawkeye Model H904
- D. Current Status Switches, Fixed Trip
1. Acceptable Manufacturer: Hawkeye or approved equal.
 2. General: Fixed trip point current switch.
 3. Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from .25 A to 200 A.
 4. Normally open current sensor output. 0.1A at 30 VAC/DC
 5. Similar to Hawkeye Model H800
- E. High Differential Pressure Switch
1. Static pressure/electric relay to detect dirty air filter or fan over-pressure condition. Diaphragm operated contact. Adjustable setpoint range.
- F. Low Temperature Limit Switch (Freeze Protection Relay)
1. Low temperature cutout relay. SPDT contact. Adjustable setpoint from 35 degrees F to 50 degrees F.
 2. Fixed differential sensing element. Minimum 1 lineal foot of element per 1 square foot of coil area.
 3. Manual reset

2.05 ACTUATORS

- A. Acceptable Manufacturers: Belimo or approved equal.
- B. Proportional Electric Actuator:
 1. Direct coupled, spring return. Fully proportioning with ample power to operate valve or damper against fluid pressures and mechanical friction.
 2. Size to provide specified valve shut-off pressure or damper differential pressure.
 3. 0 to 10 VAC or 4 to 20 mA input control signal.
 4. 24 VAC supply power. Suitable for use with Class 2 wiring. Maximum 10 VA for AC installations and 8 watts for DC applications.
 5. Actuator shall have electronic overload or digital rotation circuitry to prevent damage to actuator through entire rotation range.
 6. Actuators shall initialize when actuator is powered. Initialization will determine stroke length and enable actuator to set minimum and maximum limits of supplied control signal to ensure use of entire control signal range. Feedback automatically adjusted to the effective stroke.

7. Provide manual override and visual position indicator.
 8. Provide NEMA Type 1 enclosures.
 9. Damper Service:
 - a. Direct shaft-mounted
 - b. Provide one actuator per damper section. No connecting rods or jack shafts allowed except where indicated on control drawings.
 - c. Provide positive method of attaching actuator to damper shaft. If single bolt or set screw is used, mill flat side on damper shaft to avoid slippage.
- C. Two Position Electric Actuator
1. Direct coupled, spring return or last position as required. Ample power to operate valve or damper against fluid pressures and mechanical friction.
 2. Size to provide specified valve shut-off pressure or damper differential pressure.
 3. 0 to 24 VAC input control signal.
 4. 24 VAC supply power. Suitable for use with Class 2 wiring. Maximum 10 VA for AC installations and 8 watts for DC applications.
 5. Actuator shall have electronic overload or digital rotation circuitry to prevent damage to actuator through entire rotation range.
 6. Provide manual override and visual position indicator.
 7. Provide NEMA Type 1 enclosures.
 8. Damper Service
 - a. Direct shaft-mounted
 - b. Provide one actuator per damper section. No connecting rods or jack shafts allowed except where indicated on control drawings.
 - c. Provide positive method of attaching actuator to damper shaft. If single bolt or set screw is used, mill flat side on damper shaft to avoid slippage.
- D. Floating Point Control Actuators
1. Direct-coupled, floating point control, spring return fail-safe
 2. Tri-state binary input control application
 3. 24 VAC supply power
 4. Actuator shall have electronic overload or digital rotation circuitry to prevent damage to actuator through entire rotation range.
 5. Provide manual override and visual position indicator
 6. Provide NEMA Type 2 enclosures

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Locate field-mounted devices as shown on Drawings and install per manufacturers recommendations.

3.02 SENSORS AND TRANSMITTERS

- A. Provide temperature sensor for space temperature sensing applications.
- B. Provide temperature transmitter for the following applications:
 1. Outside Air Temperature
 2. Ductwork Temperature with Averaging Sensor
 3. Ductwork Temperature with Probe Sensor
- C. Space Temperature Sensors:
 1. Mount on wall or on ceiling pendant as shown on Drawings.
 2. For wall installation, mount on wall 60 inches above finished floor level in concealed junction boxes properly supported by wall framing.

3. For ceiling installation, mount on minimum 24-inch pendant, but not less than 84 inches above finished floor level.
 4. Locate space temperature sensor to avoid localized heating or cooling effects from space equipment, lights, or diffusers.
 5. All wires attached to sensors shall be air sealed in their raceways to prevent air transmitted from other areas from affected sensor accuracy.
- D. Outside Air Temperature Transmitter:
1. Mount on north walls
 2. Mount inside ventilated sun shield to minimize radiant energy and wind effects.
- E. Ductwork Temperature Transmitters:
1. Duct mounted sensors duct mounted in electrical box on duct exterior.
 2. For outdoor applications, provide a weatherproof mounting box with weatherproof cover and gasket.
- F. Ductwork Averaging Temperature Transmitter: Provide for mixed air applications, ductwork with a cross sectional dimension greater than 48 inches, and any application where non-uniform air temperature exists.
- G. Ductwork Probe Temperature Transmitter: Size to position tip of probe in middle of air stream.
- 3.03 SPACE HUMIDITY SENSOR**
- A. Mount on wall or on ceiling pendant as shown on Drawings. Mount on wall 60 inches above finished floor level. Mount on 24-inch pendant, but not less than 84 inches above finished floor level.
- 3.04 RELAYS AND SWITCHES**
- A. Current Status Switches:
1. Provide current status switch to monitor status of all motor-driven equipment where status is required.
 2. Wrap power conductor through current transformer multiple times to amplify current signal where required.
 3. Provide enclosure adjacent to existing motor starter when space in starter is not adequate to house current status switch.
- B. Low Temperature Limit Switches:
1. Sensors elements shall be installed to protect entire face of coils
 2. To allow testing, install with 12-inch loop of sensing element outside of fan housing. Not applicable for outdoor installations.
- 3.05 ACTUATORS**
- A. Damper actuators shall not be installed in the air stream unless specified shown on Drawings.
- B. Provide weather shield where actuators are mounted outside of conditioned space.
- C. Provide air gaps, thermal isolation washers or spacers, standoff legs, or insulation if required to ensure that actuator ambient temperature does not exceed actuator rating.
- D. Actuator cords or conduit shall incorporate a drip leg if condensation is possible.

END OF SECTION

**SECTION 23 0929
BAS SEQUENCE OF OPERATIONS FOR HVAC**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Description of Control Sequences.

1.02 WORK INCLUDED

- A. The control system will consist of all necessary devices and software to provide the sequences of operation described herein.
- B. Provide custom engineered BAS operating software to perform control sequences specified. Sequence of operations describes major control functions but does not limit Contractor's responsibility to provide a fully operational automatic control system. Contractor shall provide additional control functions not specifically described herein including time delays, control deadbands, equipment interlocks, equipment sequencing, alarm notification, control functions recommended by equipment manufacturers, or as otherwise required.

1.03 SUBMITTALS

- A. Provide submittals for products listed in the Product Table below in accordance with Section 23 05 00 – General HVAC Provisions. Submittal requirements indicated by column number designation as follows:
 - 1. Materials List
 - 2. Catalog Data
 - 3. Product Data
 - 4. Performance Data
 - 5. Wiring Diagrams
 - 6. Shop Drawings
 - 7. Installation Instructions
 - 8. Special Requirements listed herein.
 - 9.

PRODUCT TABLE	1	2	3	4	5	6	7	8
All Products This Section								X

- B. Special Requirements: Provide a complete written sequence of operations for each system or subsystem under all modes of operation. Where Contractor proposes any variation to the sequence of operation described hereunder, the Contractor shall specifically highlight the change and describe the reason for the revision.

1.04 DESIGN REQUIREMENTS

- A. All safety control circuits interlocked with motor starters or VFDs shall be hardwired and shall function in all operating modes (Automatic, Hand, and Manual Bypass).
- B. Control setpoints and parameters listed in control sequences are initial values. Adjust setpoints and control parameters as directed by Engineer to achieved desired environment conditions, optimum system performance, and as recommended by TAB contractor.
- C. Control setpoints shall be adjustable from the Operator Workstation without modification of control programming or use of proprietary software. All setpoints which are necessary for normal operation and optimization of system performance as required by Owner shall be adjustable, and shall include, but not be limited to: time schedules; temperature, pressure, humidity, and CO2 setpoints; time delay settings; safety sequence setpoints; and alarming parameters.
- D. Where BAS network communications are provided to networkable control systems or equipment, Contractor shall configure accessible points for control, monitoring, and alarm as required to provide specified sequences and as directed by the Owner's Authorized Representative for trending and monitoring.

- E. All cascade control sequences and closed control loops shall have proportional-integral action and derivative capability, except where approved otherwise.
- F. Provide BAS alarm functions and configuration as detailed in plans and specifications, and as directed by Owner's Authorized Representative. Alarm functions may include:
 - 1. Visual display on workstation graphic.
 - 2. Audible alarm at workstation computer.
 - 3. Listing in workstation alarm log.
 - 4. "Pop-up" alarm notification at workstation computer.
 - 5. Dial-out alarm to Owner's security staff or alarm monitoring service.

PART 2 - PRODUCTS

2.01 SPLIT SYSTEM OPERATION, (AHU-1, EDH-1 & HP-1):

- A. General: Indoor air handler is constant volume, supply fan, heating and cooling with DX coil. Outdoor heat pump unit HP-1 is connected to unit DX coil. Electric duct heater provides heating during defrost cycle and supplemental heating when otherwise required. Supply fans (SF-1, SF-2, & SF-3) operate to maintain uniform air temperatures and dewpoint throughout open areas in basement.
- B. Space Temperature Setpoints:
 - 1. Heating: 63°F.
 - 2. Cooling: 66°F.
- C. Time Control
 - 1. Occupied Mode: Provide time schedule to define occupied times for each day of the week and holidays when facility is generally in use.
 - 2. Unoccupied Mode: Enable whenever Occupied mode is not enabled.
- D. Unoccupied Mode:
 - 1. Mode Control: Enable during unoccupied period in accordance with Time Control.
 - 2. Damper Control: Close outside air and relief air dampers. Open return air damper.
 - 3. AHU-1 Fan Operation: Supply fan on.
 - 4. AHU-1 Supply Fan Speed: Operate in accordance to Discharge Air Temperature Control & Fan Speed Control.
 - 5. HP-1 Operation: Operate in accordance to Discharge Air Temperature Control
- E. Occupied Mode:
 - 1. Mode Control: Enable during occupied period in accordance with Time Control.
 - 2. Damper Control:
 - a. Outside air damper:
 - i. Damper at minimum position, subject to economizer operation and Demand Control Ventilation. In conjunction with TAB contractor, determine outside air damper positions at minimum and maximum fan speeds to maintain minimum outside air flow setpoint.
 - ii. When outside air temperature is at return air temperature minus 2°F or more, modulate damper up to full open for economizer cooling.
 - b. Modulate return air damper with inverse signal to outside air damper
 - c. Relief air damper open
 - 3. AHU-1 Fan Operation: Fan on.
 - 4. AHU-1 Fan Speed: Operate in accordance with Fan Speed Control.
 - 5. HP-1 Operation: Operate in accordance with Discharge Air Temperature Setpoint and Discharge Air Temperature Control.
- F. Motor Control: Operate subject to individual On-Off-Auto switch at motor controller as follows:
 - 1. Auto Position: Operate motor subject to BAS control signal.

2. On Position: Override automatic control and start motor. Safety control sequences enabled.
 3. Off Position: Motor off.
- G. Discharge Air Temperature Setpoint:
1. Modulate dampers in accordance with Damper Position Sequence to maintain discharge air temperature.
 2. Modulate discharge air temperature setpoint to maintain space temperature setpoint. Discharge air temperature setpoint ranges from minimum of 53°F and maximum of 80°F.
- H. Fan Speed Control:
1. Supply Fan: Operate supply fan at maximum or minimum speed, in accordance to Discharge Air Temperature Control. When changing fan speed between minimum and maximum, change speed over a 10 minute (adj.) time span.
 - a. When changing fan speed between minimum and maximum, change speed over 10-minute (adj.) time span.
 2. Minimum speed setpoint: 50% supply airflow.
 3. Maximum speed setpoint: 100% supply airflow.
- I. Discharge Air temperature Control, AHU-1:
1. Outside air damper & relief damper operate in accordance with Demand Control Ventilation.
 2. Modulate return damper to maintain minimum or maximum airflow in accordance with Fan Speed Control.
 3. Heating:
 - a. Heat pump unit (HP-1) on & operating to maintain discharge temperature setpoint. Provide heating output signal to HP to maintain setpoint.
 - b. Initial AHU-1 fan speed at minimum setpoint in accordance to Fan Speed Control.
 - c. When discharge air temperature setpoint is above 75°F, reset AHU-1 fan speed to maximum setpoint in accordance to Fan Speed Control.
 - d. When HP output does not maintain supply air temperature setpoint, initiate duct heater output, and modulate to maintain setpoint.
 - e. At maximum fan speed, if heat pump cannot achieve discharge temperature setpoint after 10 minutes, activate electric duct heater to maintain discharge temperature setpoint.
 4. Cooling:
 - a. Heat pump unit (HP-1) on & operating to maintain discharge temperature setpoint. Provide cooling output signal to HP to maintain setpoint.
 - b. Initial AHU-1 fan speed at minimum setpoint in accordance to Fan Speed Control.
 - c. When discharge air temperature setpoint is below 60°F, reset AHU-1 fan speed to maximum setpoint in accordance to Fan Speed Control.
 - d. When economizer cycle is required, space temperature requirements will have heating demand.
 5. Deadband:
 - a. Heat pump unit (HP-1) off.
 - b. AHU-1 fan speed at minimum setpoint in accordance to Fan Speed Control.
 - c. Modulate outside and return air dampers to maintain discharge temperature setpoint.
- J. Supply fans (SF-1, SF-2, & SF-3): fans operate continuously.
- K. Demand Control Ventilation (DCV):
1. Modulate outside air damper minimum position to maintain DCV airflow setpoint.
 2. DCV Airflow Setpoint: Modulate setpoint to maintain maximum space CO2 level of 1200 ppm.

3. Limit DCV setpoint range between a “Upper Limit” and “Lower Limit” as follows:
 - a. Upper Limit: Minimum outside airflow rate as scheduled on the Drawings.
 - b. Lower Limit: Minimum outside airflow rate to maintain supply air CO2 level of 850 ppm.
- L. Safety/Emergency Control, Monitoring and Alarming
 1. Fire Alarm: Shut off fan when the building fire alarm is activated. When alarm signal ends, resume normal operating condition.
 2. Freeze Protection (hardware): Activate freeze protection alarm when supply temperature is less than 36°F. Stop fans. Associated valves and dampers set to unoccupied mode position. Electrically interlock to fan starter. Manual reset.
 3. Freeze Protection (software): Activate freeze protection alarm when supply temperature is less than 40°F. Stop fans. Associated valves and dampers set to unoccupied mode position, except modulate heating discharge temperature for leaving air temperature of 70°F. Automatically attempt re-start three (adjustable) times. If unit stops following third attempt, set and maintain alarms until acknowledged by operator.
 4. Low Duct Static Pressure: Stop fans and provide low mixed air plenum pressure alarm when plenum pressure is less than –1.0 inches w.c. Associated valves and dampers set to normal off position. Electrically interlock with supply fan starter. Automatically attempt re-start three (adjustable) times. If unit stops following third attempt, set and maintain alarms until acknowledged by operator.
 5. Fan Alarm Mode: If any fan is commanded “on” and fan status after a 30 second delay indicates that the fan is off, provide a critical alarm. Automatically attempt re-start three (adjustable) times. If unit stops following third attempt, set and maintain alarms until acknowledged by operator.
 6. Heat Pump Alarm Mode: Upon alarm output from HP controller, provide a critical alarm.
- M. Input/Output Points List
 1. Provide all control points required to perform the automatic control sequence described above, which as a minimum shall include all points listed below and as shown on Drawings. Where BAS points are obtained from packaged equipment, the equipment connection is listed following the point description.

BAS Points List	Equipment Connection
Digital Inputs	
AHU-1 supply fan status	
SF-1 status	
SF-2 status	
SF-3 status	
Freeze protection switch	
Supply fan low pressure switch	
HP alarm status	
Digital Outputs	
Supply fan start/stop	VFD
HP-1 enable/disable	
SF-1 start/stop	
SF-2 start/stop	
SF-3 start/stop	

Analog Inputs	
Supply air temperature	
Outside air temperature	
Return air temperature	
Mixed air temperature	
Supply air pressure	
Supply fan air flow	
Supply air CO ₂	
Space CO ₂ , typical of 2	
Analog Outputs	
Outside air damper position	
Return air damper position	
Relief air damper position	
Supply fan speed	VFD
Electric duct heater	
Cooling output to HP	
Heating output to HP	

2.02 EXISTING DEHUMIDIFIER (DH-1):

- A. General: Existing desiccant dehumidifier unit with supply fan, reactivation fan, desiccant rotor, and reactivation heater.
- B. Continue existing operation to maintain a space dewpoint of 38°F. No change to sequence.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install complete control system including all components, devices, and accessories required to perform desired sequence of operation.

END OF SECTION

**SECTION 23 2113
ABOVE GROUND HYDRONIC PIPING**

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes pipe, fittings, and joining methods for HVAC systems.

1.02 PERFORMANCE REQUIREMENTS

- A. All hydronic piping, equipment, fittings, and accessories shall be capable of withstanding the following maximum pressure and temperature. Exceptions would include specific items of equipment where a lower operating pressure is specified.
 - 1. Condensate-Drain Piping:
 - a. Maximum operating pressure: 50 psig.
 - b. Maximum operating temperature: 7°F.

1.03 ACTION SUBMITTALS

- A. Provide materials list for pipe and fittings.

1.04 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.01 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type M.
- B. DWV Copper Tubing: ASTM B 306, Type DWV.
- C. Wrought-Copper Fittings: ASME B16.22.
- D. Wrought-Copper Unions: ASME B16.22.

2.02 JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS

- A. Condensate-Drain Piping:
 - 1. 1-1/4 and larger: Type DWV drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
 - 2. 1-inch and smaller: Type M copper.

3.02 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved by Engineer.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

Install piping at a uniform grade of 0.2 percent downward in direction of flow.

3.03 HANGERS AND SUPPORTS

- A. Comply with requirements in Section 23 0529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices.
- B. Support vertical runs at roof and at each floor.

3.04 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

3.05 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
 - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
 - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 - 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
 - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
 - 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

END OF SECTION

**SECTION 23 2300
REFRIGERANT PIPING AND SPECIALTIES**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Refrigerant pipes and fittings.
 - 2. Refrigerant piping valves.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping.

1.03 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.05 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to 2010 ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.06 PRODUCT STORAGE AND HANDLING

- A. Store piping with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
 - 1. Suction Lines for Heat-Pump Applications: 535 psig.
 - 2. Hot-Gas and Liquid Lines: 535 psig.

2.02 HARD DRAWN COPPER TUBE AND FITTINGS

- A. Pipe: ASTM B 280, Type ACR. Piping shall be refrigeration grade, cleaned, sealed and capped.
- B. Fittings: ANSI B16.22, wrought copper and bronze solder joint pressure fittings. Fittings to be long radius wrought copper in all lines. Short radius is not acceptable. Fittings shall be manufactured by Mueller Brass Co. or Superior Valve Co.
- C. Joints: 7/8-inch and smaller, solder; 1-1/8 inch and larger, braze.

2.03 VALVES AND SPECIALTIES

- A. Diaphragm Packless Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Danfoss Inc.
 - b. Heldon Products; Henry Technologies.
 - c. Parker Hannifin Corp.
 - 2. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
 - 3. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
 - 4. Operator: Rising stem and hand wheel.
 - 5. Seat: Nylon.
 - 6. End Connections: Socket, union, or flanged.
 - 7. Working Pressure Rating: 500 psig.
 - 8. Maximum Operating Temperature: 275 deg F.

- B. Globe Valve: Cast bronze body, forged brass cap seal, forged brass bolted bonnet, non-rotating self-aligning swivel disc, nylon seats. Maximum working pressure 450 psig. Maximum working temperature 270o F. Similar to Henry Valve Co. Type 203.
- C. Ball Valve: Forged brass body, teflon seats, quarter turn valve stem. Extended copper brazing connections. Maximum working pressure 700 psig. Maximum working temperature 250°F. Similar to Henry Valve Co. Type 937.

2.04 SPECIALTIES

- A. Manufacturers: Danfoss Inc., Emerson Climate Technologies., Heldon Products; Henry Technologies. Parker Hannifin Corp, or approved.
- B. Straight-Type Strainers:
 - 1. Body: Welded steel with corrosion-resistant coating.
 - 2. Screen: 100-mesh stainless steel.
 - 3. End Connections: Socket or flare.
 - 4. Working Pressure Rating: 500 psig.
 - 5. Maximum Operating Temperature: 275°F.
- C. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL).
 - 1. Body and Bonnet: Plated steel.
 - 2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 - 3. Seat: Polytetrafluoroethylene.
 - 4. End Connections: Threaded.
 - 5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24 or 120 VAC coil, as available from condensing unit.
 - 6. Working Pressure Rating: 400 psig.
 - 7. Maximum Operating Temperature: 240°F.
- D. Safety Relief Valves: Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
 - 1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
 - 2. Piston, Closing Spring, and Seat Insert: Stainless steel.
 - 3. Seat: Polytetrafluoroethylene.
 - 4. End Connections: Threaded.
 - 5. Working Pressure Rating: 400 psig.
 - 6. Maximum Operating Temperature: 240°F.
- E. Thermostatic Expansion Valves: Comply with AHRI 750.
 - 1. Body, Bonnet, and Seal Cap: Forged brass or steel.
 - 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 - 3. Packing and Gaskets: Non-asbestos.
 - 4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
 - 5. Suction Temperature: 40°F.
 - 6. Superheat: Adjustable.
 - 7. End Connections: Socket, flare, or threaded union.
 - 8. Working Pressure Rating: 450 psig.
- F. Moisture/Liquid Indicators:
 - 1. Body: Forged brass.
 - 2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
 - 3. Indicator: Color coded to show moisture content in parts per million (ppm).
 - 4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.

5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240°F.
- G. Permanent Filter Dryers: Comply with AHRI 730.
 1. Body and Cover: Painted-steel shell.
 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 3. Desiccant Media: Activated alumina.
 4. End Connections: Socket.
 5. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
 6. Maximum Pressure Loss: 2 psig.
 7. Rated Flow: 50 tons.
 8. Working Pressure Rating: 500 psig.
 9. Maximum Operating Temperature: 240°F.

PART 3 - EXECUTION

3.01 PIPING INSTALLATION

- A. Piping shall be installed in workmanlike manner in conformance with provisions and intent of Specifications and Drawings. Changes in direction made by appropriate use of fittings.
- B. Care shall be taken to keep the entire system clean and dry during installation. Nitrogen gas shall flow through the piping being welded to prevent scaling during the welding operation. Owner has option to cut maximum of two welded fittings to inspect proper use of nitrogen. Refrigeration contractor shall replace all fittings as directed if oxidation is present at any one of the fittings inspected.
- C. The liquid and suction refrigeration lines from the compressor to fixture shall be of the size designated and run generally as shown on Drawings or as recommended by the equipment manufacturer.
- D. Hot gas piping shall be sloped 1/2-inch per every 10 feet from compressors to condenser.
- E. Provide oil traps in hot gas piping adjacent to compressor, inverted traps at entering and leaving condenser connections, and isolation valves as recommended by equipment manufacturer and as required for proper operation.
- F. All piping shall be installed to allow for expansion and contraction without harm to system.
- G. Piping shall be arranged so that normal inspection and servicing of the compressors is not hindered. Do not obstruct the view of the sight glasses or run piping so it interferes with removal of the compressor or other parts.

3.02 VALVE AND SPECIALTY APPLICATIONS

- A. Install service valves in suction and discharge lines of compressor.
- B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.
- C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
- D. Except as otherwise indicated, install service valves on inlet and outlet side of filter dryers.
- E. Install thermostatic expansion valves as close as possible to distributors on evaporators.
 1. Install valve so diaphragm case is warmer than bulb.
 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
 3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- F. Install safety relief valves where required by 2010 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

- G. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- H. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:
 - 1. Solenoid valves.
 - 2. Thermostatic expansion valves.
 - 3. Compressor.
- I. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

3.03 LEAK TESTING

- A. Contractor shall notify Engineer prior to leak test. Contractor shall obtain all permits and inspections required by governing authorities.
- B. After piping connections have been completed, raise system pressure to 150 psi, or higher pressure if required governing authority, with all other valves open. Pressure test to be accomplished by first charging enough refrigerant into the port in the liquid shut-off valve on the receiver to raise the pressure in the system to 10 to 20 psi. Then enough dry nitrogen shall be introduced to raise the pressure to the required test pressure. A suitable pressure regulating valve shall be attached to the nitrogen cylinder to reduce pressure of the testing gas to test pressure. All joints shall then be carefully tested for leaks, using a Halide torch or an electronic Halogen Leak Detector.
- C. All tests shall be logged as to date and time and pressure at start and end of test. Owner's Authorized Representative shall witness and approve tests.

END OF SECTION

**SECTION 23 3113
METAL DUCTWORK**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes metal ductwork, liner, and related fittings and sealants.

1.02 PERFORMANCE REQUIREMENTS

- A. Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.03 ACTION SUBMITTALS

- A. See Section 23 0500 for general submittal requirements.
- B. Materials List:
 - 1. Shop fabricated ductwork:
- C. Catalog Data:
 - 1. Pre-manufactured Ductwork and Fittings.
 - 2. Duct Liner
- D. Shop Drawings:
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Factory- and shop-fabricated ducts and fittings.
 - 3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
 - 4. Elevation of top of ducts.
 - 5. Dimensions of main duct runs from building grid lines.
 - 6. Fittings.
 - 7. Reinforcement and spacing.
 - 8. Seam and joint construction.
 - 9. Penetrations through fire-rated and other partitions.
 - 10. Equipment installation based on equipment being used on Project.
 - 11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 - 12. Hangers and supports, including methods for duct and building attachment.

1.04 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
 - 3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- C. Comply with applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.01 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- E. Sealing Requirements:
 - 1. Concealed: Seal longitudinal seams and transverse joints with liquid duct sealer or tape-and-adhesive. Flanged, gasketed joints that meet seal requirements do not require separate duct sealant application.
 - 2. Exposed: Seal non-flanged transverse joints with liquid duct sealer, specified herein, applied to male end fittings only, so that sealer is not visible when joint is assembled.

2.02 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. McGill AirFlow LLC.
 - 2. MKT Metal Manufacturing.
 - 3. Sheet Metal Connectors, Inc.
- B. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.
- C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- F. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard." See Duct Schedule in Part 3 for liner thickness.
 - 1. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.

2. Coat insulation with antimicrobial coating.
 3. Cover insulation with polyester film complying with UL 181, Class 1.
- G. Inner Duct: Minimum 0.028-inch solid sheet steel.
- H. Formed-on Transverse Joints (Flanges): Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- I. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- J. Sealing Requirements: Seal transverse joints in accordance with duct manufacturer recommendations.

2.03 **SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS**

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
- B. General: Round ductwork may be either shop or factory fabricated. Flat-oval ductwork shall be factory fabricated.
- C. Manufacturers: Subject to compliance with requirements, available manufacturers offering factory fabricated products that may be incorporated into the Work include, but are not limited to the following:
1. McGill AirFlow LLC.
 2. MKT Metal Manufacturing.
 3. Sheet Metal Connectors, Inc.
 4. Spiral Manufacturing Co., Inc.
- D. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
- E. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- F. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- G. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

H. Sealing Requirements:

1. Concealed: Flanged, gasketed joints that meet seal requirements do not require separate duct sealant application.
2. Exposed: Seal non-flanged transverse joints with liquid duct sealer, specified herein, applied to male end fittings only, so that sealer is not visible when joint is assembled.

2.04 **SHEET METAL MATERIALS**

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 1. Galvanized Coating Designation: G60.
 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

2.05 **DUCT LINER**

- A. Flexible (Type I) or Rigid (Type II) Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Owens Corning.
 2. An antimicrobial coating is not Systems West standard but is an option that can be applied where appropriate.
 - a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Insulation Pins and Washers:
 1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel, aluminum, stainless steel to match duct material; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
 1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Where multiple layers are required to obtain indicated thickness, provide inner perforated sheet metal duct.
 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 3. Butt transverse joints without gaps, and coat joint with adhesive.
 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
7. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.06 SEALANT AND GASKETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Ductmate Industries
 2. McGill AirSeal LLC.
 3. Carlisle HVAC Products
- B. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- C. Water-Based Joint and Seam Sealant:
 1. Application Method: Brush on.
 2. Solids Content: Minimum 65 percent.
 3. Shore A Hardness: Minimum 20.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. VOC: Maximum 75 g/L (less water).
 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 8. Service: Indoor or outdoor.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Solvent-Based Joint and Seam Sealant:
 1. Application Method: Brush on.
 2. Base: Synthetic rubber resin.
 3. Solvent: Toluene and heptane.
 4. Solids Content: Minimum 60 percent.
 5. Shore A Hardness: Minimum 60.
 6. Water resistant.
 7. Mold and mildew resistant.
 8. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
 9. Service: Indoor or outdoor.
 10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- E. Flanged Joint Sealant: Comply with ASTM C 920.
 1. General: Single-component, acid-curing, silicone, elastomeric.
 2. Type: S.
 3. Grade: NS.
 4. Class: 25.
 5. Use: O.
 6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.07 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- G. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.01 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved by Engineer.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round and flat-oval ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 23 3300 "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.02 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 DUCT SEALING

- A. Provide Seal Class in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible,"
- B. Clean duct surfaces prior to applying sealant.
- C. Prior to application, verify that ducts are dry and within specified temperature limits.
- D. Open ends of completed and overnight work-in-progress shall be sealed.

3.04 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
 - 6. Confirm design of existing concrete slabs prior to installing fasteners. Where existing slabs contain embedded components such as tension cables. Locate embedded components and install fasteners to so that embedded components remain undamaged.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.05 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. See Section 23 0548 "Vibration and Seismic Controls for HVAC."

3.06 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 23 3300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.07 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 2. Test representative duct sections selected by Owner's Authorize Representative from sections installed.
 3. Test the following systems:
 - a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
 4. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 5. Test for leaks before applying external insulation.
 6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
 7. Give seven days' advance notice for testing.
- C. Duct System Cleanliness Tests:
1. Visually inspect duct system to ensure that no visible contaminants are present.
 2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.08 START UP

- A. Air Balance: Comply with requirements in Section 23 0593 "Testing, Adjusting, and Balancing for HVAC."

3.09 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated.
- B. Seal Class
1. Class A
- C. Leakage Class
1. Leakage Class 4
- D. All ductwork single-wall, except as otherwise indicated.
- E. Double wall ductwork may be manufacturer or shop fabricated in accordance with product requirements.
- F. Supply Ducts:
1. Ducts Connected to Constant-Volume Air-Handling Units:
 - a. Single wall
 - b. Pressure Class: Positive 4-inch w.g.
 2. Ducts Connected to Variable-Air-Volume Air-Handling Units :
 - a. Single wall
 - b. Pressure Class: Positive 4-inch w.g.
 3. Ducts Connected to Equipment Not Listed Above:
 - a. Single wall
 - b. 4-inch w.g.
- G. Return Ducts:
1. Ducts Connected to Air-Handling Units :
 - a. Single-wall.

- b. Pressure Class: Positive or negative 3-inch w.g.
- H. Exhaust Ducts:
 - 1. Ducts Connected to Air-Handling Units :
 - a. Single-wall
 - b. Pressure Class: Positive or negative 2-inch wg.
 - 2. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Positive or negative 2-inch wg.
- I. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
 - 1. Ducts Connected to Plenums:
 - a. Double Wall
 - b. Pressure Class: Negative 4-inch wg.
 - 2. Ducts Connected to Air-Handling Units :
 - a. Single Wall
 - b. Pressure Class: Positive or negative 3-inch wg.
- J. Intermediate Reinforcement: Match duct material.
- K. Liner Schedule: Schedule applies to both single and double wall duct systems.
 - 1. Supply Fan Plenums: Fibrous glass, Type II, 2 inches thick.
 - 2. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 2 inches thick.
 - 3. Outside Air Plenums: Fibrous glass, Type II, 3 inch thick.
- L. Inner Duct Schedule: Provide perforated inner duct for all double wall ducts.
- M. Elbow Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 800 fpm or Lower:
 - i. Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - ii. Mitered Type RE 4 without vanes.
 - b. Velocity 800 to 1500 fpm:
 - i. Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - ii. Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - iii. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - i. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - ii. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - iii. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - 2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - i. Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - ii. Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - iii. Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.

- c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.
- N. Branch Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch:
 - i. Velocity less 1000 fpm: Conical tap or 45-degree entry.
 - ii. Velocity 1000 fpm or Higher: 45-degree entry.
 - 2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity less 1000 fpm: Conical tap or 45-degree lateral.
 - b. Velocity 1000 fpm or Higher: 45-degree lateral.

END OF SECTION

**SECTION 23 3300
AIR DUCT ACCESSORIES**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Accessories for duct systems.

1.02 ACTION SUBMITTALS

- A. Provide submittals for products listed in the Product Table below in accordance with Section 23 05 00 – General HVAC Provisions. Submittal requirements indicated by column number designation as follows:
 1. Materials List
 2. Catalog Data
 3. Product Data
 4. Performance Data
 5. Wiring Diagrams
 6. Shop Drawings
 7. Installation Instructions
 8. Special Requirement listed herein.

PRODUCT TABLE	1	2	3	4	5	6	7	8
Manual Volume Dampers		x						
Automatic Dampers			x	x				
Turning Vanes		x						
Duct Mounted Access Doors		x						
Duct Connectors		x						

1.03 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.02 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 1. Galvanized Coating Designation: G60.
 2. Exposed-Surface Finish: Mill phosphatized.
- B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.03 MANUAL VOLUME DAMPERS

- A. Acceptable Manufacturers
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Greenheck

- b. Nailor Industries Inc.
 - c. Pottorff.
 - d. Ruskin Company.
 - e. Trox USA Inc.
 - f. Young Regulator Company.
- B. Round/Oval Single Blade Manual Volume Dampers:
- 1. Operating Conditions:
 - a. Maximum temperature: 180°F
 - b. Maximum differential pressure: 1-inch water column.
 - c. Maximum air velocity: 2,000 fpm.
 - d. Standard leakage rating.
 - 2. Suitable for horizontal or vertical applications.
 - 3. Frames:
 - a. One piece 20-gauge construction. Material to match connected ductwork.
 - 4. Blades:
 - a. Single blade.
 - b. 20-gauge construction. Material to match connected ductwork.
 - c. Stiffen damper blades for stability.
 - 5. Blade Axles: Minimum 3/8-inch dia. plated steel or stainless steel, except stainless steel where adjacent ductwork is aluminum or stainless steel.
 - 6. Bearings:
 - a. Dampers shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 7. Actuator:
 - a. Manual quadrant, except where remote damper operator is required.
 - b. Elevated platform for insulated duct mounting.
- C. Round Multiple Blade Manual Volume Dampers:
- 1. Operating Conditions:
 - a. Maximum temperature: 180°F
 - b. Maximum differential pressure: 4-inch water column.
 - c. Maximum air velocity: 2,500 fpm.
 - d. Standard leakage rating.
 - 2. Suitable for horizontal or vertical applications.
 - 3. Frames:
 - a. One piece 10-gauge construction. Material to match connected ductwork.
 - 4. Blades:
 - a. Multiple blade.
 - b. 16-gauge construction. Material to match connected ductwork.
 - c. Stiffen damper blades for stability.
 - 5. Blade Axles: Minimum 1/2-inch dia. plated steel or stainless steel, except stainless steel where adjacent ductwork is aluminum or stainless steel.
 - 6. Bearings:
 - a. Dampers shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 7. Actuator:
 - a. Manual quadrant, except where remote damper operator is required.
 - b. Elevated platform for insulated duct mounting.
- D. Single Blade Rectangular Manual Volume Dampers:
- 1. Operating Conditions:

- a. Maximum temperature: 180°F
- b. Maximum differential pressure: 1-inch water column.
- c. Maximum air velocity: 2,000 fpm.
- d. Standard leakage rating.
2. Suitable for horizontal or vertical applications.
3. Frames: Hat-shaped, welded or gusset reinforced corners. 18-gauge construction. Material to match connected ductwork.
4. Blades:
 - a. Single blade.
 - b. 20-gauge construction. Material to match connected ductwork.
 - c. Stiffen damper blades for stability.
5. Blade Axles: Minimum ½ inch dia. plated steel or stainless steel, except stainless steel where adjacent ductwork is aluminum or stainless steel.
6. Linkages: Concealed in jamb outside or air stream.
7. Bearings:
 - a. Dampers shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Actuator:
 - a. Manual quadrant, except where remote damper operator is required.
 - b. Elevated platform for insulated duct mounting.
- E. Multiple Blade Rectangular Manual Volume Dampers:
 1. Operating Conditions:
 - a. Maximum temperature: 180°F
 - b. Maximum differential pressure: 4-inch water column.
 - c. Maximum air velocity: 2,000 fpm.
 - d. Standard leakage rating.
 2. Suitable for horizontal or vertical applications.
 3. Frames:
 - a. Hat-shaped, welded or reinforced corners. Material to match connected ductwork.
 - i. Galvanized steel or stainless steel: 16-gauge.
 - ii. Aluminum: 12-gauge.
 - b. Mitered corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 4. Blades:
 - a. Opposed blade.
 - b. Rolled Formed. Material to match connected ductwork.
 - i. Galvanized steel or stainless steel: 16-gauge.
 - ii. Aluminum: 12-gauge.
 - c. Stiffen damper blades.
 5. Blade Axles: Minimum ½ inch diameter plated-steel or stainless-steel, except stainless-steel where adjacent ductwork is aluminum or stainless-steel.
 6. Bearings:
 - a. Dampers shall have axles full length of damper blades and bearings at both ends of operating shaft.
 7. Actuator:
 - a. Manual quadrant, except where remote damper operator is required.
 - b. Elevated platform for insulated duct mounting.
 8. Transitions: Provide factory transitions for connection to round and oval ductwork as required.

2.04 **AUTOMATIC DAMPERS, A**

- A. Acceptable Manufacturer: Greenheck, Ruskin, Tamco, or approved.
- B. General: Opposed blade or parallel blade as indicated below or as shown on Drawings.
 - 1. Provide parallel blade dampers for outdoor/return air mixing dampers and face and by-pass dampers. Arrange to direct air streams toward each other for optimum mixing.
 - 2. Provide opposed blade dampers for all other modulating applications.
 - 3. Two-position shutoff may be opposed blade or parallel blade type with blade and side seals.
 - 4. Individual damper sections not larger than 48 inches x 60 inches.
- C. Construction:
 - 1. Frames: 13-gauge galvanized steel or 1/8-inch aluminum with reinforced corner bracing.
 - 2. Blades:
 - a. Style: Airfoil-shaped, single-piece
 - b. Action: Parallel or opposed blade as specified
 - c. Orientation: Horizontal or vertical with thrust washers as shown on Drawings.
 - d. Material: Heavy duty 6063-T5 extruded aluminum
 - e. Width: Maximum 6 inches
 - f. Insulation: Provide insulated blades where dampers are installed exterior to the building envelope opening. Complete blade shall have an insulating factor of R-2.2.
 - 3. Bearings: Molded synthetic sleeve or equal
 - 4. Seals:
 - a. Blade: Extruded EPDM. Mechanically attached to blade edge
 - b. Jamb: Flexible metal compression type or equal
 - 5. Linkage: Concealed in frame
 - 6. Finish: Mill aluminum
- D. Performance Data:
 - 1. Temperature Rating: Withstand -72 to 275°F
 - 2. Capacity: Demonstrate capacity of damper to withstand HVAC system operating conditions.
 - a. Closed Position: Maximum pressure of 13 inches w.g. a 12-inch blade length.
 - b. Open Position: Maximum air velocity of 6,000 feet per minute.
 - 3. Leakage: Maximum 5.2 cubic feet per minute per square foot at 4 inches w.g. for size 48 x 48 inches.
 - 4. Pressure Drop: Maximum 0.03-inch w.g. at 1,500 feet per minute across 24-inch x 24-inch damper.

2.05 **TURNING VANES**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. Elgen Manufacturing.
 - 4. SEMCO LLC.
- B. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- C. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

- D. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- E. Vane Construction: Single wall for ducts up to 18 inches wide and double wall for larger dimensions.

2.06 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Cesco Products; a division of MESTEK, Inc.
 - 2. Greenheck Fan Corporation.
 - 3. Nailor Industries Inc.
 - 4. Pottorff.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
 - 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - 3. Number of Hinges and Locks:
 - a. Access doors less than 12 inches square: No hinges and two sash locks.
 - b. Access doors up to 24 inches square: Continuous and two sash locks.
 - c. Access doors larger than 24 by 24 inches: Continuous and two compression latches with outside and inside handles.

2.07 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. Elgen Manufacturing.
 - 4. Hardcast, Inc.
 - 5. JP Lamborn Co.
 - 6. Ventfabrics, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd.
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200°F.

2.08 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts.
- C. Provide low leakage control dampers as close as possible to the inlet of building exhaust fans as required by Oregon Energy Efficiency Specialty Code.
- D. Install products in locations that are accessible and that will permit adjustment and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.
- E. Manual Volume Dampers:
 - 1. Install in ductwork where shown on drawings and as required to properly balance airflow rates to values shown on Drawings. Provide damper for each air inlet and outlet.
 - 2. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 3. Dampers must be accessible to allow inspection, adjustment, and replacement of components.
 - a. Where manual actuators are not accessible for adjustment provide remote manual cable actuator. An actuator is not accessible if it is located more than 24 inches horizontally from an access point or more than 48 inches above an access point. Coordinate location of actuator drive assembly with Architect & Engineer.
 - 4. Do not compress or stretch the damper frame into the duct or opening. Damper shall move freely throughout full range of travel.
 - 5. Dampers shall be rigid and secure not producing any audible noise due to vibration of components.
 - 6. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Automatic Dampers
 - 1. Install dampers straight and true, level in all planes, and square in all dimensions. Install supplementary structural steel reinforcement for large multiple-section dampers if factory support alone cannot handle loading.
 - 2. Install smooth transitions, not exceeding 15 degrees, to dampers smaller than adjacent duct. Install transitions as close to damper as possible but at distance to avoid interference and impact on performance.
 - 3. Unless specifically designed for vertical blade application, dampers mounted with blades horizontal.
 - 4. For duct-mounted and equipment-mounted dampers installed outside of equipment, install a visible and accessible indication of damper position from outside.
 - 5. Seal between damper frame and ductwork and between multiple damper sections to prevent leakage around perimeter of damper.
 - 6. Provide a minimum of one damper actuator per damper section.
 - 7. Provide ceiling, floor, roof, and wall openings and sleeves required by installation. Before proceeding with drilling, punching, or cutting, check location first for concealed products that could potentially be damaged. Patch, flash, grout, seal, and refinish openings to match adjacent condition.
 - 8. Service Access:

- a. Dampers and actuators shall be accessible for visual inspection and service.
 - b. Install access door(s) in duct or equipment located upstream of damper to allow service personnel to hand clean any portion of damper, linkage, and actuator.
- G. Turning Vanes
- Install in mitered ductwork elbows and as shown on drawings.
1. Install with leading and trailing edges parallel to entering and leaving airflow.
- H. Duct-mounted Access Doors:
1. Install on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - a. On both sides of duct coils.
 - b. At outdoor-air intakes and mixed-air plenums.
 - c. At each change in direction and at maximum 50-foot spacing.
 - d. Upstream and downstream from turning vanes.
 - e. Control devices requiring inspection.
 - f. Elsewhere as indicated.
 2. Install access doors with swing against duct static pressure.
 3. Access Door Sizes:
 - a. One-Hand or Inspection Access: 8 by 5 inches.
 - b. Two-Hand Access: 12 by 6 inches.
 - c. Head and Hand Access: 18 by 10 inches.
 - d. Head and Shoulders Access: 21 by 14 inches.
 - e. Body Access: 25 by 14 inches.
 - f. Body plus Ladder Access: 25 by 17 inches.
 4. Label access doors according to Section 23 05 53 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- I. Flexible Connectors
1. Install flexible connectors to connect ducts to equipment.
 2. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- J. Test Holes
1. Install test holes at fan inlets and outlets, coil inlets and outlets, and elsewhere as indicated.

3.02 APPLICATION

- A. Manual Volume Dampers:
1. Material: Volume damper construction frame and blade material shall match material of connected ductwork.
 2. Type:
 - a. Round/Oval Single Blade Manual Volume Dampers: All round ductwork 20-inch diameter and below.
 - b. Round Multiple Blade Manual Volume Dampers: All round ductwork greater than 20-inch diameter in exposed or concealed locations.
 - c. Rectangular Single Blade Manual Volume Dampers: Rectangular ductwork where largest cross-sectional dimension is 18-inches and below.
 - d. Rectangular Multiple Blade Manual Volume Dampers:
 - i. Round or oval ductwork greater than 20-inch diameter located in concealed locations. Provide rectangular to round transition for connecting to round ductwork.

- ii. Rectangular or oval ductwork where largest cross-sectional dimension greater than 18-inches. Provide rectangular to oval transition for connecting to oval ductwork.

B. Flexible Connectors

1. Indoor system: All indoor applications, except where otherwise required.
2. Outdoor system: All outdoor applications, except where otherwise required.

3.03 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Inspect turning vanes for proper and secure installation.

B. Automatic Damper Checkout:

1. Check installed products before continuity tests, leak tests, and calibration.
2. Check dampers for proper location and accessibility.
3. Verify that control dampers are installed correctly for flow direction.
4. Verify that proper blade alignment, either parallel or opposed, has been provided.
5. Verify that damper frame attachment is properly secured and sealed.
6. Verify that damper actuator and linkage attachment are secure.
7. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
8. Verify that damper blade travel is unobstructed.
9. Stroke and adjust control dampers following manufacturer's recommended procedure, from 100 percent open to 100 percent closed back to 100 percent open.

END OF SECTION

**SECTION 23 3400
HVAC FANS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. In-line Centrifugal Fans (SF)

1.02 QUALITY ASSURANCE

- A. Fan performance ratings for air flow, pressure, power, air density, speed of rotation, and efficiency shall be factory tested and ratings established in accordance with AMCA Standard 210. Air foil blade fans shall bear AMCA rating seal.
- B. Sound power level ratings shall be established in accordance with AMCA 300.
- C. Equipment performance shall be calculated using actual project conditions.

1.03 DESIGN REQUIREMENTS

- A. Equipment performance calculated using project site elevation.

1.04 REFERENCES

- A. Air Movement and Control Association (AMCA):
 - 1. 210 Test Code for Air Moving Devices
 - 2. Test Code For Sound Rating

PART 2 PRODUCTS

2.01 IN-LINE CENTRIFUGAL FANS (SF-1)

- A. Acceptable Manufacturers: Carnes, Loren Cook, Greenheck, Carnes, Penn Berry, Twin City Blower. Basis of Design: Greenheck SQ-VG Series.
- B. Description: Direct drive in-line type, centrifugal fan, aluminum construction, backward inclined wheel, statically and dynamically balanced wheel and shaft
- C. Housing: Heavy gauge steel, designed and reinforced to prevent vibration, air and water leakage. Maximum casing dimensions as shown on drawings. Furnish with necessary access panels to allow easy access for service and repair.
- D. Fan: Centrifugal, blade type as scheduled.
- E. Bearings: Air handler quality, self-aligning, grease lubricated, pillow block, selected for a minimum L10-80,000 hours at maximum cataloged operating conditions in accordance with ABMA-9. Grease fittings extended to accessible location.
- F. Motor: ECM type Provided hereunder. See Section 23 05 13 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT.
- G. ECM motor controller.
- H. Capacity: As scheduled on drawings

PART 3 EXECUTION

3.01 INSPECTION

- A. Install fan level and plumb as recommended by manufacturer.
- B. Install fans with clearances for service and maintenance.
- C. Make final connections with flexible connectors.
- D. Ground equipment in accordance with manufacturer's recommendations. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values

3.02 FIELD QUALITY CONTROL

- A. Equipment Start-up Checks
 - 1. Verify shipping, blocking, and bracing has been removed.
 - 2. Verify that unit is secure on mountings and supporting devices, and that connection to ducts and electrical components are complete.
 - 3. Verify that proper thermal overload protection is installed in motors, starters, and disconnect switches. Adjust overload settings for fan motor rated load amperage.
 - 4. Verify that cleaning and adjusting is complete.

5. Verify motor rotation direction.
6. Verify that fan wheel rotates freely and the bearing operation is smooth.
7. Verify lubrication of bearing and other rotating parts.
8. Verify that manual and automatic volume control dampers and fire and smoke dampers in ductwork work system are fully open.

B. Start-up Procedures:

1. Energize fan motor.
2. Measure and record motor voltage and amperage.

3.03 **ADJUSTING**

- A. Lubricate bearings.

END OF SECTION

**SECTION 23 3713
AIR OUTLETS AND INLETS**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Grilles

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.

1.03 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Ceiling suspension assembly members.
 - 2. Size and location of initial access modules for acoustical tile.
 - 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 4. Duct access panels.

PART 2 - PRODUCTS

2.01 COMMON REQUIREMENTS

- A. Source Quality Control
 - 1. Verification of Performance: Rate diffusers according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following, unless specifically stated otherwise:
 - 1. Anemostat Products; a Mestek company.
 - 2. Krueger.
 - 3. Nailor Industries Inc.
 - 4. Price Industries.
 - 5. Titus.

2.02 SUPPLY GRILLES

- A. Adjustable Blade Register SG-1
 - 1. Basis of Design: Titus 300 RL/RS
 - 2. Material: Steel.
 - 3. Finish: Baked enamel, white.
 - 4. Blade Arrangement: Individually adjustable horizontal and vertical blades, front blades parallel to long dimension. Spaced 3/4 inch apart.
 - 5. Core Construction: Integral.
 - 6. Frame: 1-1/4 inches wide.
 - 7. Mounting:
 - a. Surface: Countersunk screw.
 - b. Exposed: Countersunk screw.

2.03 RETURN GRILLES

- A. Fixed Blade Grille RG/EG-1
 - 1. Basis of Design: Titus 350 RL/RS
 - 2. Material: Steel.
 - 3. Finish: Baked enamel, white.

4. Blade Arrangement: 35-degree blade deflection. Spaced 3/4 inch apart. Blades parallel to long dimension if installed in ceiling or horizontal position. Blades parallel to floor if installed in wall or vertical position.
5. Frame: 1-1/4 inches wide.
6. Mounting:
 - a. Surface: Countersunk screw.
 - b. Exposed: Countersunk screw.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install diffusers level and plumb.
- B. Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- D. Mounted devices tight to finished surface

3.03 ADJUSTING

- A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

**SECTION 23 4100
PARTICULATE AIR FILTRATION**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 1. Pleated panel filters.
 2. Filter gages.

1.02 SUBMITTALS

- A. Provide submittals for products listed in the Product Table below in accordance with Section 23 0500 – General HVAC Provisions. Submittal requirements indicated by column number designation as follows:
 1. Materials List
 2. Catalog Data
 3. Product Data
 4. Performance Data
 5. Wiring Diagrams
 6. Shop Drawings
 7. Installation Instructions
 8. Special Requirement listed herein.

PRODUCT TABLE	1	2	3	4	5	6	7	8
All filters		x						
Filter gages		x						

1.03 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.

1.04 MATERIALS MAINTENANCE SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Provide two complete set(s) of filters for each filter bank. Filters shall be clean at date of Substantial Completion. Filters furnished herein shall be in addition to those provided to replace filters used during construction.

1.05 QUALITY ASSURANCE

- A. ASHRAE Compliance:
 1. Comply with applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality"; Section 5 - "Systems and Equipment"; and Section 7 - "Construction and Startup."
 2. Comply with ASHRAE 52.1 for arrestance and ASHRAE 52.2 for MERV for methods of testing and rating air-filter units.
- B. Comply with NFPA 90A and NFPA 90B.

PART 2 - PRODUCTS

2.01 PLEATED PANEL FILTERS

- A. Description: Factory-fabricated, self-supported, extended-surface, pleated, panel-type, disposable air filters with holding frames.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. AAF International.
 - b. Camfil Farr.
 - c. Flanders Corporation.
- B. Filter Unit Class: UL 900, Class 2.

- C. Media: Cotton and synthetic fibers coated with nonflammable adhesive.
 - 1. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 - 3. Media shall be coated with an antimicrobial agent.
 - 4. Separators shall be bonded to the media to maintain pleat configuration.
 - 5. Welded wire grid shall be on downstream side to maintain pleat.
 - 6. Media shall be bonded to frame to prevent air bypass.
 - 7. Support members on upstream and downstream sides to maintain pleat spacing.
- D. Filter-Media Frame: Cardboard frame with perforated metal retainer sealed or bonded to the media.
- E. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.
- F. Capacities and Characteristics:
 - 1. Designation: F-1
 - a. Face Dimensions: As required to accommodate filter frame or housing.
 - b. Depth: 4 inch as required to match filter housing.
 - c. Initial Pressure Drop: 0.35-inches w.g. at 500 fpm.
 - d. Final Resistance: 1-1/2- inches w.g. at 500 fpm.
 - e. Maximum Rated Pressure Drop: 10-inches w.g..
 - f. MERV Rating: 11 when tested according to ASHRAE 52.2.

2.02 FILTER GAGES

- A. Diaphragm-type gage with dial and pointer in metal case, vent valves, black figures on white background, and front recalibration adjustment. Gages located outdoors shall have waterproof enclosure and sun shield.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Dwyer Instruments, Inc.
- B. Size and Scale
 - 1. Diameter: 4-1/2 inches.
 - 2. Scale Range:
 - a. Filter Final Resistance of 0.5-Inch wg and Less: 0 to 0.5-inch wg.
 - b. Filter Final Resistance of 0.5 to 1.0-Inch wg: 0 to 1.0-inch wg.
- C. Accessories: Static-pressure tips, tubing, gage connections, and mounting bracket.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Sizing:
 - 1. Select filter frames and housing to allow use of standard, readily available filter sizes.
 - 2. Metric size filters not allowed.
- B. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
- C. Install filters in position to prevent passage of unfiltered air.
- D. Install filter gage for each filter bank.
- E. If permanently installed air handlers and air distribution system are used during construction, MERV 8 filtration media shall be installed at each return-air grille. Filters in air handlers used during construction shall have a minimum MERV 13 rating for systems that deliver air to occupied spaces or through air coils or heat exchangers.

- F. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.
- G. Install filter-gage, static-pressure taps upstream and downstream from filters. Install filter gages on filter banks with separate static-pressure taps upstream and downstream from filters. Mount filter gages on outside of filter housing or filter plenum in an accessible position.
- H. Coordinate filter installations with duct and air-handling-unit installations.
- I. Filters shall fit in racks without bending, distortion, or modification.

3.02 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
 - 1. Test for leakage of unfiltered air while system is operating.
- C. Air filter will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.03 CLEANING

- A. After completing system installation and testing, adjusting, and balancing of air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION

**SECTION 23 8143
AIR SOURCE HEAT PUMPS**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Split-system air-source heat pump

1.02 DEFINITIONS

- A. External Static Pressure: Static pressure difference between supply air and return air ductwork connections.

1.03 DESIGN

- A. Equipment performance calculated for actual project elevation.
 - 1. Design Conditions:
 - 2. Internal static pressure +/- 5.0 inches water column.
 - 3. Air velocities shall not exceed level listed below unless otherwise shown.
 - a. Heat pump coil face velocity: 500 fpm
 - b. Parallel or opposed blade damper velocity: 1200 fpm
 - c. Filter face velocity: 500 fpm
 - 4. Leakage Rate: casing leakage rate shall not exceed .5 cfm per square foot of cabinet area at design internal static pressure.
 - 5. Panel deflection shall not exceed L/240 ratio at 125% of design internal static pressure. Deflection shall be measured at the midpoint of the panel height.
 - 6. All sheet metal shall have G60 protective zinc coating.

1.04 ACTION SUBMITTALS

- A. Provide submittals for products listed in the Product Table below in accordance with Section 23 05 00 – General HVAC Provisions. Submittal requirements indicated by column number designation as follows:
 - 1. Materials List
 - 2. Catalog Data
 - 3. Product Data
 - 4. Performance Data
 - 5. Wiring Diagrams
 - 6. Shop Drawings
 - 7. Installation Instructions
 - 8. Special Requirement listed herein.

PRODUCT TABLE	1	2	3	4	5	6	7	8
All Products in this Section			X	X				

- B. Special Requirements:
 - 1. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
 - 2. Provide manufacturer sized refrigerant piping and component drawings documenting required refrigerant specialties.
 - 3. Performance Calculations:
 - a. Computer generated fan curves for each air handling unit shall be submitted with specific design operating point noted.
 - b. Computer generated psychometric chart for each cooling coil with design points and final operating point clearly noted.
 - c. Sound data for discharge, radiated and return positions by octave band for each unit.

- d. Calculations for required baserail heights to satisfy condensate trapping requirements of cooling coil shall be included, minimum 6" height.
- 4. Provide manufacturer refrigerant pipe sizing for project installed conditions.
- 5. Product Data: Provide literature of components
 - a. Provide literature for individual components that indicates dimensions, weights, capacities, ratings, and electrical characteristics and connection requirements.
 - b. Provide data of filter media, filter performance data, filter assembly, and filter frames.

1.05 QUALITY ASSURANCE

- A. Unit shall be UL listed.
- B. Unit shall be AHRI 430-199 and AHRI 260-2001.
- C. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration
- D. Unit (Seasonal) Energy Efficiency Ratio, (SEER) EER, shall be equal to or greater than prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Building.
- E. Unit shall be factory assembled and tested including leak testing of the coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. Run test report shall be supplied with the unit in the controls compartment's literature pocket

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Unit shall be shipped with doors bolted shut and outside air hood closed to prevent damage during transport and thereafter while in storage awaiting installation.
- B. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids. Inspect for damage.
- C. Follow Installation, Operation and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.
- D. Unit shall be stored in a clean, dry place protected from construction traffic in accordance with the Installation, Operation and Maintenance manual.
- E. Verify path through building to mechanical room, including available doorway sizes. Provide unit module sizes to fit pathway from outside, through building into room.

PART 2 - PRODUCTS

2.01 INDOOR AIR HANDLER, AHU-1:

- A. Acceptable Manufacturers: Daikin, Trane, Carrier.
 - 1. Description: Factory assembled, consisting of fans, motor and drive assemblies, coil, dampers, plenums, filters, drain pans motor controller, and accessories.
 - 2. Wall and Roof: Minimum two-inch thick thermally broken double walled panels injected with foam insulation, minimum R-12 or equal. Outer Panel minimum 24 gauge, G60 galvanized steel. Inner wall minimum 22 gauge solid G90 galvanized steel. Panel seams sealed air.
 - 3. Access Doors: Double wall, continuously welded corners, two "Ventlock" or equal latches operable from either side of door, gasketed. Door thickness and insulation same as walls. Provide access doors as required to repair and maintain equipment components. Doors sized to remove internal components without disassembling unit. Provide 6" x 8" wire glass viewing window in or adjacent to fan access doors. Door Swing shall oppose cabinet pressurization. Access doors service pressurized sections must have safety label.
 - 4. Drain pans: Continuously welded stainless steel, insulated. Terminate drain connection on side of unit 3" inch above base rail. Provide drain pan for cooling coil sections. Intermediate drain pans required for multiple coils or coils with a height greater than 48 inches. Sloped for complete drainage with no standing water.
 - 5. Filter Housings: Flat or Vee frame as required or as shown on Drawings. Side access door. Provide independent filter housing where multiple filter sections are required.

6. Finish: Unpainted, G90 galvanized.
7. Lifting lugs: Minimum four for unit or any split section.
- B. Fans: Type and performance as scheduled. Airfoil wheels steel painted with zinc chromate primer and an enamel finish. Statically and dynamically balanced wheel and shaft. Fans shall be IRD balanced at design RPM to a vibration velocity less than or equal to 0.080 inches per second measured at each bearing pad prior to shipment with motor, sheaves and belts in place. Fan housing welded steel construction. Solid, ground, and polished carbon steel shafts, SAE 1045, keyed to wheel, coated with rust inhibitor. Tested in accordance with AMCA Standard 210.
 1. Bearings: Air handler quality, self-aligning, grease lubricated, pillow block, selected for a minimum L50 life of 500,000 hours at maximum cataloged operating conditions in accordance with ABMA-9. Grease fittings extended to accessible location near access door.
 2. Vibration Isolation: Fan and motor mounted on an all welded structural steel internal isolation base with four spring-type isolators located at each corner. Isolators shall be free standing with sound deadening pads and leveling bolts. Spring deflection minimum of 2-inch. Flexible fabric connection at fan discharge. Spring isolators shall have seismic restraints. Provide thrust restraints where required.
 3. Motor: Variable speed motor provided hereunder, see SECTION 23 0513 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT. Locate adjacent to access door.
 4. Variable Frequency Drive: Provided hereunder as scheduled, refer to SECTION 23 0514 – COMMON MOTOR CONTROL DEVICES FOR HVAC.
 5. Balancing: Statically and dynamically balance fan section assemblies including fan wheels, shafts, bearing, drives, isolation bases, and isolators.
- C. Heat Pump Coil: Provided hereunder, refer to SECTION 23 8216 – AIR COILS.
- D. Filters: Provided hereunder, refer to SECTION 23 4100 – PARTICULATE AIR FILTRATION.
- E. Automatic Dampers: Opposed blade or parallel blade as required to provide adequate mixing. Provided hereunder, refer to SECTION 23 3300 – AIR DUCT ACCESSORIES.
- F. Electrical Connections:
 1. Fan Motors: Independent power connections for each motor. Motor controller and power wiring provided between controller and motor factory installed.
 2. Lights and Receptacles: Independent power connection, 120 volt, 20 amp.
- G. Accessories
 1. Lights: Marine lights, protective metal cage and glass seals with duplex receptacles. Light switch with indicator adjacent to access door. Provide light in each accessible section. Provide LED lamps.
 2. Filter gauges: Magnehelic, +/- 2% of full scale, sensing probes, piping, and shutoff valves for each gauge. Provide one gauge for each filter bank.
 3. Fan Airflow Measurement: Piezometer ring airflow measuring system for each fan consisting of static pressure ports on face and throat of fan inlet cone, pressure tubing, and differential pressure transmitter. Factory installed, piped, and wired.
 - a. Accuracy: +/- 5% of actual flow at throat velocity greater than 500 fpm
 - b. 4-20mA or 0-10 Vdc output linear to airflow.
 - c. Transmitter display programmed for the display airflow in cfm.
- H. Acoustic Performance
 1. Sound power levels for fan assemblies shall be established in accordance with AMCA 300 and 310.
 2. Sound power levels (db) for assembled unit shall be established by testing or by calculation.
 3. Sound power levels for units and components shall not exceed the following values:

SOUND POWER LEVELS (db)								
Frequency	63	125	250	500	1000	2000	4000	8000
UNIT TAG #AHU-B1								
Radiated	67	72	63	64	68	56	46	51
Supply air outlet	72	77	75	79	84	78	75	67
Return air inlet	67	72	65	64	68	61	51	51

2.02 SPLIT-SYSTEM AIR SOURCE HEAT PUMP

- A. Outdoor Condensing Unit, HP-1
- B. Manufacturers: RAE manufacturing, or approved.
- C. Description: Factory assembled, air-cooled scroll compressor condensing unit. Each unit shall consist of an air-cooled condenser section and isolated control compartment containing hermetic scroll compressors, control system, suction and liquid connection valves, and all components necessary for safe and controlled unit operation when connected to the specified low side equipment.
- D. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
- E. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 1. Compressor Type: Scroll.
 2. One single speed compressor motor, and one variable speed compressor motor. Each with manual-reset high-pressure switch and automatic-reset low-pressure switch.
 3. Refrigerant: R-410a.
 4. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid sub-cooler. Comply with ARI 206/110.
- F. Condenser
 1. Coils: Aluminum microchannel.
 - a. Series of flat tubes containing a series of multiple, parallel flow microchannels layered between refrigerant header manifolds.
 - b. Single- or multiple-pass arrangement.
 - c. Factory tested at 450 psig minimum.
 2. Condenser fan:
 - a. Propeller type arranged for vertical air discharge and driven by variable speed, direct drive fan motor. The fan discharge area shall be equipped with a heavy-gauge fan guard.
 - b. Fan speed based on equipment staging and outdoor temperature.
 - c. Variable speed head pressure control
 3. Coils: Seamless copper tubes mechanically bonded into plate type aluminum fins. The fins shall have full drawn collars to completely cover the tubes. A sub-cooling section shall be an integral part of the main condenser coil.
 4. Fan Motor(s): weather protected, single-phase, direct drive, 1100 rpm, open drip-proof type.
- G. Refrigerant Circuits:
 1. Designed for R-410A refrigerant. Condensing unit furnished with liquid line filter driers and service valves for liquid and suction connections. The finished field installed refrigerant circuit furnished by the contractor shall include the low side cooling components, refrigerant, thermal expansion valve, liquid line, insulated hot gas line, and insulated suction line.

2. Condensing unit shall be provided with adjustable condenser head pressure control to allow cooling operation down to 45°F and heating down to -5°F.
 3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
- H. Control System:
1. Centrally located weatherproof control panel shall be isolated from condenser coil airflow, and shall contain the field power connection points, control terminal block and control system.
 2. Control circuit transformer and wiring shall provide 24V control voltage from the line voltage provided to the unit.
 3. Power and starting components shall include fan motor contactors, 5 minute off time delay relay(s) for the compressor(s), inherent fan motor overload protection and unit power terminal blocks for connection to remote disconnect switch. Safety and operating controls shall include a manually reset high pressure switch and an automatic reset low pressure switch. Barrier panels shall be furnished to protect against accidental contact with line voltage when accessing the control system.
 4. Unit terminal block shall provide for Building Automation System start stop of each compressor stage and modulation of the variable capacity scroll compressor using a 0 to 5V signal.
 5. Control equipment and sequence of operation are specified in Section 230923 Building Automation Systems and Section 230929 "Sequence of Operations for HVAC."
 6. Automatic-reset timer to prevent rapid cycling of compressor.
 7. Controller Monitoring:
 - a. Monitor constant and variable motor loads.
 - b. Monitor variable-frequency-drive operation.
 - c. Monitor cooling load.
 8. Provide all associated control wiring, relays, and other components needed for a complete and fully operational system.
- I. Electrical:
1. Electrical capacity: As scheduled on Drawings.
 2. Main power supply disconnect, operable without opening panel door.
 3. Electrical SCCR: 5 kAIC.
 4. Convenience Outlets: One 20-A duplex GFCI receptacle with junction box located on outside casing wall.
 5. Resettable circuit breakers.
 6. Phase failure protection.
 7. Wiring Diagram:
 - a. Color-coded and marked wiring diagrams shall be provided in both "point-to-point" and "ladder" to match the color and markings of the unit wiring.
 - b. Diagrams laminated in plastic and permanently fixed to the control compartment door.
- J. Acoustical Performance
1. Sound pressure levels for the unit shall not exceed the following specified levels. The manufacturer shall provide the necessary sound treatment to meet these levels as required.
 2. Acoustical testing in accordance with AHRI Standard 370.
 3. Radiated sound power levels for units and components shall not exceed values listed below:

SOUND POWER BY FREQUENCY (Hz)								
FREQUENCY	63	125	250	500	1000	2000	4000	8000
RADIATED	91	91	88	86	86	82	80	79

- K. Capacity and Performance: As scheduled on Drawings.

2.03 REFRIGERANT PIPING

- A. Provided hereunder. See section 23 23 13 Refrigerant Piping.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install in accordance with manufacturer's installation instruction. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

3.02 SPLIT-SYSTEM AIR SOURCE HEAT PUMP

- A. Provide refrigerant piping and supporting components between indoor and outdoor units in accordance with manufacturer requirements and recommendations.

3.03 START-UP

- A. Manufacturer's certified representative to provide the following services:
1. Inspect after installation to ensure equipment is installed in accordance with manufacturer's recommendation.
 2. Supervise initial start-up.
 3. Adjust control system parameters and setpoints to obtain specified performance.
 4. Provide minimum 2 hours of training, including operation and maintenance.

3.04 DEMONSTRATION

- A. Demonstration system operation and adjustment of control system setpoints and parameters to Owner's Authorized Representative.

END OF SECTION

**SECTION 23 8216
AIR COILS**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Refrigerant air coils.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each air coil.
 - 2. Include rated capacities and operating characteristics per coil schedule on drawings.

1.03 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air coils to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 REFRIGERANT AIR COILS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aerofin.
 - 2. Carrier Corporation; a unit of United Technologies Corp.
 - 3. Colmac Coil Manufacturing, Inc.
 - 4. Dunham-Bush, Inc.
 - 5. Greenheck Fan Corporation.
 - 6. Heatcraft Worldwide Refrigeration.
 - 7. Trane.
 - 8. RAE Corporation
- B. Performance Ratings: Tested and rated according to AHRI 410 and ASHRAE 33.
- C. Pressure rating in "Minimum Working-Pressure Rating" Paragraph below is common. Some manufacturers may vary rating.
- D. Minimum Working-Pressure Rating: 300 psig.
- E. Source Quality Control: Factory tested to 450 psig.
- F. Tubes: ASTM B 743 copper, minimum 0.020 inch thick.
- G. Fins: Aluminum, minimum 0.006 inch thick.
- H. Suction and Distributor Piping: ASTM B 88, Type L copper tube with brazed joints.
- I. Capacities and Characteristics:
 - 1. Coil Face Dimensions: As scheduled on Drawings or as required to achieve scheduled performance.
 - 2. Minimum Fin Spacing: 0.083 inch.
 - 3. Tube Diameter: 0.375 inch.
 - 4. Number of Rows: As required to achieve scheduled performance.
 - 5. Frames: Galvanized-steel channel frame, minimum 0.064 inch thick.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine ducts, plenums, and casings to receive air coils for compliance with requirements for installation tolerances and other conditions affecting coil performance.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before coil installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install coils level and plumb.
- B. Install coils in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible.
- C. Straighten bent fins on air coils.
- D. Clean coils using materials and methods recommended in writing by manufacturers, and clean inside of casings and enclosures to remove dust and debris.
- E. Seal joints to eliminate air bypassing coil or leakage from ductwork at coil piping and drain connections.

3.03 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to coils to allow service and maintenance.

END OF SECTION

**SECTION 23 8217
ELECTRIC DUCT HEATER**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Duct mounted electric heating coils

1.02 ACTION SUBMITTALS

- A. Provide submittals for products listed in the Product Table below in accordance with Section 23 05 00 – General HVAC Provisions. Submittal requirements indicated by column number designation as follows:
 1. Materials List
 2. Catalog Data
 3. Product Data
 4. Performance Data
 5. Wiring Diagrams
 6. Shop Drawings
 7. Installation Instructions
 8. Special Requirement listed herein.

PRODUCT TABLE	1	2	3	4	5	6	7	8
Electric duct coils		X		X				

1.03 QUALITY ASSURANCE

- A. Heaters ETL listed for zero clearance from combustibles, and bear ETL listing mark.
- B. Heaters shall meet the requirements of the NEC and UL 1996.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Indeeco, Nailor, Markel

2.02 ELECTRIC DUCT COILS

- A. General: Aluminized steel frame size to match duct dimension shown on drawings or as scheduled. Duct mounted units may be flanged or slip-in design with built-in terminal box completely factory wired to terminals. Control panel NEMA I enclosure. Affix as-built electrical wiring diagram to inside surface of control panel door.
- B. Coils: Open type, 80 percent nickel, 20 percent chromium resistance wire, insulated by floating ceramic bushings and supported in aluminized steel brackets spaced on maximum 4-inch centers. Coils shall be mechanically crimped in stainless steel terminals which are insulated from the frame with high temperature molded phenolic bushings.
- C. Over Temperature Protection:
 1. Primary system: Automatic reset thermal cutout
 2. Secondary system: Load-carrying manual reset thermal cutout factory wired in series with each heater stage.
- D. Electrical:
 1. Over-current Protection: Comply with UL and NEC.
 2. Disconnect: Provided by DIV. 26
- E. Airflow Interlock: Diaphragm operated differential airflow pressure switch
- F. Capacity Control:
 1. SCR Controller: SCR controller with back-up electrical contractor capable of modulating from 0 to 100% output. Input signal 0-10 VDC, 4-20 mA compatible with Building Automation System.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Locate & install airflow interlock in accordance with manufacturer's installation recommendations and equipment listings.
- B. Locate in ductwork at least two feet away from ductwork change in direction or size, two feet from air handler and four feet from heat pump or air conditioner.

END OF SECTION

**SECTION 26 0126
SUBMITTALS AND SHOP DRAWINGS**

PART 1 - GENERAL

1.01 REQUIREMENTS

- A. Refer to General Divisions for submittal requirements and procedures.

1.02 DEFINITIONS

- A. **Manufacturer's Product Data:** Manufacturer's product data consist of one or more levels of manufacturer's information as described below and as requested in the submittal schedule. The three levels of information include: manufacturer's list, manufacturer's catalog data, and manufacturer's technical and engineering data.
1. **Manufacturer's List:** Manufacturer's list shall include a typewritten list of manufacturer's name, sizes and model or catalog numbers, referenced to the specification section.
 2. **Manufacturer's Catalog Data:** Manufacturer's catalog data shall include standard catalog information marked to indicate specific equipment proposed and point of operation, if appropriate. Include installation instructions.
 3. **Manufacturer's Technical and Engineering Data:** Manufacturer's technical and engineering data shall include materials, dimensions, details, installation instructions, weights, capacities, illustrations, wiring diagrams, control diagrams, piping diagrams, connection diagrams, performance data (including performance curves), mix design, and any other information required for a complete and thorough evaluation of the equipment or items specified, and to verify compliance with specifications. Control diagrams or control schematics, where specified and required by the submittal schedule, shall include a detailed schematic of the proposed control modifications and their interface with existing control equipment, where appropriate, and a manufacturer and model number listing of all proposed control components shown on the control schematic.
- B. **Shop Drawings:** Shop Drawings are construction drawings of items manufactured specifically for this project. Shop Drawings include dimensions, construction details, weights, and additional information to identify the physical features of the system or piece of equipment.
- C. **Samples:** Samples illustrate functional characteristics of the product with integral parts and attachment devices. Samples shall allow evaluation of full range of manufacturer's standard colors, textures, and patterns.
- D. **Certificates, Test Data or Other Information:** Requirements for certificates, test data, or other information will be listed under referenced specification sections.

1.03 SUBMITTALS REQUIRED

- A. **Product Evaluation Data.** The submittal schedule for product evaluation data is as indicated below. Each item requiring a submittal is given the following code:
1. Manufacturer's list
 2. Manufacturer's catalog data
 3. Manufacturer's technical and engineering data
 4. Shop Drawings
 5. Samples
 6. Certificates
 7. Test data
 8. Worker's qualifications
 9. See individual sections for special requirements

1.04 **SUBMITTAL SCHEDULE**

Division 26 – Electrical Codes

Section 26 05 19 – Low Voltage EC Power and Cables	1,2,3
Section 26 05 33 – Raceways and Boxes for Electrical Systems	1,2,3
Section 26 27 26 - Wiring Devices	1,2,3
Section 26 28 16 - Overcurrent Protective Devices	1,2,3
Section 26 29 13 - Motor and Circuit Disconnects	1,2,3
Section 26 51 13 – Lighting Fixtures	1,2,3

PART 2 - PRODUCTS

2.01 **THIS PART NOT USED**

PART 3 - EXECUTION

3.01 **THIS PART NOT USED**

END OF SECTION

**SECTION 26 0500
GENERAL ELECTRICAL PROVISIONS**

PART 1 - GENERAL

1.01 CONTRACT DOCUMENTS

- A. General electrical provisions apply to all work performed in Division 26.
- B. The Contract Documents are complementary. What is required by any one, as affects this Division, shall be as binding as if repeated herein.
- C. Separation of this Division from other Contract Documents shall not be construed as segregation of the Work.
- D. Particular attention is called to Instructions to Bidders, General Conditions, Drawings and Specifications, and modifications incorporated in the documents before execution of the Agreement.
- E. Location of equipment on Drawings is approximate. Plan exact location with respect to site measurements and work of other trades prior to starting work. If measurements differ slightly, modify work. If measurements differ substantially, notify Architect/Engineer and Owner's Authorized Representative prior to fabrication.
- F. Make minor changes in equipment connections and equipment locations as directed or required before rough-in without extra cost.
- G. Use of the word "Provide" shall be equivalent to "Furnish and Install."

1.02 DEFINITIONS

- A. Authority Having Jurisdiction (AHJ): The governmental agency or sub-agency which regulates the construction process.
- B. Owner's Authorized Representative (OAR): Owner's representative with authority to act on Owner's behalf.

1.03 COORDINATION

- A. Check drawings of other trades to avert possible installation conflicts. Should major changes from original drawings be necessary to resolve such conflicts, notify Architect/Engineer and secure written approval and agreement on necessary adjustments before start of work.
- B. Architectural drawings govern all other drawings. Consult in detail the door swings, counter heights and similar items affecting work before rough-in.
- C. Coordinate identification systems with other trades. All electrical systems shall use identical wiring, conduit, and equipment identification and regulatory signage.

1.04 SUBMITTALS AND SHOP DRAWINGS

- A. See Section 01 3323 "Shop Drawings, Product Data, and Samples."
- B. Action Submittal Content
 - 1. Action submittal information not expressly required by the specifications will not be reviewed.
 - 2. Action submittal information shall be provided in sufficient detail to establish conformance with specified requirements. Where submitted literature includes multiple models, features, or options, the specific models, features, or options proposed shall be clearly indicated. Where a brief inspection shows that product data is not complete, the submittal will be rejected without review.
 - 3. Action submittal data shall be clear, concise, legible, and relevant. Where data is not properly organized and contains significant information that is not relevant, the submittal will be rejected without review.
 - 4. Action submittal requirements are listed in individual specification sections. The following definitions apply.
 - a. Materials List: Provide tabular list of materials including specification reference, specification product name, manufacturer, model/part number, and size and/or quantity

where appropriate. Do not include supplemental data, except where specifically requested.

- b. Catalog data: Manufacturer's standard product cut sheet.
- c. Product Data: Detailed data including dimensions, weight, materials of construction, connections, and all other information needed to confirm that the product conforms to all requirements listed in the individual specification section.
- d. Performance Data: Capacity, input, output, flow, etc. as required to confirm that the product meets the performance requirements scheduled in the Specifications or on the Drawings.
- e. Wiring Diagrams: Power and control wiring diagrams.
- f. Shop Drawings: Construction drawings of items manufactured specifically for this project including dimensions, construction details, weights, and additional information to identify the physical features of the system or piece of equipment.
- g. Installation Instructions
- h. Special Requirements Listed: Additional requirements indicated in individual specification sections.

1.05 **QUALITY ASSURANCE**

- A. All materials and equipment provided hereunder shall be installed and started in complete conformance with the manufacturer's recommendations.
- B. Asbestos products or equipment or materials containing asbestos shall not be used.
- C. Certify that each welder has passed the American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.

1.06 **DESIGN REQUIREMENTS**

- A. Equipment and systems provided hereunder shall be rated to provide performance specified and scheduled on Drawings at the elevation of the project site.
- B. Materials and equipment provided hereunder shall be rated for the service conditions of the system to which they are connected including but not limited to temperature, pressure, and humidity.

1.07 **CODES AND STANDARDS**

- A. Applicable codes and standards shall determine minimum requirements for materials, methods, and labor practices not otherwise stated herein.
- B. Work shall comply with the Americans with Disabilities Act (ADA).

1.08 **OPERATIONS AND MAINTENANCE MANUALS**

- A. Bind manuals in three-ring, high quality vinyl covered binders, clearly indexed and provided with thumb tabs for each item or product. Include a directory of all subcontractors and maintenance contractors with names, addresses, and telephone numbers, indicating the area of responsibility for each. Index tabs shall match submittal schedule and include any additional information required for operations and maintenance, whether in submitted schedule or not.
- B. Maintenance instructions shall indicate routine-type work with step-by-step instructions that should be performed to ensure long life and proper operations. Recommended frequency of performance shall also be included.
- C. Provide copy of approved submittal for each product included in manual
- D. Provide printed copy and electronic configuration files for all packaged equipment control systems furnished with equipment.
- E. Mark the model actually provided where the literature covers more than one model. Include four copies of all submittal data corrected to "as-built" conditions within the manual.
- F. Provide a composite summary table indicating each item of equipment listed in the operations and maintenance manual and its required maintenance and time period. This summary table shall be the first section in the O&M manual.

- G. Manual Content: Manuals shall contain complete information for each item of mechanical, electrical or other operating equipment. Include as applicable:
 - 1. Manufacturer's instructions for installation, startup, operation, inspection, and maintenance
 - 2. Performance capacity
 - 3. Catalog data sheets
 - 4. Parts list
 - 5. Maintenance schedules

1.09 RECORD DRAWINGS

- A. Provide record "as-built" drawings in accordance with Division 1 requirements. Show all deviations from contract drawings and location of all underground lines by accurate dimensions from building lines. Show depth of all stub outs and underground lines. All concealed raceways, that contain feeder cables, communication conduits that are 1.5" or greater shall be dimensioned from column grids or building lines. Alternately, provide electronically using .pdf markup of contract drawings.

1.10 DEMONSTRATION

- A. General: After installation is complete, demonstrate to Engineer and Owner's Authorized Representative satisfaction as being complete and operational and entirely in conformance with Contract Documents.
- B. Preparation: Prior to demonstration, submit check-off list indicating completeness of submittals and certificates of compliance for review to Owner's Authorized Representative. Operate completed system for one week. Verify that control verification is complete and verification report has been approved by Architect/Engineer.
- C. Arrange for demonstration with Owner, Engineer, required factory technicians, and installer at least one week in advance of demonstration.

1.11 COORDINATION DOCUMENTS

- A. Preparation of documents:
 - 1. Perform modeling in Revit, Navisworks, or Autodesk BIM 360 Glue.
 - 2. Incorporate addenda, changes, field adjustments and RFIs into model.
 - 3. Submit model with Record documents at project closeout.
- B. Notify architect of Construction Document discrepancies and conflicts where installation requirements require greater space than is available and cannot be resolved through trade coordination efforts alone.
 - 1. Model/drawings level of detail to include the following components:
 - a. Lighting, transformer, switchgear, panelboards, generators, conduits 2" and larger.
 - b. All conduit sizes of panelboard feeders and branch circuit conduits 2" and larger.
 - c. Cable trays, IT equipment and UPS
 - d. Equipment disconnects.
 - e. Networked lighting control equipment.
 - f. Audio/visual equipment.

1.12 WARRANTY

- A. Warrant all Work included in this Specification for a period of one year from the date of substantial completion, under provisions of Division 1.
- B. During warranty period, remedy without delay or expense to Owner any defects providing, in judgement of Engineer, that such defects are not result of misuse or abuse on part of Owner.
- C. Warrant that all equipment and installations are in compliance with OSHA regulations.

PART 2 - PRODUCTS

2.01 PRODUCTS AND MATERIALS

- A. All materials employed in permanent construction shall be new, full weight, in first class condition, and suitable for space provided. All similar equipment and materials shall be of one manufacturer.
- B. Equipment used as the basis of design is scheduled on Drawings or designated in product specifications. If Contractor chooses to use equipment that is not the basis of design, Contractor is responsible for all re-design and construction costs associated with variations in arrangement, dimension, or capacity. Such work may include, but is not limited to, changes to facility structure or dimensions and revisions to associated mechanical and electrical systems needed to provide equal system performance and maintainability.

2.02 ELECTRICAL EQUIPMENT

- A. Electrical Disconnect Switch: Electrical disconnect switches specified for mechanical equipment shall conform to OSHA Lock-out/Tag-out requirements.
- B. All electrical equipment shall be listed as approved for its application by the Underwriters Laboratory or other testing agency approved by the State of Oregon Electrical and Elevator Board. Approval indicates agency meets testing standard requirements for electrical safety required by Oregon Revised Statutes 479.510 through 479.855 and Oregon Administrative Rules.
- C. Enclosure: Provide the following electrical equipment enclosure types.
 - 1. NEMA 1: Dry, enclosed locations where the ambient temperature will not be outside of the equipment temperature ratings.
 - 2. NEMA 12: Enclosed mechanical spaces equipped with floor drains where dripping or splashing may occur and where the ambient temperature will not be outside of the equipment temperature ratings.
 - 3. NEMA 3R: Outdoors or in spaces where sustained water spray is possible.
 - 4. NEMA 3R: with Temperature Control: Outdoors or in unconditioned spaces where ambient temperatures will be outside of the equipment temperature ratings.
 - 5. NEMA 4X: Outdoors or in spaces that are corrosive environments.

2.03 EQUIPMENT CONNECTIONS

- A. Provide a complete electrical connection for all items of equipment including incidental wiring, materials, devices and labor necessary for a complete operating system. The location and method for connection to each item of equipment shall be verified prior to rough-in. The voltage and phase of each item of equipment shall be checked prior to connecting. Motor rotations shall be made in the proper direction. Pump motors are not to be test run until liquid is in the system and proper lubrication to all bearings in unit is checked.
- B. Conduit, wire and circuit breaker sizes for mechanical and similar equipment are based on the equipment ratings of one manufacturer. The equipment actually furnished may have different electrical characteristics. Conduit, wire, and circuit breakers shall not be ordered or installed until exact electrical requirements are obtained. The Contractor is responsible for this coordination.

2.04 FIRESTOPPING

- A. Acceptable Manufacturers: 3M, Hilti, Tremco, Nelson Firestop Products.
- B. Provide firestopping for the following:
 - 1. All penetrations through fire resistance rated floors, walls and partitions including openings containing pipes, ducts and other penetrating items.
 - 2. All penetrations through non-fire resistance rated floors where the vertical service riser penetrates three or more floors.
- C. Firestop system shall be UL Classified for the application and correspond to those indicated by reference to designation listed by UL Fire Resistance Directory.

- D. Material shall be tested in accordance to UL-1479, ASTM E-814 for the specific fire-rated construction conditions confirming to construction assembly type, penetration item type, annular space requirements, and fire-rating involved.

PART 3 - EXECUTION

3.01 ACCESS TO EQUIPMENT AND ACCESSORIES

- A. Install equipment with sufficient access for service. Where not conveniently accessible by other means, provide adequately sized access doors for junction & pull boxes, relays & power packs, and all other electrical equipment requiring access for removal or maintenance. Type, size and exact location of access doors shall be coordinated with Architect prior to work.
- B. Provide clearances for maintenance access as indicated on Drawings or as recommended by manufacturer. If access requirements shown on Drawings conflict with manufacturer's recommendations, provide larger clearance of the two.
- C. If equipment location shown on Drawings does not allow required access, notify Architect/ Engineer prior to start of work.
- D. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract drawings and specifications to Architect/Engineer for resolution prior to starting work.
- E. Provide access doors as required for access to electrical equipment. Doors required for access are not necessarily shown on Drawings. Consult with Architect for direction on placement of required doors not shown on Drawings.
 - 1. Comply with manufacturer's instructions for installation of access doors. Provide all necessary support and supplemental framing for assembly where the access doors are required. Set accurately in position, plumb, level, and flush to adjacent finish surfaces; and secure to support.

3.02 ARRANGEMENT AND INSTALLATION OF ELECTRICAL EQUIPMENT AND CONDUIT

- A. Coordinate location of conduit, sleeves, inserts, hangers, cable trays and equipment. Locate conduit, sleeves, inserts, hangers, cable tray and equipment clear of windows, doors, openings, lights, ducts, piping, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.
- B. Equipment and Conduit Support: Coordinate structural systems necessary for conduit and equipment support with pipe and equipment locations to permit proper installation.
- C. Location of conduit sleeves, trenches and chases shall be accurately coordinated with equipment and conduit locations.
- D. Minor Conduit: Small diameter conduit runs from receptacles, lighting, equipment, and similar minor services are generally not shown but must be provided. Contractor is responsible to provide all such minor conduit where needed to maintain electrical spaces clean and neat and to allow full equipment function and maintenance.
- E. Work in Existing Building: Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Owner's Authorized Representative. Locate openings that will least affect structural slabs, columns, ribs or beams. Refer to the Architect/Engineer for determination of proper design for openings through structural sections and obtain layout approval prior to cutting or drilling into structure. After Architect/Engineer's approval, carefully cut opening through construction no larger than absolutely necessary for the required installation.
- F. Inaccessible Equipment
 - 1. Where the Owner's Authorized Representative determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment

shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Owner.

2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.03 EXISTING EQUIPMENT REUSED OR RELOCATED

- A. All equipment designated as existing or furnished by Owner shall be cleaned and repaired before reinstallation. Any items requiring repair shall be brought to the attention of the construction manager before the item is reinstalled. Damage not brought to the attention of the construction manager shall be deemed the result of reinstallation of the item and shall be repaired without expense to the Owner.

3.04 ELECTRICAL SYSTEMS FIRESTOPPING

- A. Do not cover firestop installations until they are examined by the Authority Having Jurisdiction, if required.
- B. Install firestopping in accordance with manufacturer's recommendations and conditions of product UL listing.

3.05 CLEANING SYSTEMS

- A. General: After all equipment, conduits and cable tray are installed, system shall be thoroughly cleaned. Remove all nonessential stickers and labels from equipment or fixtures. Clean all light fixture lenses. Clean interior of conduit systems prior to installation of wiring.
- B. Repair or replace any discolorations or damage to systems, building finish, or furnishings resulting from Contractor's failure to properly clean system.

3.06 START UP

- A. The Electrical Contractor shall be responsible for proper operation of all systems and shall coordinate startup procedures, calibration and system checkout. System operational problems shall be diagnosed and corrected as required for system operation prior to Substantial Completion inspection.
- B. Start equipment in accordance with manufacturer's recommendations and under manufacturer's supervision where required. Ensure that associated breakers, relays, electrical overloads, and other devices intended to protect the equipment are installed and functional prior to startup.

END OF SECTION

**SECTION 26 0501
ELECTRICAL DEMOLITION**

PART 1 - GENERAL

1.01 SCOPE

- A. Contractor shall coordinate with the Owner so that work can be scheduled not to interrupt operations, normal activities, building access, access to different areas. The Owner will cooperate to the best of their ability to assist in a coordinated schedule but will remain the final authority as to time of work permitted.

1.02 EXISTING CONDITIONS

- A. The locations of existing utilities and equipment are shown in an approximate way only and have not been independently verified by the Owner or its representative. The Contractor shall determine the exact location of all existing utilities before commencing work and agrees to be fully responsible for any and all damages which might be occasioned by the Contractor's failure to exactly locate and preserve any and all utilities and equipment. Replace damaged items with new material to match existing. Promptly notify Owner if utilities are found which are not shown on the Drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. All materials accumulated during the demolition process are the Owner's property and shall be removed from the job site as directed by the Owner.

PART 3 - EXECUTION

3.01 DEMOLITION

- A. Remove all existing electrical equipment and devices and associated wiring from walls, ceilings, floors, and other surfaces scheduled for remodeling, relocation, or demolition unless specifically shown as retained or relocated on the Drawings.
- B. Disconnect all existing mechanical equipment scheduled for removal, relocation or abandonment. See mechanical drawings for scope of work. Remove abandoned cables and unusable raceways. Relabel panels and motor control centers to reflect changes.
- C. Maintain electrical continuity of all existing systems. Remove or relocate electrical boxes, conduit, wiring, equipment, fixtures, etc. as may be encountered in removed or remodeled areas in the existing construction affected by this work. Wiring which serves usable existing outlets shall be removed and restored clear of the construction or demolition. If existing junction boxes will be made inaccessible, or if abandoned outlets serve as feed through boxes for other existing electrical equipment which is being retained, new conduit and wire shall be provided to bypass the abandoned outlets. If existing conduits pass through partitions or ceiling which are being removed or remodeled, new conduit and wire shall be provided to reroute clear of the construction or demolition and maintain service to the existing load.
- D. Extend circuiting and devices in all existing walls to be furred out.
- E. Existing electrical outlets and light fixtures are denoted by dotted or dashed lines. Verify exact location of existing electrical outlets and light fixtures in the field. Only partial existing electrical shown. Locations of items shown on the Drawings as existing are partially based on as-built and other drawings which may contain errors. The contractor shall verify the accuracy of the information shown prior to bidding and provide such labor and material as is necessary to accomplish the intent of the contract documents.
- F. Remove all abandoned wiring to leave site clean.
- G. Keep outages to occupied areas to a minimum and prearrange all outages with the Owner's representative. Requests for outages shall state the specific dates and hours and the maximum durations, with the outages kept to these specific dates and hours and the maximum durations. This Contractor will be liable for any damages resulting from unscheduled outages or for those

not confined to the preapproved times. Outages shall take place at times when the facility is not in operation or occupied by non-essential personnel. Include all costs for overtime labor as necessary to maintain electrical services in the initial bid proposal. Temporary wiring and facilities, if used, shall be removed and the site left clean before final acceptance. Requests for outages must be submitted at least (5) days prior to intended shutdown time.

- H. No circuit breaker or disconnects shall be turned off without prior approval from Owner. Coordinate with the Owner's representative responsible for the area or equipment affected for any electrical interruptions which affect the operation of the remaining portions of the facility.
- I. Verify with the General Contractor a location for storage of materials, supplies, tools, rubbish, etc. prior to start of work.

END OF SECTION

SECTION 26 0519

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Wires and Cables
- B. Wire Connections

1.02 REFERENCE STANDARDS

- A. National Fire Protection Association (NFPA)
 - 1. NFPA 70 National Electrical Code

1.03 SUBMITTALS

- A. Provide submittals for products listed in the Product Table below in accordance with Section 26 0126.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver new wire to Site in new standard coils or reels with approved tag denoting length, wire size, insulation type and manufacturer's name.
- B. Protect from weather and damage during storage and handling.

PART 2 - PRODUCTS

2.01 CONDUCTOR AND CABLE MATERIALS

- A. Building Wiring: 98 percent conductivity copper, 600-volt insulation, stranded. Type THHN for interior dry and damp locations. Type THWN or XHHW for wet and exterior locations.
- B. Branch Circuit Wiring: Conductors smaller than No. 12 AWG for power system branch circuits not permitted.
- C. Motor control wires shall be No. 14 minimum.
- D. Wire for special areas shall be as specified on the Drawings.

2.02 TWIST-ON CONNECTOR

- A. UL pressure-type, solderless, insulated, wound spring grip twist on connector.
- B. Solderless pressure connectors for terminals, taps, and splices.

2.03 COMPRESSION ADAPTER

- A. For terminating a single aluminum wire into mechanical connectors, such as a circuit breaker or set screw lugs. Burndy "Hyplug" Type AYP, or approved equal by Anderson, Illsco, Kearney, Mac-Adapt, T&B.

2.04 TERMINAL, CRIMP-ON

- A. Flat, fork tongue, self-insulating.
- B. For connection of stranded wire to screw terminals.
- C. T & B "Sta-Kon," or approved equal.

PART 3 - EXECUTION

3.01 CONDUCTOR AND CABLE INSTALLATION

- A. Make conductor length for parallel feeders identical.
- B. Lace or clip groups of feeder conductors at distribution centers, pullboxes, and wireways.
- C. Provide copper grounding conductors and straps. A ground wire shall be pulled through conduits and used as the equipment grounding conductor.
- D. Use 10 AWG conductors for 20 ampere, 120-volt branch circuit home runs longer than 100 feet, and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet. Neutral conductor shall be sized the same as corresponding "hot" conductors.
- E. No shared neutrals. Provide one neutral for each phase conductor in branch circuits.
- F. Wire and cable shall be brought to the job in the original containers bearing the U.L. label.
- G. Install wire and cable in code conforming raceway.
- H. Use wire pulling lubricant for pulling No. 4 AWG and larger wire. UL approved type only.

- I. Install wire in conduit runs after concrete and masonry work is complete and after moisture is swabbed from conduits.
- J. Couplings and conduit connectors shall have pre-insulated bushings in place before pulling wires.
- K. Splice only in accessible junction or outlet boxes. Splice in feeders and services not permitted. Splices or taps in branch circuits permitted only in junction boxes where circuits divide.
- L. Color code conductors to designate neutral, phase, and ground as follows:

CONDUCTOR	120/208 OR 120/240	277/480
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Gray
Ground	Green	Green
Switchlegs	Pink	Pink
Travelers	Purple	Purple
Fire Alarm	Red	
Intercom/Clock/Bell	Grey	
Security	Orange	
HVAC Control	Green	
Data/Telecom	White (CAT6)	

- M. Wires shall be factory color coded by integral pigmentation. Colored plastic tape permitted on No. 6 and larger where integral pigmentation impractical. Apply tape in spiral half-lap over exposed portions in manholes, boxes, panels, switchboards and other enclosures.
- N. All circuit conductors shall be identified with circuit number at all terminals, intermediate outlets, disconnect switches, circuit breakers, motor control centers, etc. Both ends of a given conductor shall be identified alike.
- O. DO NOT install wires of different voltage systems in same raceway, box, gutter or other enclosure.
- P. Radius of cable bends shall not be less than 10 times the outer diameter of the cable.
- Q. Megger test all power conductors except as specified in manufacturer's instructions. Maintain megger sheets for all insulation tests conducted and megger readings per manufacturer's instructions. (ASI-04)

3.02 CONNECTIONS AND SPLICES

- A. Follow manufacturer's instructions using manufacturers recommended tools.
- B. Stripping Insulation: Carefully strip, avoid nicking conductor. No "ringing."
- C. Design: Connectors shall be designed and approved for the purpose used. Connectors between aluminum and copper shall be listed "AL/CU" for the purpose of preventing electrolytic action.
- E. Bare Connectors and Conductor Free Ends: Wrap with insulating rubber or friction tape to equivalent insulation of wire.
- F. Ground Continuity to Metallic Surfaces: Remove any paint coating and polish surface beneath connection.
- G. Copper conductors may be terminated in any approved compression or mechanical connector, including set screws.
- H. No splices or taps permitted in feeder or branch circuit terminating in a single outlet.
- I. Branch circuit splices and taps in junction and outlet boxes: Twist-on connectors.
- J. Conductor and cable copper shall not be reduced at the terminal for making connections.
- K. Slack shall be left at equipment, pullboxes, or outlet boxes to allow for a neat termination.

END OF SECTION

**SECTION 26 0533
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Metal conduits and fittings.
 - 2. Nonmetallic conduits and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Nonmetal wireways and auxiliary gutters.
 - 5. Surface raceways.
 - 6. Boxes, enclosures, and cabinets.
 - 7. Handholes and boxes for exterior underground cabling.

1.03 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.
- B. IMC: Intermediate metal conduit.

1.04 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.05 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Qualification Data: For professional engineer.
- C. Seismic Qualification Data: Certificates, for enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - 4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.
- D. Source quality-control reports.

PART 2 - PRODUCTS

2.01 METAL CONDUITS AND FITTINGS

- A. Metal Conduit:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Allied Tube & Conduit; a part of Atkore International.
 - b. Calconduit.

- c. Thomas & Betts Corporation; A Member of the ABB Group.
 - d. Western Tube and Conduit Corporation.
 - e. Wheatland Tube Company.
 2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 3. GRC: Comply with ANSI C80.1 and UL 6.
 4. IMC: Comply with ANSI C80.6 and UL 1242.
 5. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - a. Comply with NEMA RN 1.
 - b. Coating Thickness: 0.040 inch, minimum.
 6. EMT: Comply with ANSI C80.3 and UL 797.
- B. Metal Fittings:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Allied Tube & Conduit; a part of Atkore International.
 - b. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - c. Thomas & Betts Corporation; A Member of the ABB Group.
 - d. Western Tube and Conduit Corporation.
 - e. Wheatland Tube Company.
 2. Comply with NEMA FB 1 and UL 514B.
 3. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 4. Fittings, General: Listed and labeled for type of conduit, location, and use.
 5. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
 6. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Setscrew.
 7. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
 8. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. B-line, an Eaton business.
 2. Hoffman; a brand of nVent.
 3. MonoSystems, Inc.
 4. Square D.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 or Type 3R unless otherwise indicated, and sized according to NFPA 70.
 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.03 **BOXES, ENCLOSURES, AND CABINETS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Crouse-Hinds, an Eaton business.
 - 2. FSR Inc.
 - 3. Hoffman; a brand of nVent.
 - 4. Hubbell Incorporated.
 - 5. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 6. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, Type FD, with gasketed cover.
- E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- G. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.
 - 1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- J. Device Box Dimensions: 4 inches square by 2-1/8 inches deep minimum.
- K. Gangable boxes are allowed.

PART 3 - EXECUTION

3.01 **RACEWAY APPLICATION**

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: GRC.
 - 2. Concealed Conduit, Aboveground EMT.
 - 3. Underground Conduit: RNC, Type EPC-40-PVC.
 - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 5. Boxes and Enclosures, Aboveground: NEMA 250.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: EMT.
 - 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 - 3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - 4. Concealed in Ceilings and Interior Walls and Partitions: EMT

5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: GRC.
 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use setscrew steel fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- G. Install surface raceways only where indicated on Drawings.

3.02 **INSTALLATION**

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.
- C. Do not fasten conduits onto the bottom side of a metal deck roof.
- D. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- E. Complete raceway installation before starting conductor installation.
- F. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- G. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- H. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- I. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- J. Support conduit within 12 inches of enclosures to which attached.
- K. Stub-Ups to Above Recessed Ceilings:
 1. Use EMT, IMC, or RMC for raceways.
 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- L. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

- M. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- N. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- O. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- P. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- Q. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- R. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- S. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- T. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch radius control at bend points.
 - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- U. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- V. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Conduit extending from interior to exterior of building.
 - 4. Conduit extending into pressurized duct and equipment.
 - 5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
 - 6. Where otherwise required by NFPA 70.
- W. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

3.03 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

**SECTION 26 2726
WIRING DEVICES**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Standard-grade receptacles, 125 V, 20 A.
 - 2. GFCI receptacles, 125 V, 20 A.
 - 3. Toggle switches, 120/277 V, 20 A.
 - 4. Wall plates.

1.03 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.

1.05 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.01 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Comply with NFPA 70.
- C. RoHS compliant.
- D. Comply with NEMA WD 1.
- E. Devices that are manufactured for use with modular plug-in connectors are not acceptable.
- F. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: Gray unless otherwise indicated or required by NFPA 70 or device listing.
- G. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 SPECIFICATION-GRADE RECEPTACLES, 125 V, 20 A

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Hubbell Incorporated (Commercial and Industrial Group - Wiring Device-Kellems).
 - 2. Leviton Manufacturing Co., Inc.
 - 3. Pass & Seymour/Legrand (Pass & Seymour).
- B. Duplex Receptacles, 125 V, 20 A:
 - 1. Description: Two pole, three wire, and self-grounding.
 - 2. Configuration: NEMA WD 6, Configuration 5-20R.
 - 3. Standards: Comply with UL 498 and FS W-C-596.
- C. Weather-Resistant Duplex Receptacle, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498.
4. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

2.03 GFCI RECEPTACLES, 125 V, 20 A

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Hubbell Incorporated (Commercial and Industrial Group - Wiring Device-Kellems).
 2. Leviton Manufacturing Co., Inc.
 3. Pass & Seymour/Legrand (Pass & Seymour).
- B. Duplex GFCI Receptacles, 125 V, 20 A:
 1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
 2. Configuration: NEMA WD 6, Configuration 5-20R.
 3. Type: Non-Feed through.
 4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
- C. Tamper- and Weather-Resistant, GFCI Duplex Receptacles, 125 V, 20 A:
 1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
 2. Configuration: NEMA WD 6, Configuration 5-15R.
 3. Type: Non-feed through.
 4. Standards: Comply with UL 498 and UL 943 Class A.
 5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.04 WALL PLATES

- A. Single Source: Obtain wall plates from same manufacturer of wiring devices.
- B. Single and combination types shall match corresponding wiring devices.
 1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces: 0.035-inch-thick, satin-finished, Type 302 stainless steel.
 3. Material for Unfinished Spaces: Galvanized steel.
 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.
- D. Antimicrobial Cover Plates:
 1. Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
 2. Tarnish resistant.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 3. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.
 4. Existing Conductors:
 - a. Cut back and pigtail or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
 6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
 7. When conductors larger than No. 12 AWG are installed on 20-A circuits, splice No. 12 AWG pigtails for device connections.
 8. Tighten unused terminal screws on the device.
 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
 10. Install toggle switches at 48 inches to center line of faceplate above finished floor with OFF position down, unless otherwise noted.
 11. Install receptacles at 18 inches to center line of faceplate above finished floor, unless otherwise noted.
 12. Verify mounting height and orientation of wiring devices above counter tops and benches with Architectural Details prior to rough-in.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.
- F. Device Plates:
1. Do not use oversized or extra-deep plates.
 2. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush, level, or do not cover rough wall opening.

3. Where outlets are adjacent to each other at same mounting heights, install under common device plate, except where outlets are of different voltages, such as data and duplex receptacle, unless otherwise noted.
 - G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.
 - H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.
- 3.02 **GFCI RECEPTACLES**
- A. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required.
- 3.03 **IDENTIFICATION**
- A. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with **black**-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

END OF SECTION

**SECTION 26 2913
MOTOR AND CIRCUIT DISCONNECTS**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Provide and install motor disconnects as shown and as required by Code.
- B. Provide and install circuit disconnects as shown and as required by Code.
- C. Disconnects to include mounting stands, brackets, plates, supports, and required hardware and accessories for complete installation.

1.02 REFERENCE STANDARDS

- A. Underwriters' Laboratory (UL)
 - 1. Annual Product Directories
 - 2. UL-98 Enclosed Switches
- B. National Electrical Manufacturer's Association (NEMA)
 - 1. NEMA KS-1 Enclosed Switches

1.03 REQUIREMENTS OF REGULATORY AGENCIES

- A. Conform to National Electrical Code and to applicable inspection authority.
- B. Provide circuit and motor disconnects in the proper enclosure as required by NEC for the location installed unless more stringent requirements otherwise noted on the Drawings or herein.

1.04 SUBMITTALS

- A. Provide submittals for products listed in the Product Table below in accordance with Section 26 05 0126.

PART 2 - PRODUCTS

2.01 COMPONENTS

- A. Motor and circuit disconnects shall have an Underwriters' Laboratory label.
- B. Three-Phase Disconnect Switches: Three-pole heavy duty quick make, quick break 600 volt. Number of poles and ampacity as noted or required by Code. Fusible where noted with fuse clips suitable for dual element fuses unless current limiting fuses are noted. Short circuit rating sufficient to withstand the available fault current or let-through current before the fuse melts without damage or changes in rating.
- C. Compression or set-screw lugs approved for use with copper wire.
- D. ON/OFF Positions: Clearly marked, lockable in "OFF" position.
- E. Cover Interlock:
 - 1. Prevents switch from being opened when "on."
 - 2. Prevents closing switch when cover is open.
 - 3. Defeater to permit authorized personnel to open door and inspect switch when "on," or operate with cover open.
- F. Motor disconnects shall contain minimum 2 NO/NC control circuit disconnecting contacts interlocked with operating handle.
- G. Enclosure for Dry, Indoor Locations: NEMA 1 minimum. Enclosures for outdoor locations: NEMA 3R minimum. Others as required for location installed.

2.02 MANUAL MOTOR CONTROLLER, SINGLE PHASE

- A. Acceptable Manufacturer: Square D.
- B. General: Manual toggle switch with handle guard and lockoff, thermal overload relay, NEMA 1 surface mounted enclosure. Square D, Class 2510 or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install motor and circuit disconnects as recommended by manufacturer and as required by Code and UL.
- B. Maintain Code clearances.

- C. Provide a nameplate on each motor and circuit disconnect identifying the equipment item served. Where disconnect is to be installed in existing motor control center replace existing nameplate with new nameplate identifying new equipment item served.

END OF SECTION

**SECTION 26 5100
LIGHTING FIXTURES**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section includes supply and installation of luminaires, supports and accessories; and supply of plaster frames, trim rings and backboxes for plaster, tile, drywall or concrete ceilings.

1.02 REFERENCE STANDARDS

- A. National Electrical Manufacturer's Association (NEMA)
 - 1. NEMA SSL 1: Electronic Drivers for LED Devices, Arrays, or Systems.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.
 - 3. Include physical description and dimensions of luminaires.
 - 4. Include emergency lighting units, including batteries and chargers.
 - 5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
 - 6. Photometric data and adjustment factors based on laboratory tests[, complying with IES "Lighting Measurements Testing and Calculation Guides" for each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project] [IES LM-79] [and] [IES LM-80].
 - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
 - b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
- B. Shop Drawings: For nonstandard or custom luminaires.
 - 1. Include plans, elevations, sections, and mounting and attachment details.
 - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
- C. Samples: For each luminaire and for each color and texture with standard factory-applied finish.
 - 1. Samples for Initial Selection: For each type of luminaire with custom factory-applied finishes.
- D. Include Samples of luminaires and accessories involving color and finish selection.
- E. Samples for Verification: For each type of luminaire.
 - 1. Include Samples of luminaires and accessories to verify finish selection.

1.04 COORDINATION

- A. Confirm compatibility and interface of other materials with luminaire and ceiling system. Report discrepancies to the Engineer/Architect and defer ordering until clarified.
- B. Supply plaster frames, trim rings and backboxes to other trades.
- C. Coordinate with Division 22 and 23 to avoid conflicts between luminaires, supports, fittings, piping, and mechanical equipment.

1.05 JOB CONDITIONS

- A. Existing Conditions:
 - 1. Prior to ordering lighting fixtures, verify finish material in locations where lighting fixtures are mounted.
 - 2. Prior to ordering lighting fixtures, verify conditions for mounting lighting fixtures and select proper mounting hardware.

3. Verify fire rating of new ceilings.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Refer to LUMINAIRE SCHEDULE.

2.02 PENDANTS/CABLE HANGERS

- A. Swivel sockets permitting normal fixture motion and self-adjustment. Adjustable to provide fixture height alignment.
- B. One-piece, white finish, with matching canopies.
- C. Fixtures shall be factory counter-weighted and balanced to provide level hanging. Weights shall not be visible.
- D. Cable hangers shall be adjustable for a minimum of 18".

2.03 LED LUMINAIRES

- A. General:
 1. LED light fixtures shall be in accordance with IES, NFPA, UL as shown on the Drawings and as specified.
 2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS) compliant.
 3. LED drivers shall include the following features unless otherwise indicated:
 - a. Minimum Efficiency: 85% at full load.
 - b. Minimum Operating Ambient Temperature: -20°C (-4°F).
 - c. Input Voltage: 120-277V (±10%) at 60 Hz.
 - d. Integral short circuit, open circuit, and overload protection.
 - e. Power Factor: ≥ 0.95.
 - f. Total Harmonic Distortion: ≤ 20%.
 - g. 4-wire (0-10VDC voltage controlled) dimming driver.
 - h. Capable of dimming to black from 100% to 1% light output and step to 0%. Driver shall respond similarly when raising from 0% to 100%.
 - i. Driver shall be free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10).
 4. LED modules shall include the following features unless otherwise indicated:
 - a. Comply with IES LM-79 and LM-80 requirements.
 - b. Minimum CRI 80 and color temperature 4000° K unless otherwise specified in LUMINAIRE SCHEDULE.
 - c. Minimum Rated Life: 50,000 hours per IES L70.
 - d. Light output lumens as indicated in the LUMINAIRE SCHEDULE.

2.04 CORRELATED COLOR TEMPERATURE (CCT) AND COLOR RENDERING INDEX (CRI)

- A. 4100K

PART 3 - EXECUTION

3.01 COORDINATION

- A. Refer to Reflected Ceiling Plans for exact locations with respect to ceiling construction.
- B. Consult Finish Schedule for ceiling and wall construction and finish.
- C. Prior to ordering lighting fixtures, coordinate style of mounting with ceiling construction and trim details for ceiling system finally selected.

3.02 PENDANTS

- A. Support from structure per paragraph titled "SUPPORT".
- B. Provide steel, stranded safety cable between fixture and structure to support fixture in the event of a pendant breakage.

3.03 SUPPORT

- A. Suspended ceiling:

1. Positively attach all light fixtures to the suspended ceiling system. The attachment device shall have a capacity of 150% of the lighting fixture weight acting in any direction.
 2. Support grid with No. 12 minimum gage hangers attached to the grid members within 3 inches of the corner of each fixture, attached to structure above.
 3. Attach two No. 12 minimum hangers from the fixture housing to the structure above. These wires may be slack.
 4. Where suspended fixtures do not align with grid, provide "bridging" above grid and support from structure.
 5. Support pendent-hung lighting fixtures directly from the structure above with No. 9 minimum wire or approved alternate support.
- B. Support all other fixtures from structure by method rated at least five times support weight.
- 3.04 PREPARATION**
- A. Field Measurements:
1. See architectural reflected ceiling plans for exact location of ceiling mounted lighting fixtures.
 2. See architectural elevations for exact location of wall mounted lighting fixtures.
 3. Coordinate lighting fixture location in mechanical spaces with mechanical equipment. Report adverse conditions to Architect.
 4. Lighting fixtures are generally located for symmetrical pattern and to suit structural conditions. Location changes shall be approved by Architect.
 5. Do not install any work until any discrepancies discovered have been resolved.
- B. Preparation of Surfaces:
1. Ensure finished surfaces of pole base tops smooth and relatively level prior to application of lighting fixture poles. Make final adjustment to plumb poles with leveling nuts.
- 3.05 CLEAN-UP**
- A. At time of acceptance, fixtures, lamps, and poles shall be clean, with visible labels removed. Touch-up any blemishes at completion of work.
- B. Remove ballast leakage and dispose of cleaning materials in accordance with EPA regulations.
- 3.06 FIXTURES AS RACEWAYS**
- A. Code Reference: NEC 410-31
- B. Through-Wiring: In continuous rows of fluorescent lighting, a connection to a single point in the row indicates that the branch circuit conductors are to be routed through the fixture wiring compartments and a connection made to each ballast.

END OF SECTION

**SECTION 32 3113
CHAIN LINK FENCES AND GATES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Posts, rails, and frames.
- B. Wooden fence boards.
- C. Concrete anchorage for posts.
- D. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 02 4100 - Demolition: Dissassembly of existing fence section for re-use of components.

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 2016a.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2019a.
- D. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete 2020.
- E. ASTM F567 - Standard Practice for Installation of Chain-Link Fence 2014a.
- F. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework 2018.
- G. CLFMI CLF-PM0610 - Product Manual 2017.
- H. CLFMI CLF-SFR0111 - Security Fencing Recommendations 2014.
- I. CLFMI WLG 2445 - Wind Load Guide for the Selection of Line Post and Line Post Spacing 2018.

1.04 SUBMITTALS

- A. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components. See CLFMI CLF-SFR0111 for planning and design recommendations.

1.05 QUALITY ASSURANCE

- A. Fence Installer: Company with demonstrated successful experience installing similar projects and products, with not less than five years of documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Posts, Rails, and Frames: [_____]:
 - 1. Line Posts: Type I round.
 - 2. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round.
 - 3. Comply with CLFMI CLF-PM0610.

2.02 COMPONENTS

- A. Rail and post sizes listed below are minimum sizing. New components are to match existing component sizing.
 - 1. Line Posts: 1.9 inch diameter.
 - 2. Corner and Terminal Posts: 2.38 inch diameter.
 - 3. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.
 - 4. Bottom Rail: 1.66 inch diameter, plain end, sleeve coupled.
- B. Wooden fence boards:

1. Match species, dimensions, spacing, stain/sealer, and attachment method of existing fence. BOD: cedar 1x6.

C. Concrete:

1. Comply with ASTM C94/C94M for Ready-mix concrete.
2. 3/4 inch maximum size aggregate.
3. Minimum compressive strength of 3000psi at 28 days.

2.03 ACCESSORIES

- A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.
- B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Verify that areas are clear of obstructions or debris.

3.02 PREPARATION

- A. Removal: Obstructions or debris.

3.03 INSTALLATION

- A. Install framework, fabric, accessories and gates in accordance with ASTM F567.
- B. Set intermediate posts plumb, in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.
- C. Line Post Footing Depth Below Finish Grade: ASTM F567.
- D. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567.
- E. Provide top rail through line post tops and splice with 6 inch long rail sleeves.

3.04 CLEANING

- A. Leave immediate work area neat at end of each work day.
- B. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.
- C. Clean fence with mild household detergent and clean water rinse well.
- D. Touch up scratched surfaces using materials recommended by manufacturer. Match touched-up paint color to factory-applied finish.

END OF SECTION

EXHIBIT G

Plans (available at the following: <https://oregonstate.box.com/s/dk7adj9z6ph81teq0mp4uuci28zcdlzh>)



COMcheck Software Version 4.1.2.0

Mechanical Compliance Certificate

Project Information

Energy Code: 90.1 (2016) Standard
Project Title: OSU RWB - LIBRARY ARCHIVE
Location: Corvallis, Oregon
Climate Zone: 4c
Project Type: Alteration

Construction Site:
4700 SW Research Way
Corvallis, OR 97333

Owner/Agent:
Amy Keene
Oregon State University
3015 SW Western Blvd
Corvallis, OR 97331
541-485-1003
AMY.KEENE@OREGONSTATE.EDU

Designer/Contractor:
Paul Fooks
Systems West Engineers
725 A Street
Springfield, OR 97477
541-342-7210
pfooks@systemswestengineers.com

Mechanical Systems List

Quantity System Type & Description

1 AHU-1 / HP-1
Split System Heat Pump
Heating Mode: Capacity = 182 kBtu/h,
Proposed Efficiency = 3.70 COP, Required Efficiency = 3.30 COP
Cooling Mode: Capacity = 72 kBtu/h, , Air Economizer
Proposed Efficiency = 12.20 EER, Required Efficiency: 11.00 EER + 12.2 IEER
Fan System: AHU-1 -- Compliance (Brake HP method) : Passes
Fans:
FAN 1 Supply, Single-Zone VAV, 6000 CFM, 7.5 motor nameplate hp, 5.3 design brake hp (5.3 max. BHP), 85.0 fan efficiency grade

SYSTEM VERIFICATION REQUIRED.

Mechanical Compliance Statement

Compliance Statement: The proposed mechanical alteration project represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed mechanical systems have been designed to meet the 90.1 (2016) Standard requirements in COMcheck Version 4.1.2.0 and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Tyson Oleman - Mechanical Designer
Name - Title

Signature

07/09/2020
Date



Inspection Checklist

Energy Code: 90.1 (2016) Standard

Requirements: 92.0% were addressed directly in the COMcheck software

Text in the "Comments/Assumptions" column is provided by the user in the COMcheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

Section # & Req.ID	Plan Review	Complies?	Comments/Assumptions
4.2.2, 6.4.4.2.1, 6.7.2 [PR2] ¹	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the mechanical systems and equipment and document where exceptions to the standard are claimed. Load calculations per acceptable engineering standards and handbooks.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
4.2.2, 8.4.1.1, 8.4.1.2, 8.7 [PR6] ²	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the electrical systems and equipment and document where exceptions are claimed. Feeder connectors sized in accordance with approved plans and branch circuits sized for maximum drop of 3%.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
6.7.2.4 [PR5] ¹	Detailed instructions for HVAC systems commissioning included on the plans or specifications for projects >=50,000 ft ² .	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)
---	----------------------	---	------------------------	---	---------------------

Section # & Req.ID	Footing / Foundation Inspection	Complies?	Comments/Assumptions
6.4.3.7 [FO9] ³	Freeze protection and snow/ice melting system sensors for future connection to controls.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.

Additional Comments/Assumptions:

1 High Impact (Tier 1)	2 Medium Impact (Tier 2)	3 Low Impact (Tier 3)
------------------------	--------------------------	-----------------------

Section # & Req.ID	Mechanical Rough-In Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
6.4.1.4, 6.4.1.5 [ME1] ²	HVAC equipment efficiency verified. Non-NAECA HVAC equipment labeled as meeting 90.1.	Efficiency: _____	Efficiency: _____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Mechanical Systems list for values.
6.4.3.4.1 [ME3] ³	Stair and elevator shaft vents have motorized dampers that automatically close.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
6.4.3.4.2, 6.4.3.4.3 [ME4] ³	Outdoor air and exhaust systems have motorized dampers that automatically shut when not in use and meet maximum leakage rates. Check gravity dampers where allowed.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. Location on plans/spec: Specification Section 230929
6.4.3.4.5 [ME39] ³	Enclosed parking garage ventilation has automatic contaminant detection and capacity to stage or modulate fans to 50% or less of design capacity.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
6.4.3.4.4 [ME5] ³	Ventilation fans >0.75 hp have automatic controls to shut off fan when not required.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. Location on plans/spec: Specification Section 230929
6.4.3.8 [ME6] ¹	Demand control ventilation provided for spaces >500 ft ² and >25 people/1000 ft ² occupant density and served by systems with air side economizer, auto modulating outside air damper control, or design airflow >3,000 cfm.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. Location on plans/spec: Specification Section 230929
6.5.3.2.1 [ME40] ²	DX cooling systems \geq 75 kBtu/h (\geq 65 kBtu/h effective 1/2016) and chilled-water and evaporative cooling fan motor hp \geq ¼ designed to vary supply fan airflow as a function of load and comply with operational requirements.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. Location on plans/spec: Specification Sections 230929 and 238143 See the Mechanical Systems list for values.
6.4.4.1.1 [ME7] ³	Insulation exposed to weather protected from damage. Insulation outside of the conditioned space and associated with cooling systems is vapor retardant.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. Location on plans/spec: Specification Section 230719
6.4.4.1.2 [ME8] ²	HVAC ducts and plenums insulated per Table 6.8.2. Where ducts or plenums are installed in or under a slab, verification may need to occur during Foundation Inspection.	R- _____	R- _____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. Location on plans/spec: Specification Section 230713
6.4.4.1.3 [ME9] ²	HVAC piping insulation thickness. Where piping is installed in or under a slab, verification may need to occur during Foundation Inspection.	_____ in.	_____ in.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. Location on plans/spec: Specification Section 230719

1 High Impact (Tier 1) 2 Medium Impact (Tier 2) 3 Low Impact (Tier 3)

Section # & Req.ID	Mechanical Rough-In Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
6.4.4.1.4 [ME41] ³	Thermally ineffective panel surfaces of sensible heating panels have insulation \geq R-3.5.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
6.4.4.2.1 [ME10] ²	Ducts and plenums having pressure class ratings are Seal Class A construction.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. Location on plans/spec: Specification Section 233113
6.4.4.2.2 [ME11] ³	Ductwork operating $>$ 3 in. water column requires air leakage testing.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
6.5.2.3 [ME19] ³	Dehumidification controls provided to prevent reheating, recooling, mixing of hot and cold airstreams or concurrent heating and cooling of the same airstream.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Location on plans/spec: N/A
6.5.2.4.1 [ME68] ³	Humidifiers with airstream mounted preheating jackets have preheat auto-shutoff value set to activate when humidification is not required.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
6.5.2.4.2 [ME69] ³	Humidification system dispersion tube hot surfaces in the airstreams of ducts or air-handling units insulated \geq R-0.5.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
6.5.2.5 [ME70] ³	Preheat coils controlled to stop heat output whenever mechanical cooling, including economizer operation, is active.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. Location on plans/spec: Specification Section 230929
6.5.2.6 [ME106] ³	Units that provide ventilation air to multiple zones and operate in conjunction with zone heating and cooling systems are prevented from using heating or heat recovery to warm supply air above 60°F when representative building loads or outdoor air temperature indicate that most zones demand cooling.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
6.5.3.1.3 [ME74] ²	Fans have efficiency grade (FEG) \geq 67. The total efficiency of the fan at the design point of operation \leq 15% of maximum total efficiency of the fan.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. Location on plans/spec: Sheet M601
6.5.3.6 [ME72] ²	Motors for fans \geq 1/12 hp and $<$ 1 hp are electronically-commutated motors or have a minimum motor efficiency of 70%. These motors are also speed adjustable for either balancing or remote control.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. Location on plans/spec: SHEET M601

1 High Impact (Tier 1) 2 Medium Impact (Tier 2) 3 Low Impact (Tier 3)

Section # & Req.ID	Mechanical Rough-In Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
6.5.3.4 [ME108] ²	Parallel-flow fan-powered VAV air terminals have automatic controls to a) turn off the terminal fan except when space heating is required or if required for ventilation; b) turn on the terminal fan as the first stage of heating before the heating coil is activated; and c) during heating for warmup or setback temperature control, either operate the terminal fan and heating coil without primary air or reverse the terminal damper logic and provide heating from the central air handler through primary air.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
6.5.3.7 [ME109] ²	Required minimum outdoor air rate is the larger of minimum outdoor air rate or minimum exhaust air rate required by Standard 62.1, Standard 170, or applicable codes or accreditation standards. Outdoor air ventilation systems shall comply with one of the following: a) design minimum system outdoor air provided < 135% of the required minimum outdoor air rate, b) dampers, ductwork, and controls allow the system to supply <= the required minimum outdoor air rate with a single set-point adjustment., or c) system includes exhaust air energy recovery complying with Section 6.5.6.1.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. Location on plans/spec: Specification Section 230929 & Sheet M601
6.5.3.3 [ME42] ³	Multiple zone VAV systems with DDC of individual zone boxes have static pressure setpoint reset controls.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply. <i>See the Mechanical Systems list for values.</i>
6.5.4.2 [ME25] ³	HVAC pumping systems with >= 3 control valves designed for variable fluid flow (see section details).			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
6.5.6.1 [ME56] ¹	Exhaust air energy recovery on systems meeting Tables 6.5.6.1-1, and 6.5.6.1-2.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
6.5.7.1 [ME100] ²	Conditioned supply air to space with mechanical exhaust <= the greater of criteria of supply flow, required ventilation rate, exhaust flow minu the available transfer air (see section details).			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. Location on plans/spec: SHEETS M121 & M601
6.5.7.2.1 [ME32] ²	Kitchen hoods >5,000 cfm have make up air >=50% of exhaust air volume.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.

1 High Impact (Tier 1) 2 Medium Impact (Tier 2) 3 Low Impact (Tier 3)

Section # & Req.ID	Mechanical Rough-In Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
6.5.7.2.4 [ME49] ³	Approved field test used to evaluate design air flow rates and demonstrate proper capture and containment of kitchen exhaust systems.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
6.5.8.1 [ME34] ²	Unenclosed spaces that are heated use only radiant heat.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
6.4.3.9 [ME63] ²	Heating for vestibules and air curtains with integral heating include automatic controls that shut off the heating system when outdoor air temperatures > 45F. Vestibule heating and cooling systems controlled by a thermostat in the vestibule with heating setpoint <= 60F and cooling setpoint >= 80F.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
6.5.10 [ME73] ³	Doors separating conditioned space from the outdoors have controls that disable/reset heating and cooling system when open.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Alteration project to existing building. Location on plans/spec: N/A

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)
---	----------------------	---	------------------------	---	---------------------

Section # & Req.ID	Rough-In Electrical Inspection	Complies?	Comments/Assumptions
8.4.2 [EL10] ²	At least 50% of all 125 volt 15- and 20-Amp receptacles are controlled by an automatic control device.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
8.4.3 [EL11] ²	New buildings have electrical energy use measurement devices installed. Where tenant spaces exist, each tenant is monitored separately. In buildings with a digital control system the energy use is transmitted to to control system and displayed graphically.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
10.4.1 [EL9] ²	Electric motors meet requirements where applicable.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. Location on plans/spec: Specification Section 230513 & Sheet M601

Additional Comments/Assumptions:

1 High Impact (Tier 1)	2 Medium Impact (Tier 2)	3 Low Impact (Tier 3)
------------------------	--------------------------	-----------------------

Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
6.4.3.1.2 [FI3] ³	Thermostatic controls have a 5 °F deadband.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. Location on plans/spec: Specification Section 230929
6.4.3.2 [FI20] ³	Temperature controls have setpoint overlap restrictions.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. Location on plans/spec: Specification Section 230929
6.4.3.3.1 [FI21] ³	HVAC systems equipped with at least one automatic shutdown control.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. Location on plans/spec: Specification Section 230929
6.4.3.3.2 [FI22] ³	Setback controls allow automatic restart and temporary operation as required for maintenance.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. Location on plans/spec: Specification Section 230929
6.4.3.5 [FI5] ³	Heat pump controls prevent supplemental electric resistance heat from coming on when not needed.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. Location on plans/spec: Specification Section 230929
6.4.3.12 [FI200] ³	Air economizer has a fault detection and diagnostics (FDD) system (see details for configuration and operational requirements).	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
6.4.3.6 [FI6] ³	When humidification and dehumidification are provided to a zone, simultaneous operation is prohibited. Humidity control prohibits the use of fossil fuel or electricity to produce RH > 30% in the warmest zone humidified and RH < 60% in the coldest zone dehumidified.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Zones served by desiccant systems.
6.7.2.1 [FI7] ³	Furnished HVAC as-built drawings submitted within 90 days of system acceptance.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
6.7.2.2 [FI8] ³	Furnished O&M manuals for HVAC systems within 90 days of system acceptance.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
6.7.2.3 [FI9] ¹	An air and/or hydronic system balancing report is provided for HVAC systems serving zones >5,000 ft ² of conditioned area.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. Location on plans/spec: Specification Section 230593
6.7.2.4 [FI10] ¹	HVAC control systems have been tested to ensure proper operation, calibration and adjustment of controls.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. Location on plans/spec: Specification Sections 230923, 230925, & 230929
10.4.3 [FI24] ²	Elevators are designed with the proper lighting, ventilation power, and standby mode.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)
---	----------------------	---	------------------------	---	---------------------

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)
---	----------------------	---	------------------------	---	---------------------

EXHIBIT I

available at the following: <https://oregonstate.box.com/s/dk7adj9z6ph81teq0mp4uuci28zcdlzh>